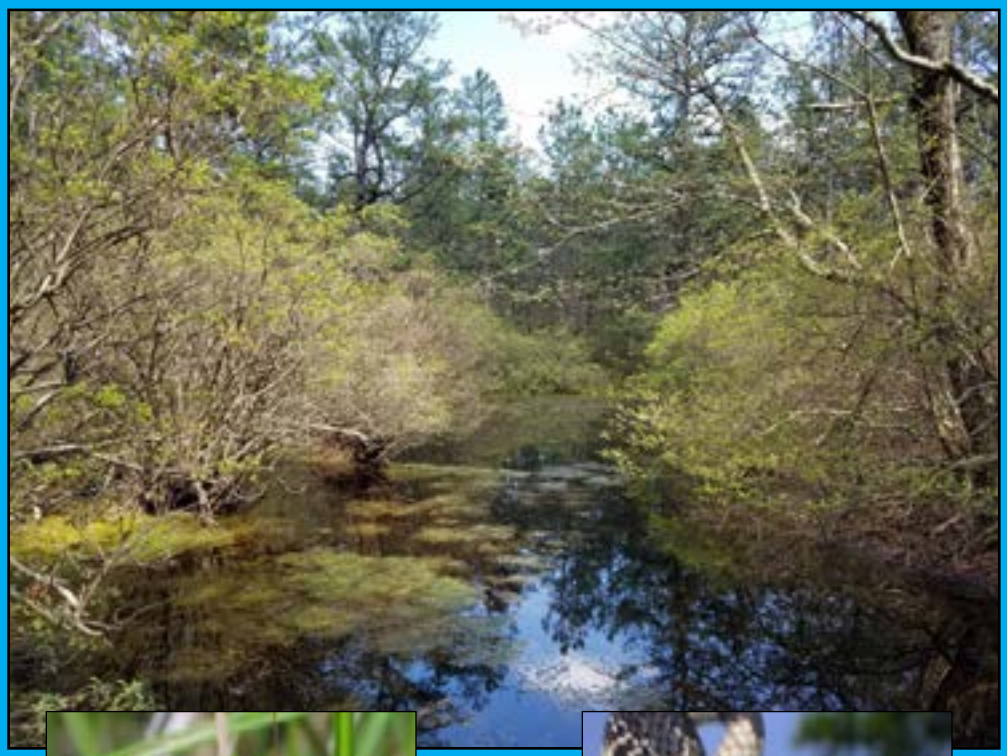
Integrated Natural Resources Management Plan

177th Fighter Wing,Warren Grove Bombing Range, Coyle Field, and Atlantic City Air National Guard Base
New Jersey

Final
September 2018



Final
Integrated Natural Resources
Management Plan for the 177th Fighter Wing,
Warren Grove Bombing Range, Coyle Field,
and
Atlantic City Air National Guard Base

Burlington County and Atlantic County, New Jersey

Prepared for
Air National Guard
Plans and Requirements Branch NGB/A4AM
3501 Fetchet Avenue
Joint Base Andrews, Maryland 20762

On Behalf of

New Jersey Air National Guard
177th Fighter Wing
400 Langley Road
Egg Harbor Township, New Jersey 08234

September 2018

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SIGNATURE PAGE
NEW JERSEY AIR NATIONAL GUARD BASE
EGG HARBOR TOWNSHIP, NEW JERSEY

This Integrated Natural Resources Management Plan (INRMP), dated September 2018, has been developed for the 177th Fighter Wing, New Jersey Air National Guard, located at Atlantic City International Airport in Atlantic County, New Jersey, and its geographically separated units, Warren Grove Bombing Range (WGR) and Coyle Training Annex (Coyle Field) in accordance with Air Force Instruction 32-7064, *Integrated Natural Resources Management;* Air Force Policy Directive 32-70, *Environmental Quality*; Department of Defense Instruction 4715.03, *Natural Resources Conservation Program*; Department of Defense Manual 4715.03, *Integrated Natural Resource Management Plan*, and the provisions of the Sikes Act, as amended (16 United States Code §670a et seq.) in cooperation with the United States Fish and Wildlife Service (USFWS) and New Jersey Department of Environmental Protections (NJDEP). The management of natural resources in this INRMP reflects the mutual agreement of all parties.

To the extent that resources permit, the USFWS, NJDEP, and New Jersey Air National Guard, by signature of their agency representative, do hereby agree to enter a cooperative agreement program for the conservation, protection, and management of natural resources present on WGR and Coyle Field, New Jersey. The intention of this agreement is to develop functioning, sustainable ecological communities on WGR and Coyle Field that integrate the interests and mission of the agencies charged with conservation, protection, and management of natural heritage in the public interest. This agreement may be modified and amended by mutual agreement of the authorized representatives of the three agencies. This agreement will become effective upon the date of the last signatory and shall continue in full force until terminated by written notice to the other parties, in whole or in part, by any of the parties signing this agreement.

By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence and acceptance of the following document.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection Signatory	**Date**

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ANNUAL REVIEW AND COORDINATION DOCUMENTATION
2019

Signatures from the approving officials on this page certify the annual review and coordination of the INRMP for the 177 Fighter Wing, Warren Grove Bombing Range has been completed for the specified year.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection Signatory	**Date**

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ANNUAL REVIEW AND COORDINATION DOCUMENTATION
2020

Signatures from the approving officials on this page certify the annual review and coordination of the INRMP for the 177 Fighter Wing, Warren Grove Bombing Range, has been completed for the specified year.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection Signatory	**Date**

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ANNUAL REVIEW AND COORDINATION DOCUMENTATION
2021

Signatures from the approving officials on this page certify the annual review and coordination of the INRMP for the 177 Fighter Wing, Warren Grove Bombing Range, has been completed for the specified year.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection Signatory	**Date**

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ANNUAL REVIEW AND COORDINATION DOCUMENTATION
2022

Signatures from the approving officials on this page certify the annual review and coordination of the INRMP for the 177 Fighter Wing, Warren Grove Bombing Range, has been completed for the specified year.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection **Signatory**	**Date**

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ANNUAL REVIEW AND COORDINATION DOCUMENTATION
2023

Signatures from the approving officials on this page certify the annual review and coordination of the INRMP for the 177 Fighter Wing, Warren Grove Bombing Range, has been completed for the specified year.

Approving Officials:

BRADFORD R. EVERMAN, Col **New Jersey Air National Guard** **Commander**	**Date**
United States Fish and Wildlife Service Signatory	**Date**
New Jersey Department of Environmental Protection Signatory	**Date**

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1. EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) has been developed for the 177th Fighter Wing (177 FW), New Jersey Air National Guard and its geographically separated units, Warren Grove Bombing Range (WGR) and Coyle Training Annex (Coyle Field) in accordance with Air Force Instruction 32-7064, *Integrated Natural Resources Management*; Air Force Policy Directive 32-70, *Environmental Quality;* Department of Defense Instruction 4715.03, *Natural Resources Conservation Program*; Department of Defense Manual (DoDM) 4715.03, *Integrated Natural Resource Management Plan (INRMP)*, and the provisions of the Sikes Act, as amended (16 United States Code [USC] §670a et seq.). The focus of this INRMP is WGR. The parent installation for the 177 FW is Atlantic City Air National Guard Base (ANGB) and is an urban developed site where no significant natural resources are found. Coyle Field is on land owned and managed by the New Jersey Department of Environmental Protection (NJDEP), Division of Parks and Forestry; the 177 FW does not have a role in land use management at Coyle Field. Unless otherwise noted in the INRMP, all information including project goals and project objectives pertain to WGR.

This INRMP provides location descriptions of Atlantic City ANGB, WGR, Coyle Field, and the surrounding environment. This INRMP presents various management practices designed to mitigate negative impacts and enhance the positive effects of the installation's mission on regional ecosystems, specifically for WGR. These recommendations have been balanced against the requirements of WGR to accomplish their missions at the highest possible level of efficiency. To obtain an accurate assessment of the installations' influences, analyses were conducted to determine the physical and biotic nature of WGR, Atlantic City ANGB, Coyle Field and its surrounding environment, as well as the operational activities taking place.

This INRMP is a practical guide for the management and stewardship of all natural resources present on WGR, while ensuring the successful accomplishment of the military mission. This INRMP is an update and reorganization of the 2011 WGR INRMP. The INRMP was developed using an interdisciplinary approach in which information was gathered from a variety of organizations. Guidance was also solicited from a variety of federal agencies, state agencies, and local universities. A Task Force was formed, which included key installation personnel and individuals from various agencies that have an interest in WGR and the management of its resources. Representatives from the following federal and state regulatory agencies comprised the Task Force: United States Fish and Wildlife Service (USFWS), NJDEP, and the New Jersey Pinelands Commission. In addition, representatives from Drexel University, Office of Pinelands Research participated in the Task Force. These varying perspectives allowed for an accurate portrayal of the status and management needs of local ecosystems, balanced against the requirement for the installation to accomplish its mission(s) at the highest possible level of efficiency. As a result, the probable effects of WGR operations on the surrounding natural resources were projected, allowing for the development of possible operational alternatives that could result in lessening impacts on the environment.

Participation in the Task Force by representatives from USFWS and NJDEP satisfied the provisions of the Sikes Act (16 USC §670a et seq.). The Sikes Act requires the preparation of an INRMP in cooperation with USFWS and the appropriate state fish and wildlife agency (i.e.,

NJDEP). In addition, it is required that the resulting plan reflect the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources.

The INRMP presents practicable alternatives and recommendations that would minimize impact on the WGR missions while providing for management and stewardship of natural resources that would conserve and enhance existing ecosystems on the installation.

The overriding goals for this INRMP are to:

1. Manage for no net loss in WGR capability to support the military mission of the installation
2. Minimize habitat fragmentation and promote the natural connectivity of habitats
3. Protect native species and discourage non-native, invasive species
4. Protect rare and ecologically important species and unique or sensitive environments
5. Maintain or mimic natural processes
6. Protect genetic diversity
7. Restore species, communities, and ecosystems
8. Monitor impacts on biodiversity.

From these goals, objectives and management actions were identified that structure this plan's guidance. However, each of the management strategies described in this INRMP should be monitored so that modifications can be made as conditions change during implementation.

Throughout the development of this INRMP, management issues were identified in a number of natural resources subject areas. Some of these natural resources topics of concern could have an adverse impact on the WGR mission or future planning operations. One of the purposes of this INRMP is to identify goals and objectives for the installation and to obtain workable and useful solutions for each topic of concern. The topics of concern involving natural resource constraints to planning and mission operations are presented in Chapter 6.

2. GENERAL INFORMATION

2.1 PURPOSE AND SCOPE

This Integrated Natural Resources Management Plan (INRMP) has been developed for use by the 177th Fighter Wing (177 FW), New Jersey Air National Guard (NJANG) located at Atlantic City International Airport in Atlantic County, New Jersey, and its geographically separated units, Warren Grove Bombing Range (WGR) and Coyle Training Annex (Coyle Field) in accordance with Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management*; Air Force Policy Directive (AFPD) 32-70, *Environmental Quality*; Department of Defense Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*; Department of Defense Manual (DoDM) 4715.03, *Integrated Natural Resource Management Plans*; and the provisions of the Sikes Act (16 United States Code [USC] §670a et seq.). The focus of this INRMP is WGR. The parent installation for the 177 FW is Atlantic City Air National Guard Base (ANGB) and is an urban developed site where no significant natural resources are found. Coyle Field is on land owned and managed by the New Jersey Department of Forestry; the 177 FW does not have a role in land use management at Coyle Field.

Due to the urban conditions at the Atlantic City ANGB and Coyle Field, this INRMP is written to provide specific information for WGR. In only those instances where specific site information is needed for either Atlantic City ANGB or Coyle Field will these locations be discussed. This INRMP provides a description of WGR, Atlantic City ANGB, and Coyle Field (e.g., location, history, and mission) and information about the surrounding physical and biotic environment. Furthermore, for WGR, this INRMP provides an assessment of the impacts on natural resources as a result of mission activities and recommends various management practices in compliance with federal, state, and local standards designed to mitigate negative impacts and enhance the positive effects of the installation's mission on local ecosystems.

This INRMP integrates all aspects of natural resource management with the rest of the installation's mission and, therefore, becomes the primary tool for managing the installation's ecosystems while ensuring the successful accomplishments of the military mission at the highest possible levels of efficiency. The INRMP is a guide for the management and stewardship of natural resources present on the installation. A multiple-use approach will be implemented to allow for the presence of mission-oriented activities, as well as environmental quality through efficient management of natural resources.

Specific management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the installation. Specifically, management practices should:

- Minimize habitat fragmentation and promote the natural pattern and connectivity of habitats
- Protect native species and discourage non-native, invasive species
- Protect rare and ecologically important areas
- Protect unique sensitive environments

- Maintain or mimic natural processes
- Protect genetic diversity
- Restore species, communities, and ecosystems
- Monitor impacts on biodiversity.

Each of the management strategies described in this plan should be monitored so that modifications can be made during implementation if conditions change. There are four levels of biodiversity: genetic diversity, species diversity, ecosystem diversity, and landscape diversity. Human communities are entirely and completely dependent on the goods and services provided by our diverse ecosystems. Decline of these ecosystems and the biodiversity within them is one of the foremost limitations to human prosperity. Ecosystem sustainability is the key to both biological diversity and human existence. It is the goal of this INRMP to successfully integrate ecological sustainability with goals and objectives that will sustain human communities and the operational mission of WGR. By protecting a mosaic of habitats that support the greatest diversity of life, this INRMP helps perpetuate viable, sustainable populations of native species, and the communities they comprise. The protection of these species and communities, in turn, promotes the sustainability of functional ecosystems across the landscape.

This INRMP is an update and reorganization of the 2011 WGR INRMP, which was developed for the planning period from fiscal year 2011 to 2016, and is the result of a review for operation and effect done by the United States Fish and Wildlife Service (USFWS), New Jersey Department of Environmental Protection (NJDEP), and 177 FW. The projects identified in Chapter 8 include recurring or ongoing projects as well as some newly identified projects needed for the implementation of an existing program. The INRMP has also been reorganized to meet the requirements of AFI 32-7064, *Integrated Natural Resources Management*, and has been updated to incorporate updated natural resources data. Appendix A of this INRMP provides the references for the document, while Appendix B provides a list of acronyms and abbreviations.

2.2 MANAGEMENT PHILOSOPHY

The INRMP was developed using an interdisciplinary approach and information gathered from a variety of organizations. Information and guidance was also solicited from a variety of federal, state, and local agencies and groups. A Task Force was formed, which included key 177 FW personnel, individuals from various agencies, and groups that have an interest in the installations and the management of its resources. Representatives from the following federal and state agencies comprised the Task Force: USFWS, NJDEP, and New Jersey Pinelands Commission (NJPC). In addition, Drexel University, Office of Pinelands Research participated in the INRMP Task Force due to their extensive experience with the natural resources on WGR. INRMP Task Force meeting minutes and correspondence with the agencies are provided in Appendix C.

The INRMP Task Force ensures that information concerning the natural resources on or in the vicinity of WGR, Atlantic City ANGB, and Coyle Field is accurate and presented in accordance with local and regional management strategies, where feasible. This approach allows

for insight into possible operational alternatives, which could result in reduced impacts on the natural resources on the installations, and in surrounding areas.

Participation on the INRMP Task Force by representatives from USFWS and NJDEP Division of Fish and Wildlife satisfies the requirements of the Sikes Act (16 USC §670a et seq.). The INRMP Task Force is also the venue for achieving mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources, as well as for completing the annual reviews and 5-year reviews for operation and effect. The Sikes Act, in addition to Department of Defense (DoD) Manual 4715.03 and AFI 32-7064 requires public comment on the INRMP at its inception, as well as during revisions when there is a mission change. Appendix C includes consultation with USFWS, NJDEP, and NJPC, and the Task Force meeting minutes.

The INRMP presents practicable alternatives and recommendations that allow for the protection and enhancement of natural resources and conservation of existing ecosystems, while minimizing impacts on the military mission at the installations. Consequently, the implementation of some of these recommendations may sacrifice improvement of the natural resources in deference to the safety and efficiency of the military mission.

Enabling long-term use of WGR, Atlantic City ANGB, and Coyle Field for military training is the primary purpose of natural resources management at the installations. This INRMP is a military mission-driven plan, created with the paired goals:

- To allow for and support the conduct of military training at levels necessary to maintain a full readiness posture for national defense and civil missions; and

- To provide for sustainable management of natural resources with an ecosystem focus, consistent with federal, state, and local regulations.

The 177 FW embraces the concept of integrating holistic natural resource management with mission activities. The 177 FW recognizes that ongoing military training and associated mission activities can consume and potentially damage the natural resources on mission land, and that successful execution of their mission in perpetuity is dependent upon sustainable land use and the conservation of these natural resources. The 177 FW is committed to the planned, deliberate management of natural resources, supporting the installation operational mission, meeting or exceeding stewardship requirements, partnering in local and regional conservation initiatives, and enhancing the quality of life for its personnel and guests.

The 177 FW recognizes that it is a steward of publicly owned natural resources and, as compatible with the military mission and installation safety and security requirements, that it has a responsibility to provide access for the use and enjoyment of these resources in a manner consistent with the resources' ability to support such use. The 177 FW also recognizes the responsibility to ensure that the natural resources entrusted to their care are sustained in a healthy condition for scientific research, education, and other compatible uses by future generations.

2.3 AUTHORITY

This INRMP is developed under, and proposes actions in accordance with applicable DoD and United States Air Force (USAF) policies, directives, and instructions. AFI 32-7064, *Integrated Natural Resources Management*, provides the necessary direction and instruction for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions that include DoDI 4715.03, *Natural Resources Conservation Program*; DoD Manual 4715.03, *Integrated Natural Resources Management Plan*; AFPD 32-70, *Environmental Quality*; and AFI 32-7064. DoD Instruction 4715.03 provides direction for DoD installations in establishing procedures for an integrated program for multiple-use management of natural resources (including biological and earth resources) on property and lands managed or controlled by DoD. DoD Manual 4715.03 provides the procedures to prepare, review, update, and implement INRMPs in compliance with the Sikes Act. AFPD 32-70 discusses general environmental quality issues, including proper cleanup of polluted sites, compliance with applicable regulations, conservation of natural resources, and pollution prevention. Appendix D summarizes key legislation and guidance used to create and implement this INRMP.

2.4 INTEGRATION WITH OTHER PLANS

An INRMP is inherently multidisciplinary and provides a summary of natural resources at a specific installation. Information from an INRMP is incorporated into other plans, and other plans help identify management priorities and potential impacts to natural resources. The INRMP is integrated with other 177 FW plans including:

- ***Comprehensive Range Plan*—**provides the long-term plan for the military mission.
- ***Wildland Fire Management Plan*—**provides a summary of the wildland for program, including training, techniques, processes, responsibilities, and cooperators (Component Plan A).
- ***Bird/Wildlife Aircraft Strike Hazard Plan* (BASH Plan)—**provides a summary of the BASH program, including techniques, processes, responsibilities, and management recommendations (Component Plan B).
- ***Integrated Cultural Resources Management Plan (ICRMP)*—**plan for management of cultural resources, including consultation and other legal requirements, known cultural resources, processes, and responsibilities (Component Plan C).
- ***Integrated Pest Management Plan*—**plan for the management of pest species, including nuisance wildlife and invasive species.
- ***New Jersey Wildlife Action Plan*—**developed to manage public and private lands in the best way possible to benefit all New Jersey's wildlife, and especially those with declining populations. The New Jersey Wildlife Action Plan identifies habitat areas that demonstrate the greatest conservation need and potential, and establishes specific conservation goals for the enhancement and protection of these sites. INRMP goals, objectives and strategies are consistent with New Jersey's overall statewide and site specific plans. The New Jersey Wildlife Action Plan is available at http://www.njfishandwildlife.com/ensp/waphome.htm.

3. INSTALLATION OVERVIEW

3.1 LOCATION AND AREA

Figure 3-1 shows the locations of Atlantic City ANGB, WGR, and Coyle Field in relation to Atlantic City, New Jersey, and the surrounding region. The 177 FW is located within the Atlantic City International Airport in Atlantic County 9 miles northwest of Atlantic City, New Jersey. The airport, which covers approximately 5,000 acres, is located near the Delilah Road exit, Interchange 9, of the Atlantic City Expressway. The 177 FW leases approximately 296 acres from the Atlantic City Airport Authority. An overview of Atlantic City ANGB and its facilities is shown in Figure 3-2.

WGR is located in Burlington County, New Jersey, approximately 17 miles north of Atlantic City and 40 miles east of Trenton. WGR is west of State Route 539, approximately 2 miles south of the town of Warren Grove. WGR comprises approximately 9,416 acres bordering on the western edge of Ocean County, most of which is undeveloped and acts as a buffer to military operations. An overview of WGR and its facilities is provided in Figure 3-3.

Coyle Field is also located in Burlington County, approximately 10 miles north of WGR. Coyle Field is a 256-acre, unmanned drop zone that includes a single modern hanger. The land is leased from NJDEP, Division of Parks and Forestry to USAF, who licenses the property to NJANG. This building is not maintained by NJANG. An overview of Coyle Field and its facilities is provided in Figure 3-4.

WGR and Coyle Field are located within the New Jersey Pinelands National Reserve, which is a complex of 934,000 acres of land protected under federal legislation. In New Jersey, the Pine Barrens are referred to as the New Jersey Pine Barrens. The name Pine Barrens refers to sandy, acidic, nutrient-poor soils which typically support stunted forests dominated by pines. In 1978, Congress passed legislation to designate 1.1 million acres of the New Jersey Pine Barrens as the Pinelands National Reserve to preserve its ecology. In 1988, the area was designated by the United Nations as an International Biosphere Reserve. Development in the New Jersey Pinelands National Reserve is controlled by an independent state/federal agency, the New Jersey Pinelands Commission.

3.2 INSTALLATION HISTORY

<u>177th Fighter Wing</u>

The 177 FW began in September 1917 as the 119th Aero Squadron. The 119th Aero Squadron, an active duty training squadron during World War One, was demobilized in May 1919. In 1930, the 119th Observation Squadron was given federal recognition as part of the 44th Infantry Division, New Jersey National Guard, 119th Fighter Squadron at Newark. In 1958, the 119th Fighter Squadron moved to its current location, the former Navy facility in Egg Harbor Township, New Jersey, and was re-designated the 119th Tactical Fighter Squadron. In 1962 the unit became the 177th Tactical Fighter Group, the 177th Fighter Interceptor Group in 1972, 177th Fighter Group in 1992, and finally became the 177 FW in 1995.

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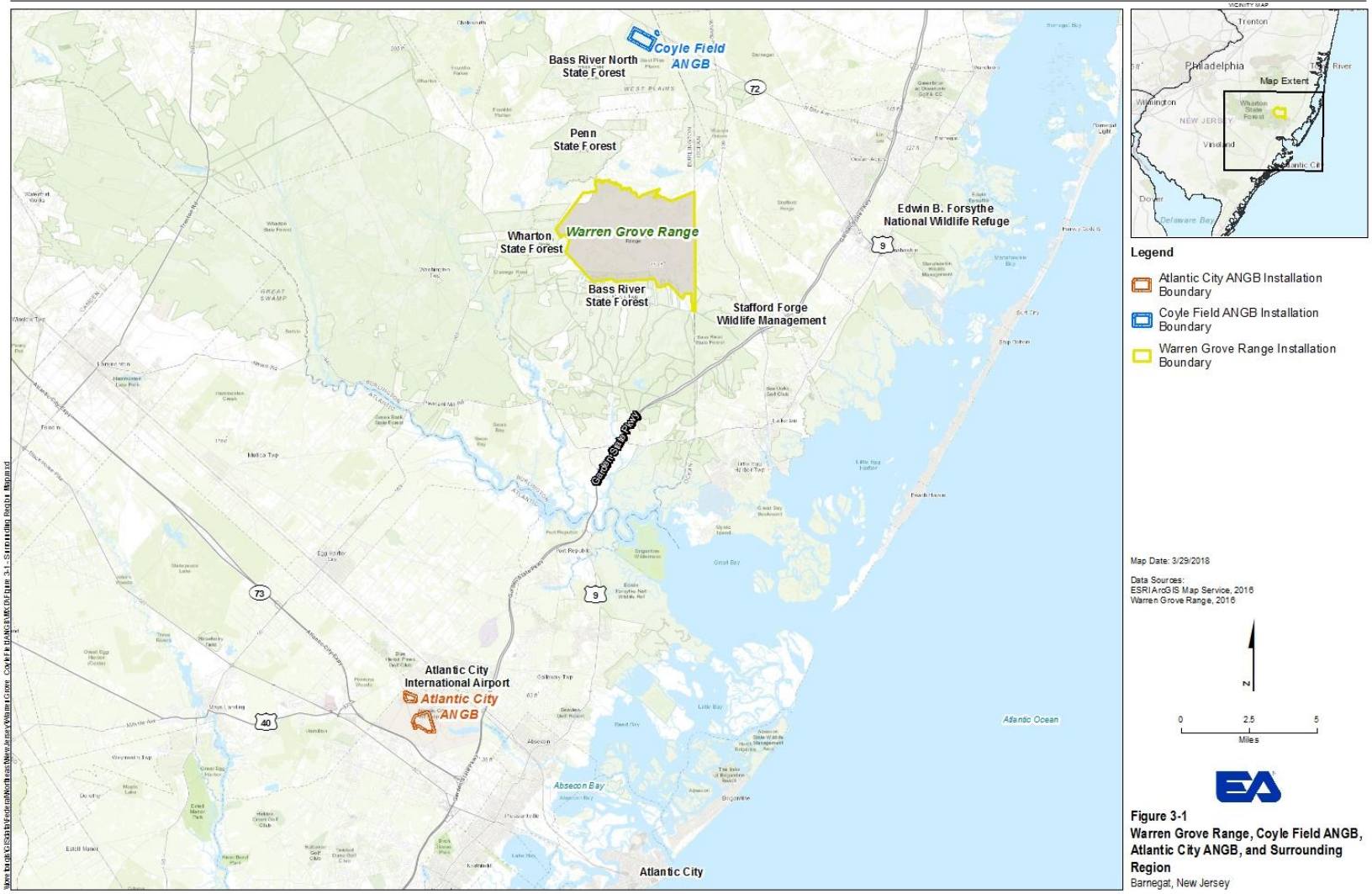

Figure 3-1
Warren Grove Range, Coyle Field ANGB, Atlantic City ANGB, and Surrounding Region
Barnegat, New Jersey

Figure 3-2
Atlantic City ANGB
Egg Harbor Township, New Jersey

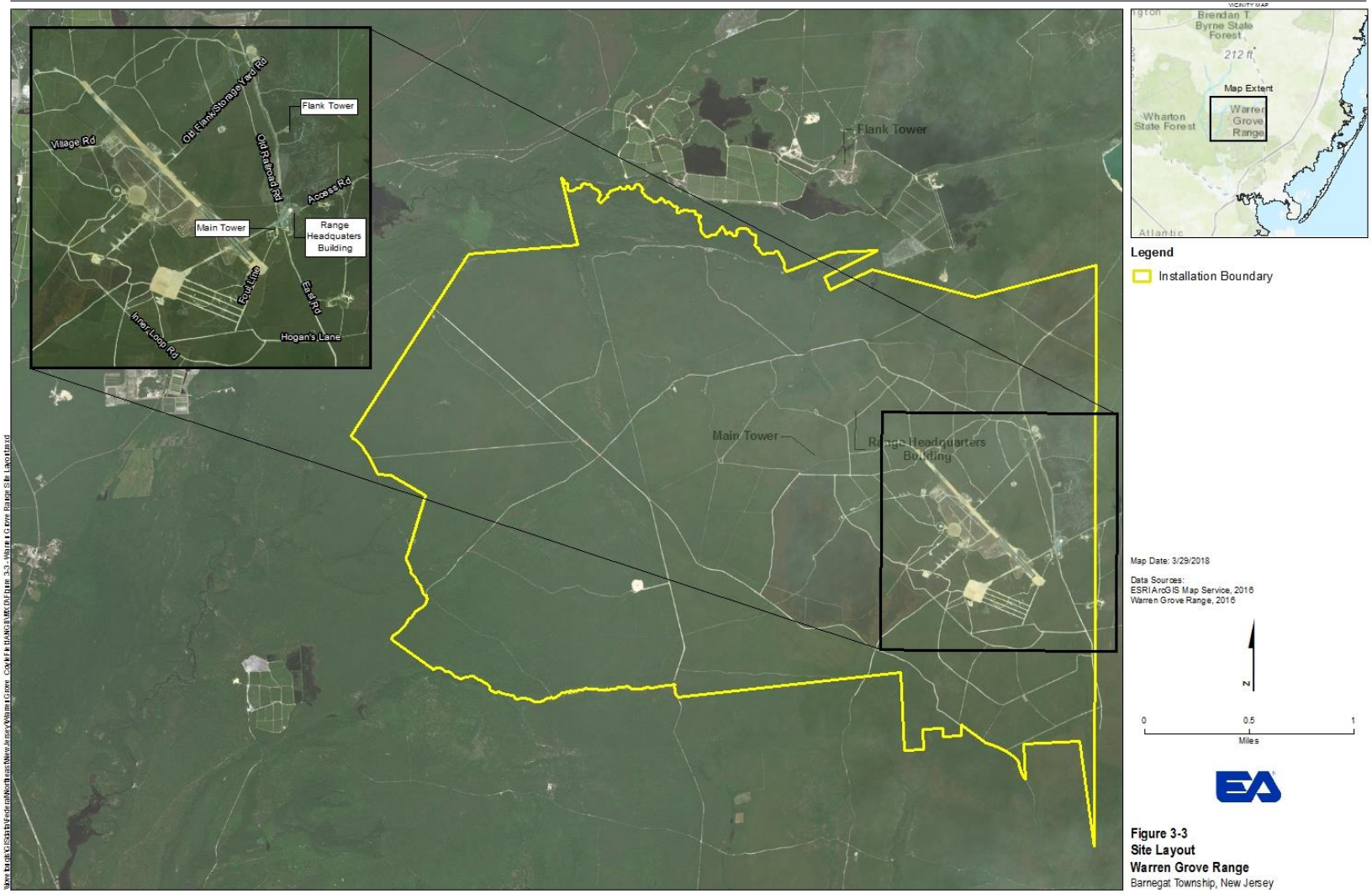

Figure 3-3
Site Layout
Warren Grove Range
Barnegat Township, New Jersey

Figure 3-4
Site Layout
Coyle Field
Barnegat Township, New Jersey

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The 177 FW has been activated twice to federal service since World War II. In 1961, the unit was called up for the Berlin Crisis and in 1968 for the Pueblo Crisis, which sent unit members to all corners of the globe including Vietnam. Years later, 70 unit members were activated in support of Desert Storm. As the events of September 11th unfolded, the 177 FW, through years of preparation, training, and commitment, launched to our nation's emergency and desperate call for help. These Air Guard warriors brought with them the character and core values of generations of heroic citizen soldiers and airmen. Since October 2001, the wing has had an active involvement in Operation Noble Eagle, Operation Southern Watch, Operation Northern Watch, Operation Enduring Freedom, and Operation Iraqi Freedom.

Warren Grove Range

WGR has been in continuous operation as a weapons range since 1942. Originally activated by the United States Navy, the Warren Grove Test Site was used to test special weapons. Research and development of torpedoes, bombs, and other naval ordnance continued until 1945. After the end of World War II, WGR remained as a test area for newly developed ordnance devices operated by the National Air Experimental Facility at Naval Air Station Atlantic City.

The construction of WGR
Photo from WGR archives

In 1949, management responsibility for WGR shifted to Naval Air Station Lakehurst. WGR remained under naval control until 1960, when it was transferred to the USAF. The Air National Guard's (ANG's) transition to A-10 Thunderbolt II aircraft in the mid-to-late 1970s prompted the DoD to acquire WGR. In late 1979 and early 1980, a review of the tax maps of all the townships under the current airspace was conducted for the purpose of acquiring the land for WGR. Although this area comprised 50,000 acres on the ground, it was decided that less than 10,000 acres would be acquired, all within Burlington County. The largest area was to be northeast of the Ocean and Burlington County line and its primary purpose was to provide a ricochet safety zone to protect the community from the dangers of the 30-millimeter Gatling gun on the A-10. Today, WGR consists of 9,416 acres of land, 500 acres of which are used for tactical and conventional air-to-ground training using inert munitions. Approximately 16 acres of WGR are used for range operations and maintenance activities. The New Jersey Army National Guard uses a portion of WGR for Unmanned Aircraft System operations.

WGR is currently under license from the USAF and operated by the 177 FW of NJANG as a Class A conventional weapons range. WGR has expanded operations to include supporting activities of the armed services and government agencies and hosting special interest groups.

For the history of WGR prior to World War II, see the ICRMP (Component Plan C) that provides details of historic and pre-historic use and cultural resources present on WGR.

Coyle Field

Military airdrop at Coyle Field

In 1936, the New Jersey Forest Fire Service (NJFFS) purchased 1 square mile (640 acres) of condemned property, including the Coyle Field drop zone, from a private landowner for use as an airfield. The Civilian Conservation Corps then built three crushed stone runways in a crossing pattern during the late 1930s. NJFFS has operated various helicopters and fixed-wing aircraft from the airfield since that time to monitor the Pinelands National Reserve. An aircraft hangar, a maintenance complex, and an equipment storage yard were constructed by NJFFS in 1961 to support their activities. In 1968, the State of New Jersey leased 253.72 acres to USAF for establishment of an ANG drop zone. It has been used since that date for training purposes, primarily for cargo drops, station keeping equipment missions, and personnel drops. The land is leased from NJDEP, Division of Parks and Forestry to USAF, who licenses the property to NJANG. Previously, the scheduling for the drop zone was managed by the 166 Air Wing of the Delaware ANG. NJANG at WGR maintained the drop zone from 1968 until 1995. NJFFS has maintained the drop zone and gravel runway since 1995. In 1997, a 2-acre parcel along State Route 72 was added to the USAF lease to allow construction of an airdrop support facility. The 177 FW began to manage Coyle Field in 2000.

3.3 MILITARY MISSIONS

177th Fighter Wing

F-16C Fighting Falcons

The 177 FW stationed at the Atlantic City International Airport, New Jersey, oversees the activities conducted on WGR. The 177 FW's federal mission is to provide combat-ready personnel, aircraft, and equipment for worldwide deployment in support of USAF objectives. The 177 FW's state mission is to protect life and property, provide disaster relief, and ensure public safety when called upon by the Governor. The 177 FW has served a number of missions both in New Jersey and throughout the world, encompassing the missions of air sovereignty, combat/irregular air patrols, strategic air defense, and defensive counter-air and air-to-ground attack. The 177 FW is home to the F-16C Fighting Falcon, a compact, multi-role fighter aircraft, flown by highly trained and skilled pilots.

Warren Grove Range

The mission of the WGR is to provide a quality combat training environment for all United States and Allied air and ground forces. WGR is a fully manned facility with a Range Control Officer (RCO) for aircraft access and range personnel who provide ground scoring during gunnery operations, maintenance, and fire protection. WGR supports the following training activities:

25 scorable target scenarios for delivery of inert and training bombs, rockets, and aerial gunnery; TGM-65 (Training Maverick Guided Missile) training; laser targets; laser target designation; air-drop of cargo; electronic combat; defensive countermeasures; and communications jamming.

WGR currently supports six daily ANG units and five regular users from the Army National Guard, USAF, and United States Marine Corps. Approximately 1,800 sorties occur per year at WGR, with increasing ground operations (NJANG 2008a).

WGR also supports the activities of other armed services as well as activities of other government agencies. This support extends to, but is not limited to, helicopter gunnery with the Army National Guard, United States Marine Corps, and ANG from the four state area; Operation Rolling Thunder, an Army helicopter exercise; Navy carrier-based aircraft use of the range; Navy Sea-Air-Land (SEAL) Teams training; 21st Air Force personnel parachute jump; NJFFS Training; Police Defensive Driving Course; early testing of night vision and laser equipment; environmental studies of the area by Drexel and Rutgers University; and state and county air disaster training.

Normal operating hours are Tuesday through Saturday, 0900 to 1600 hours with additional hours during night operations from 1200 to 2200 hours. On average, the restricted area is scheduled on a daily basis 62 percent of the year. Utilization is 82 percent of the days scheduled, and the airspace is utilized 95 percent of the time activated. WGR supports two visual low altitude routes terminating at the range. VR-1709 enters from the south and VR-1709B enters from the north. Operating hours for VR-1709 and VR-1709B are from sunrise to sunset (NJANG 2008a).

Coyle Field

Coyle Field is a rectangular parcel of land bounded by state forests that is used as an active military drop zone. Multiple units use Coyle Field for training purposes to carry out each unit's mission (USAF 1998).

3.4 SURROUNDING COMMUNITIES

Atlantic City ANGB

The Atlantic City ANGB is located within Atlantic City International Airport, approximately 5 miles west of Absecon Bay (intracoastal waters), 9 miles west of Atlantic City, and 10 miles west of the Atlantic Ocean shoreline (Figure 3-1). The installation contains two parcels of land. The main cantonment area, approximately 230 acres is located west of the airport commercial service terminal and parking facilities and south of the airfield (Figure 3-2). The base includes a headquarters building, operations building, civil engineering facility, multiple support buildings, aircraft maintenance hangars, alert hangars, and engine shop. The Ammunition Area, approximately 65 acres is located northwest of the airport terminals (Figure 3-2). The two parcels are separated by the runway running north-south. Both of the installation parcels are located on Atlantic 563 and can be accessed via Pomona/Wrangleboro Roads to the north or Amelia Earhart Blvd/Delilah Road to the south. The installation is accessed through the main gate off of Tilton Road.

The land surrounding the installation is developed airport property to the north and east. The immediate vicinity of the airport is comprised mainly of mixed commercial, residential, and light industrial. Scattered agricultural uses are located north of the installation and airport. Areas west

and south of the installation contain naturally forested areas containing a mix of pine and hardwood forests. The Laurel Memorial Cemetery is located immediately west of the Munitions Area.

Warren Grove Range

The surrounding road network intersects WGR at County Road 539, 4.5 miles north of the Garden State Parkway interchange. County Road 539 provides north-south access paralleling the New Jersey coastline. US Highway 9, a secondary highway, also provides north-south access; it follows the Parkway in one portion and joins it near New Gretna. US Highways 30 and 322, south of WGR, provide east-west access between Philadelphia and Atlantic City. North of WGR, State Highways 70 and 72 provide east-west access intersecting with both US Highway 9 and the Garden State Parkway (Figure 3-1).

Primary access to WGR is provided by a graded dirt road exiting from Ocean County Road 539 approximately 1.5 miles east of the Range. With the exception of the primary access road, 177 FW limits access to entry roads via a series of berms, gates, trenches, and posts. Controlled access to the internal roads is granted to firefighting equipment and authorized personnel. The system of internal roads is maintained to provide access during fire emergencies and to act as firebreaks during wildfires. These roads are primarily passable only by four-wheel-drive vehicles due to the loose nature of the substrate. The roads also serve to define blocks for conducting prescribed fires.

The land surrounding WGR is primarily natural forested land which is part of the New Jersey Pinelands National Reserve. The Range is principally neighbored by state forestlands and uninhabited private forest which lies in the Pinelands preservation area. The nearest residential areas to WGR are Sim Place directly north of the Range, and Warren Grove. Sim Place is a small rural community nestled among a network of commercial cranberry bogs. Warren Grove, a small unincorporated town, is approximately 3 miles northeast of the Range. There is a 55.6-acre unimproved lot under private ownership 1,000 feet (ft) from the eastern boundary of the Range. Although the local population has grown over the past decade, land use has changed very little in the immediate vicinity of the Range.

Coyle Field

Coyle Field is located on Highway 72 approximately 10 miles north of WGR (Figure 3-1). The land surrounding Coyle Field is primarily natural forested land which is part of the New Jersey Pinelands National Reserve.

3.5 LOCAL AND REGIONAL NATURAL AREAS

Natural areas in proximity to WGR, Coyle Field, and Atlantic City ANGB are comprised of New Jersey state lands. State lands adjacent to WGR include Stafford Forge Wildlife Management Area (WMA), Bass River State Forest, Wharton State Forest, and Penn State Forest (Figure 3-1). Federal lands include Edwin B. Forsythe National Wildlife Refuge (Figure 3-1).

Stafford Forge WMA is made up of two units comprising 17,212 acres located 6 miles southeast of WGR, 29 miles northeast of Atlantic City ANGB, and 11.5 miles southeast of Coyle Field. This multiple use WMA is mostly forested acreage primarily managed for wildlife habitat. Stafford Forge WMA also provides a diversity of recreational activities including hunting, hiking, canoeing, off-road vehicle use, and wildlife watching.

Bass River State Forest, located approximately 6 miles south of WGR, 25 miles northeast of Atlantic City ANGB, and 9.7 miles south of Coyle Field, was acquired by the State of New Jersey in 1905 for public recreation, water conservation, and wildlife and timber management. Lake Absegami, a 67-acre lake constructed in the early 20th century, is the primary attraction for recreationists. Recreational activities in the Bass River State Forest include boating, canoeing, fishing, hunting, horseback riding, hiking, and swimming. A nature trail loops through Absegami Natural Area (3,830 acres). This wetland forest is comprised of a white cedar swamp and the surrounding oak-pine forest community. This unique stunted forest ecosystem, known locally as the Pygmy Forest, is globally rare and supports an extensive forest of pine and oak trees that can obtain a canopy height of only 4 ft at maturity. The area also supports a New Jersey state-endangered plant species, broom crowberry (Corema conradii), and numerous rare species of moths.

Wharton State Forest, located approximately 15 miles west of WGR, 23 miles northwest of Atlantic City ANGB, and 8.7 miles south of and slightly west of Coyle Field, is the largest single tract of land, comprising 114,793 acres, within the New Jersey State Park System. It is also the site of Batsto Village, a former bog iron and glassmaking industrial center from 1766 to 1867 that reflects the agricultural and commercial enterprises that existed here during the late 19th century. Also within Wharton State Forest is the Oswego River. The Oswego River Natural Area is a freshwater wetland corridor and is home to state endangered plants, which include bog asphodel (*Narthecium americanum*), Pine Barren boneset (*Eupatorium resinosum*), and curly grass fern (*Schizaea pusilla*). The state endangered Pine Barrens treefrog *(Hyla andersonii*) is also found within the Oswego River Natural Area. Throughout Wharton State Forest there are rivers and streams for canoeing; hiking trails; 500 miles of unpaved roads for mountain biking and horseback riding; and numerous lakes, ponds, and fields ideal for wildlife observation.

Penn State Forest is located approximately 8 miles northwest of WGR, 33 miles north of Atlantic City ANGB, and 4.6 miles south and slightly west of Coyle Field. Penn State Forest's undeveloped Pine Barrens forest represents a large undeveloped region of the globally rare Pine Barrens forest. This state forest provides a variety of recreational opportunities, including hunting, fishing, canoeing, boating, wildlife watching, and hiking. Lake Oswego, a result of an upstream dam that was constructed to create a reservoir for a downstream cranberry operation, is suitable for canoeing and fishing.

The southern portion of the Edwin B. Forsythe National Wildlife Refuge, which totals 47,000 acres along a 50-mile section of the Jersey shore (mainly inter-coastal areas), is located approximately 5 miles north of Atlantic City ANGB, 15 miles east of WGR, and 17 miles southeast of Coyle Field. The wildlife refuge is managed for migratory birds as it is one of the Atlantic Flyway's most active flight paths. Recreational opportunities at the wildlife refuge include hunting, fishing, wildlife viewing, photography, and environmental education.

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4. PHYSICAL ENVIRONMENT

4.1 CLIMATE

The climate of Burlington and Atlantic County is characterized by a humid, mid-latitude, predominately continental climate. The large-scale seasonal variation in the circulation of the atmosphere controls the climate of the Pine Barrens. During most winters, strong surges of cold air and strong northwesterly winds will push southeastward from the strong, semi-permanent high-pressure area in Canada across the eastern half of the country, including the Pine Barrens. Winter occasionally brings southwesterly winds that bring mild, humid, maritime air masses from the Gulf of Mexico as far northward as New Jersey. Spring progresses in the Pine Barrens as the cold high-pressure area over Canada weakens. Typically, it has dissipated by June and the cool polar air masses are less frequent in occurrence and duration. The large semi-permanent, high-pressure atmospheric circulation centered near Bermuda dominates the summer climate in the Pine Barrens. The clockwise circulation of the air mass causes southwest winds to bring warm, humid, maritime, tropical air masses into southern New Jersey from the Caribbean Sea and the Gulf of Mexico. The high moisture content of these air masses is responsible for the humidity throughout the Mid-Atlantic and for the frequency of afternoon and evening thunderstorms that are a major source of precipitation for the Pine Barrens. A gradual weakening of the Bermuda high-pressure system is responsible for the transition to autumn and the winter system is typically restored by mid-December.

The climate has significant variation between summer and winter temperatures, as well as large daily and day-to-day temperature fluctuations. Typically, the warmest months are July and August and the coldest month is January. In 2016, the average maximum temperature in July and August was 88 degrees Fahrenheit (°F) and the average minimum temperature in January was 24°F (National Oceanic and Atmospheric Administration [NOAA] 2017). In 2016, the annual precipitation was approximately 70.7 inches (in.), which includes approximately 25.7 in. of snow in January, February, and March (NOAA 2017).

4.2 LANDFORMS

WGR, Atlantic City ANGB, and Coyle Field are in the Atlantic Coastal Plain physiographic province, which extends from Massachusetts to Florida. The Atlantic Coastal Plain is characterized by low-lying, flat to gently rolling terrain with abundant drainages that are not usually well-incised. This topography partially reflects the periglacial conditions of this area during the Pleistocene glaciation. The gentle rolling plain around the range exhibits limited topographic relief and topographic features. Elevations at WGR range from 70 to 150 ft above mean sea level (NJANG 2016) (Figure 4-1). Elevations of the drop zone at Coyle Field are slightly higher than WGR and generally range from 150 to 175 ft above mean sea level (USAF 2000) (Figure 4-2). Elevations at Atlantic City ANGB range from 40 to 85 ft above mean sea level (Figure 4-3).

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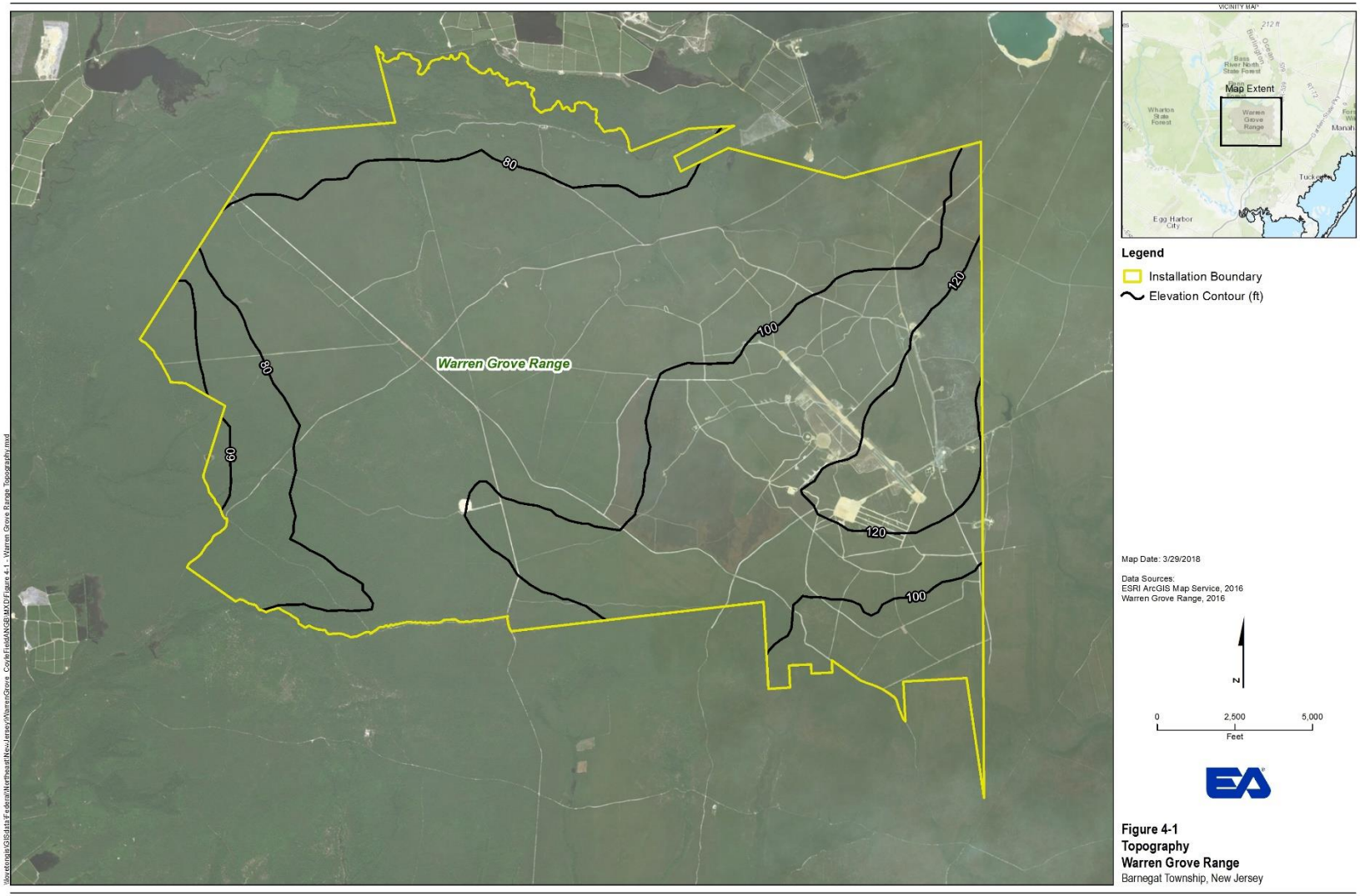

Figure 4-1
Topography
Warren Grove Range
Barnegat Township, New Jersey

Figure 4-2
Topography
Coyle Field
Barnegat Township, New Jersey

Figure 4-3
Topography
Atlantic City ANGB
Egg Harbor Township, New Jersey

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4.3 GEOLOGY AND SOILS

The Atlantic Coastal Plain consists of a thick arrangement of various unconsolidated sedimentary layers overlying a bedrock layer. The bedrock layer is composed of Wissahickon schist and gneiss. The sedimentary layers gently dip toward the southeast and thicken on the edge of the continental margin. The Cohansey Sand Formation is the most prevalent sedimentary unit throughout the WGR. The formation consists of thick beds to thickly laminated seams of sand and clay, and ranges in thickness from 0 to 250 ft. The Cohansey Sand Formation is likely the result of mixing of older marine deposits with Pleistocene alluvium and lake sediments. The Kirkwood Formation underlies the Cohansey Sand Formation and dates to the middle Miocene. The Kirkwood contains an upper sandy stratum and a lower silty stratum with interbedded clay layers that range in thickness from 0 to 896 ft. The Kirkwood overlaps several formations, making it a major unconformity in the New Jersey Coastal Plain. Various Cretaceous sands, clays, and greensands are found below the Kirkwood Formation (Rhodehamel 1998a).

Warren Grove Range

There are no saleable or leasable mineral resources documented in the area of WGR. Sand and gravel deposits used for road repair represent the only mineral resources on or within the immediate vicinity of the Range. Illminite deposits have been mined from the coastal sediments for their titanium content; however, there is a limited potential for their existence on WGR (NJANG 1993).

The major soil types present at WGR include the Lakewood, Lakehurst, and Woodmansie series. Minor soil types at WGR have been identified as Atsion, Downer, Keyport, Pits, and Urban Land. The eastern part of the range is dominated by the Woodmansie series (National Resources Conservation Service [NRCS] 2011). Soil types are identified on Figure 4-4 and described in Table 4-1.

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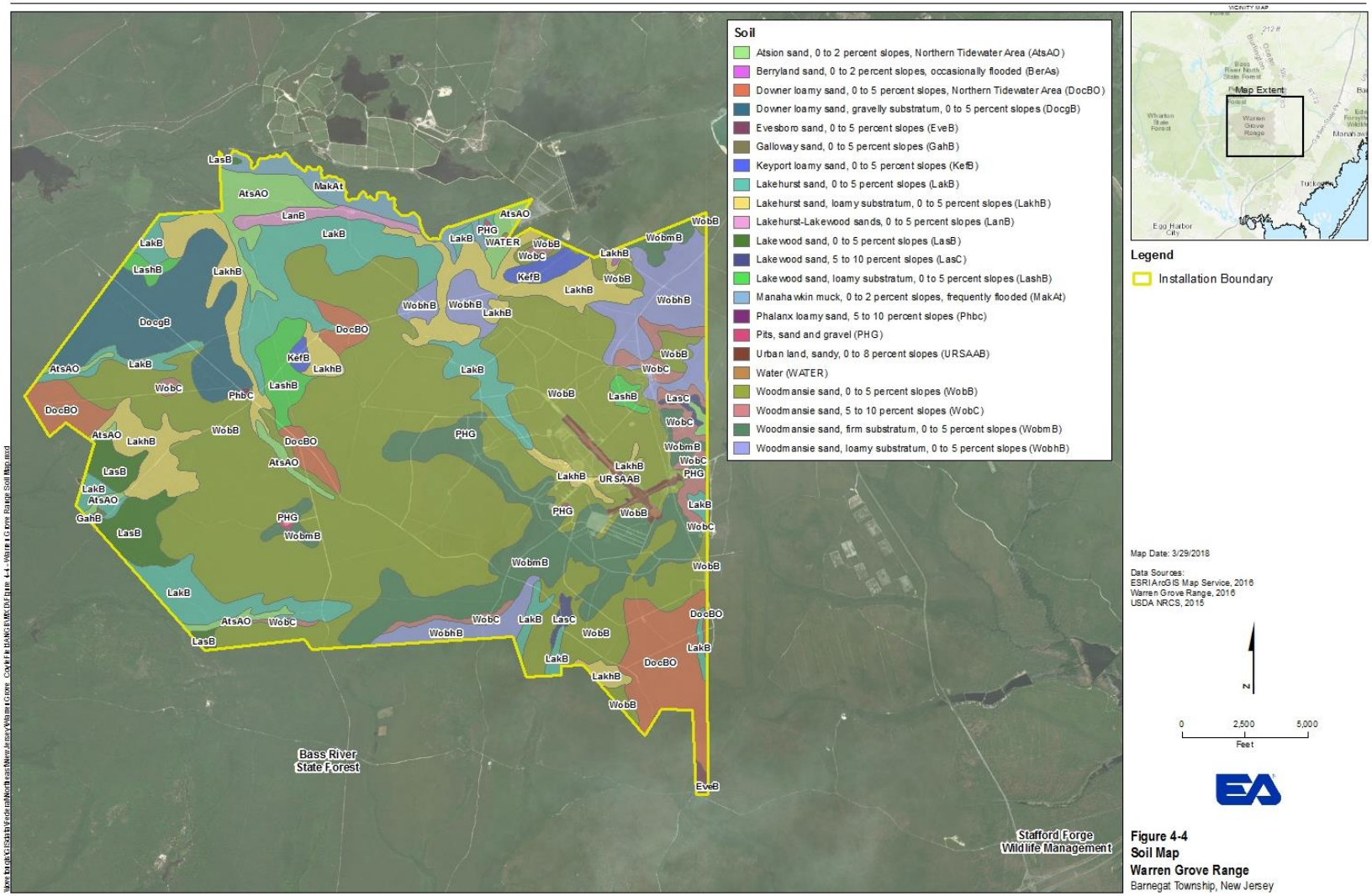

Figure 4-4
Soil Map
Warren Grove Range
Barnegat Township, New Jersey

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Table 4-1. Major Soil Type Descriptions for WGR

Map Unit Name	Map Symbol	Site Cover (acres)	Site Cover (%)	Slope	Description
Atsion sand	AtsAO	324.8	3.3	0 to 2	Sand or loamy sand soil with fluctuating water table. Permeability is moderate to high. Poorly drained soil.
Berryland sand	BerAs	3.8	<0.1	0 to 2	This nearly level soil has the profile typical for the series. Included with this soil type in mapping are areas that were cleared for cranberries and blueberries. Well drained soil.
Downer loamy sand	DocBO	566.0	5.7	0 to 5	Low to moderately permeable soil characteristic of wooded areas. Well drained soil.
Downer loamy sand, gravelly substratum	DocgB	545.4	5.5	0 to 5	Loamy sand surface layer (up to 17 inches [in.]), overlying a sandy loam layer (17–28 in.), which overlies a gravelly sand layer (2 –52 in.). Permeability is lowest at the surface and highest at the gravelly substratum level; available water capacity is the inverse (low at the surface, high at the gravelly substratum level). Well drained soil.
Evesboro sand	EveB	13.7	0.1	0 to 5	This soil has the profile described as typical for the series. In a few places, loamy layers occur at a depth of 30–60 in. These layers increase the available water capacity and the suitability of the soil for deep-rooted plants such as trees. This layer needs protection from wind erosion. Well drained soil.
Galloway sand	GahB	3.0	<0.1	0 to 5	Galloway soils were previously mapped with the Klej series. This soil occurs mostly in the outer Coastal Plain where the sands are mostly medium and coarse. Widely spaced ditches or underdrains are used to lower the water table enough so that it does not affect vehicles. Moderately well drained soil.
Keyport loamy sand	KefB	75.0	0.8	0 to 5	Form on clay beds containing thick marine deposits containing variable amounts of glauconite. High available water capacity and low permeability. Moderately well drained soil.
Lakehurst sand	LakB	954.3	9.6	0 to 5	Deep with a bleached gray sand surface soil (up to 18 centimeters [cm]) and a gleyed soil layer emergent at around 60 cm or more. The gleyed soil is indicative of a high water table that rises in late winter. Found predominantly on level ground. Moderately well to somewhat poorly drained.
Lakehurst sand, loamy substratum	LakhB	768.3	7.8	0 to 5	Deep with a bleached gray sand surface soil (up to 18 cm) and a gleyed soil layer emergent at around 60 cm or more. The gleyed soil is indicative of a high water table that rises in late winter. Found predominantly on level ground. Well drained soil.

Table 4-1. Major Soil Type Descriptions for WGR

Map Unit Name	Map Symbol	Site Cover (acres)	Site Cover (%)	Slope	Description
Lakehurst-Lakewood sand	LanB	71.2	0.7	0 to 5	Exhibits characteristics of both LakB and LasB. Moderately well to well-drained soil.
Lakewood sand	LasB LasC	247.8	2.5	0 to 5 5 to 10	Found in highly leached, impoverished conditions of uplands areas. Extremely xeric soil, highly acidic, and contains high levels of soluble aluminum. Soil formed due to unusually sandy, quartzose parent material which podzolizes easily. Excessively drained soil.
Lakewood sand, loamy substrate	LashB	177.2	1.8	0 to 5	Sandy or fine sand soil with loamy substratum. Similar description as for LtB. Moderately well drained soil.
Manahawkin muck	MakAt	144.8	1.5	0 to 2	Consists of about 2 feet (ft) of black finely decomposed, saturated organic matter, generally over clayey material in places. In a few other places this organic layer is less than 1 ft thick or more than 3 ft in places. Very poorly drained soil.
Phalanx loamy sand	PhbC	3.8	<0.1	5 to 10	These soils were formally mapped as Sandy Land, Ironstone in older surveys in New Jersey. Consists of about 2 ft of sand over discontinuous ironstone layers ½ to 2 ft thick. Slopes generally 5–15%, but in some places are more than 15%. The ironstone occurs in about 60 to 70% of the area. Soil is not suitable for cultivation. Well drained soil.
Pits sand or gravelly sand	PHG	17.4	0.2	NA	Open or exposed soil that has been excavated. Typically found at the tops of knolls which are accessible by loaders and trucks. Pits are likely underlain by clay beds, but overlying soils are highly permeable. Moderately well to well-drained soil.
Urban Land, sandy	URSAAB	60.1	0.6	0 to 8	Most of this land is developed or awaiting development. The soil has slight limitations for industrial or commercial use, moderate limitations for woodland or wildlife use, and severe limitations for farming and dug ponds. Moderately well drained soil.
Woodmansie sand	WobB WobC	4,451.1	45.0	0 to 5 5 to 10	Deep well-drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas of the landscape, the soils are affected by occasional fire which prevents organic material from building on the surface. Well drained soil.
Woodmansie sand, firm substratum	WobhB	553.4	5.6	0 to 5	Deep, well-drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas of the landscape, the soils are affected by occasional fire which prevents organic material from building on the surface. At 30 to 60 in. deep this soil becomes sandy clay loam or gravelly sandy clay loam. Well drained soil.

Table 4-1. Major Soil Type Descriptions for WGR

Map Unit Name	Map Symbol	Site Cover (acres)	Site Cover (%)	Slope	Description
Woodmansie sand, firm substratum	WobmB	912.4	9.2	0 to 5	Deep, well drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas, the soils are affected by occasional fire which prevents organic material from building on the surface. At 30 to 40 in., this soil exhibits alternating gravelly sand and loamy sand layers. At 40 to 60 in., it becomes sandy clay loam again. Well drained soil.
Note: Based on geographic information system data, the WGR comprises 9,897 acres versus 9,416 acres. Approximately 3.4 acres or <0.1 % of WGR is water. Source: *USDA* 2017.					

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Coyle Field

Soils at Coyle Field generally consist of Downer loamy sand and Woodmansie sand. These soils are acidic, porous, low in natural fertility, and are leached of nutrients. These two soils are described as follows.

Downer Loamy Sand-The Downer series occurs on nearly level or rolling uplands and consists of a surface layer of dark grayish brown, loamy sand underlain by yellowish brown, loamy sand and sandy loam. These soils experience only slight erosion due to water, but are very susceptible to wind erosion. The soil is very strongly acidic with a hydrogen ion concentration (pH) of 3.6 to 5.5, with a low shrink-swell potential. The available water capacity and organic content are low. The soil is well-drained, with moderate to moderately rapid permeability and a moderate rate of water transmission through the soil.

Woodmansie Sand-The Woodmansie sand occurs along divides and sloping uplands and consists of a surface layer of gray sand underlain by light yellow to yellowish brown sand and sandy loam. Like the Downer series, these soils are only slightly eroded by water, but are very susceptible to wind erosion. These soils are also very strongly acidic with a low shrink-swell potential. The available water capacity and organic content are low, and the soil drains well. It has moderate to moderately rapid permeability and a moderate rate of water transmission through the soil.
Soil types are identified on Figure 4-5 and described in Table 4-2.

Atlantic City ANGB

Soils at Atlantic City ANGB generally consist of downer loamy sand and psamments. As noted above, downer loamy sand is generally well-drained, with a low to moderate permeability. These soils are slightly acidic to strongly acidic, with the pH ranging from 3.6 to 5.5 depending on depth. Downer loamy sand also has low to moderate water capacity, and low organic content. Downer loamy sand is found in knolls and low hills. Psamments are well-drained sandy soils typically found in depressional areas at the base of slopes. These soils have low organic content, and are acidic. Psamments are with a moderately deep water table and low water storage availability.

According to the Soil Survey of Atlantic County (USDA 1978) the project sites are underlain primarily by fill land. The survey describes fill land to be low in natural fertility, contain a very low content of organic matter, and have low available water capacity. Permeability is rapid in most places except where fine-textured material has been introduced into the fill or where the fill has been placed over poorly graded soils. Depth to the water table is variable. According to the same survey, the Construct MAC Pad is the only project site that might be located outside the fill land area. Soil bore logs examined in the area, however, show at least 12 to 24 in. of fill material overlying the Sassafras Formation shown in the 1978 Soil Survey. Soil types are identified on Figure 4-6 and described in Table 4-3.

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Figure 4-5
Soil Map
Coyle Field
Barnegat Township, New Jersey

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Table 4-2. Major Soil Type Descriptions for Coyle Field

Map Unit Name	Map Symbol	Site Cover (acres)	Site Cover (%)	Slope	Description
Downer loamy sand	DocBO	73.9	31.3	0 to 5	Low to moderately permeable soil characteristic of wooded areas. Well drained soil.
Lakehurst sand, loamy substratum	LakhB	8.1	3.4	0 to 5	Deep with a bleached gray sand surface soil (up to 18 centimeters [cm]) and a gleyed soil layer emergent at around 60 cm or more. The gleyed soil is indicative of a high water table that rises in late winter. Found predominantly on level ground. Well drained soil.
Woodmansie sand	WobB WobC	130.5	55.2	0 to 5 5 to 10	Deep well-drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas of the landscape, the soils are affected by occasional fire which prevents organic material from building on the surface. Well drained soil.
Woodmansie sand, firm substratum	WobhB	21.0	8.9	0 to 5	Deep, well-drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas of the landscape, the soils are affected by occasional fire which prevents organic material from building on the surface. At 30 to 60 inches (in.) deep this soil becomes sandy clay loam or gravelly sandy clay loam. Well drained soil.
Woodmansie sand, firm substratum	WobmB	2.8	1.2	0 to 5	Deep, well drained soils with a bleached surface horizon (18 cm or more thick). Found in upland areas, the soils are affected by occasional fire which prevents organic material from building on the surface. At 30 to 40 in., this soil exhibits alternating gravelly sand and loamy sand layers. At 40 to 60 in., it becomes sandy clay loam again. Well drained soil.

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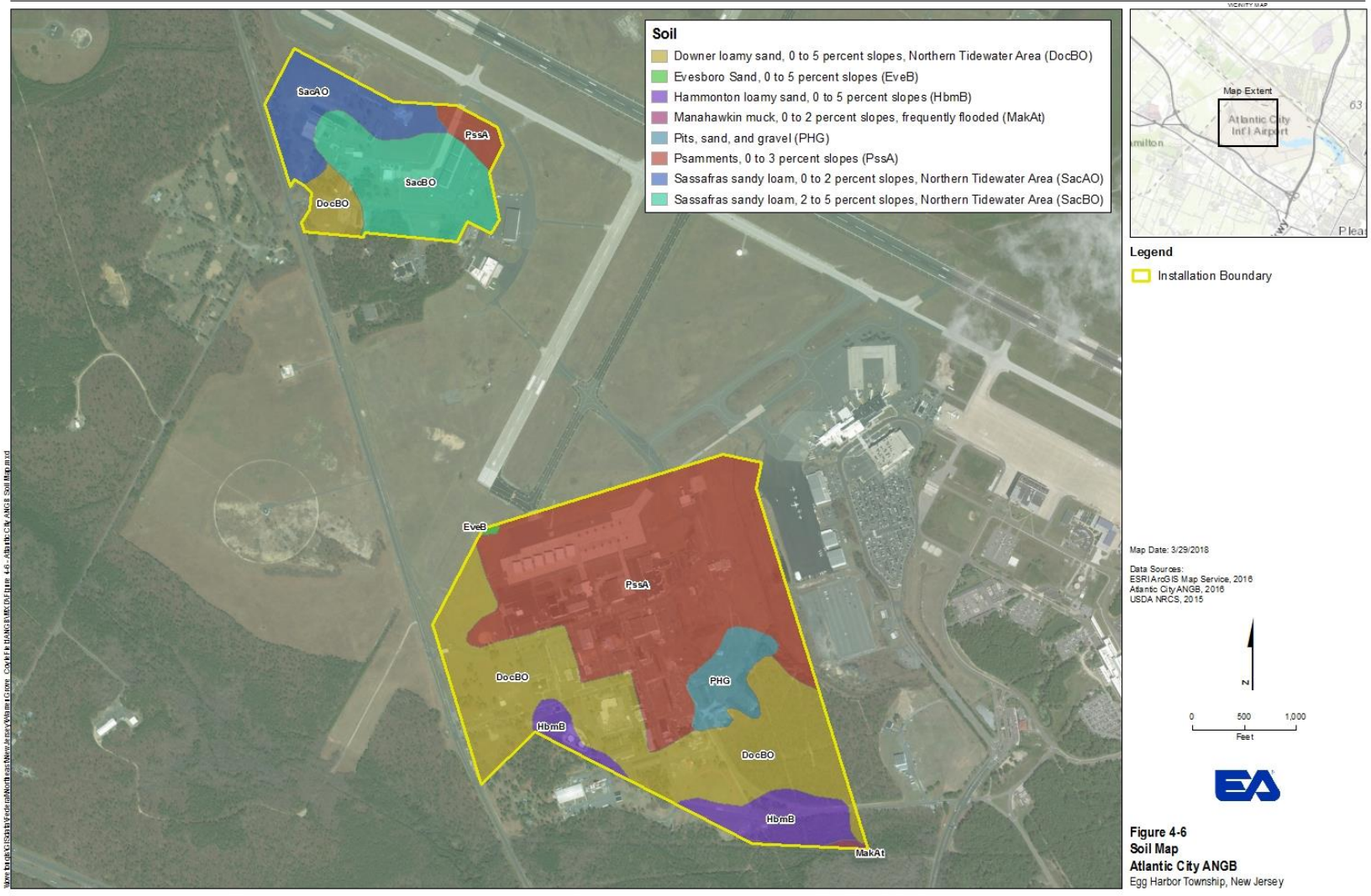

Figure 4-6
Soil Map
Atlantic City ANGB
Egg Harbor Township, New Jersey

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Table 4-3. Major Soil Type Descriptions for Atlantic City ANGB

Map Unit Name	Map Symbol	Site Cover (acres)	Site Cover (%)	Slope	Description
Downer loamy sand, Northern Tidewater Area	DocBO	89.9	30.4	0 to 5	Low to moderately permeable soil characteristic of wooded areas. Well-drained soil.
Evesboro sand	EveB	0.3	0.1	0 to 5	This soil has the profile described as typical for the series. In a few places, loamy layers occur at a depth of 30–60 inches. These layers increase the available water capacity and the suitability of the soil for deep-rooted plants such as trees. This layer needs protection from wind erosion. Well-drained soil.
Hammonton loamy sand	HbmB	18.6	6.3	0 to 5	This soil type is found on flats and depressions, and typically contains loamy sand in the top 18 inches. This layer is moderately well drained.
Manahawkin muck, frequently flooded	MakAt	0.7	0.2	0 to 2	Consists of about 2 feet (ft) of black finely decomposed, saturated organic matter, generally over clayey material in places. In a few other places this organic layer is less than 1 ft thick or more than 3 ft in places. Very poorly drained soil.
Pits, sand, and gravel	PHG	11.6	3.9	NA	Open or exposed soil that has been excavated. Typically found at the tops of knolls which are accessible by loaders and trucks. Pits are likely underlain by clay beds, but overlying soils are highly permeable. Moderately well to well-drained soil.
Psamments	PssA	120.9	40.9	0 to 3	Consists of sandy lateral spread deposits in depressions, typically found at the toeslope. Soil is well drained and sandy, with a moderately deep water table and low water storage availability.
Sassafras sandy loam, Northern Tidewater Area	SacAO	21.4	7.5	0 to 2	Soils are found on flats and fluviomarine terraces. Typically includes layers of sandy loam overlaying loamy sand and sand. Soils are well drained, with a deep water table and moderate water storage.
Sassafras sandy loam, Northern Tidewater Area	SacBO	32.5	11.0	2 to 5	Soils are found on flats and fluviomarine terraces. Typically includes layers of sandy loam overlaying loamy sand and sand. Soils are well drained, with a deep water table and moderate water storage.

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4.4 HYDROLOGY

Water resources considered in this INRMP encompass both surface and groundwater. Surface water resources include lakes, rivers, and streams, and are important for a variety of reasons including ecological, economic, recreational, and human health. Groundwater comprises subsurface water resources and is an essential resource in many areas because it is used as a source of potable water, for agricultural irrigation, and for industrial purposes. Groundwater properties are often described in terms of depth to aquifer, aquifer or well capacity, water quality, and surrounding geology.

Burlington County has a relatively low risk of droughts, floods, and hurricanes. Rainfall is distributed fairly evenly throughout the year; thus, precipitation rates rarely exceed the infiltration rates of the sandy soils. Flooding from hurricanes, tropical storms, winter storms, and snow melt are New Jersey's most common natural hazards. Extra-tropical cyclones, known in the region as "Nor'easters," result in property damage from flooding and storm surge, even outside known floodplains due to overburdened drainage systems. Flooding during winter months is caused by storm surges, ice blockages, and high water levels from snow melt.

4.4.1 Surface Water

Warren Grove Range

Streams and tributaries of three Atlantic Coastal basin stream systems drain the Pine Plains: the Oswego, Wading, and Bass rivers. The surface waters of these stream systems are acidic (pH as low as 4.5) and low in dissolved solids (Patrick et al. 1998). In Pine Barrens streams, groundwater discharge characteristically accounts for 89 percent of annual stream discharge (Rhodehamel 1998b).

Oswego River on the border of WGR
Photo by Walter F. Bien

WGR is located within the Mullica-Toms Watershed (Hydrologic Unit Code 02040301), which includes portions of five counties in New Jersey. In general, surface water flows from WGR to the north and west into the Oswego River, which borders the northern portion of WGR. Surface water on WGR includes seven streams (Figure 4-7). West Branch drains the southern end of WGR. Buck Run and Beaver Branch drain the southwestern side of WGR and flow west into the Oswego River. The Oswego River and an unnamed tributary drain the northern part of WGR and flow west. The Oswego River is a tributary of the Wading River which discharges into Great Bay and finally the Atlantic Ocean (Patrick et al. 1998). Beaver Branch, another tributary to the Wading River, borders the Range for approximately 1 mile on its southern boundary. Governor's Branch, which is a tributary to Westecunk Creek, is also in the southern portion of WGR. This tributary originates in a pond on the northern side of the entrance road, and flows southeast to join Westecunk Creek. Minor flow occurs through this drainage. South of WGR, surface waters drain south into the Bass River system. Ultimately, these river systems all drain into the Mullica River, which discharges into Great Bay, and finally into the Atlantic Ocean (NJANG 2016).

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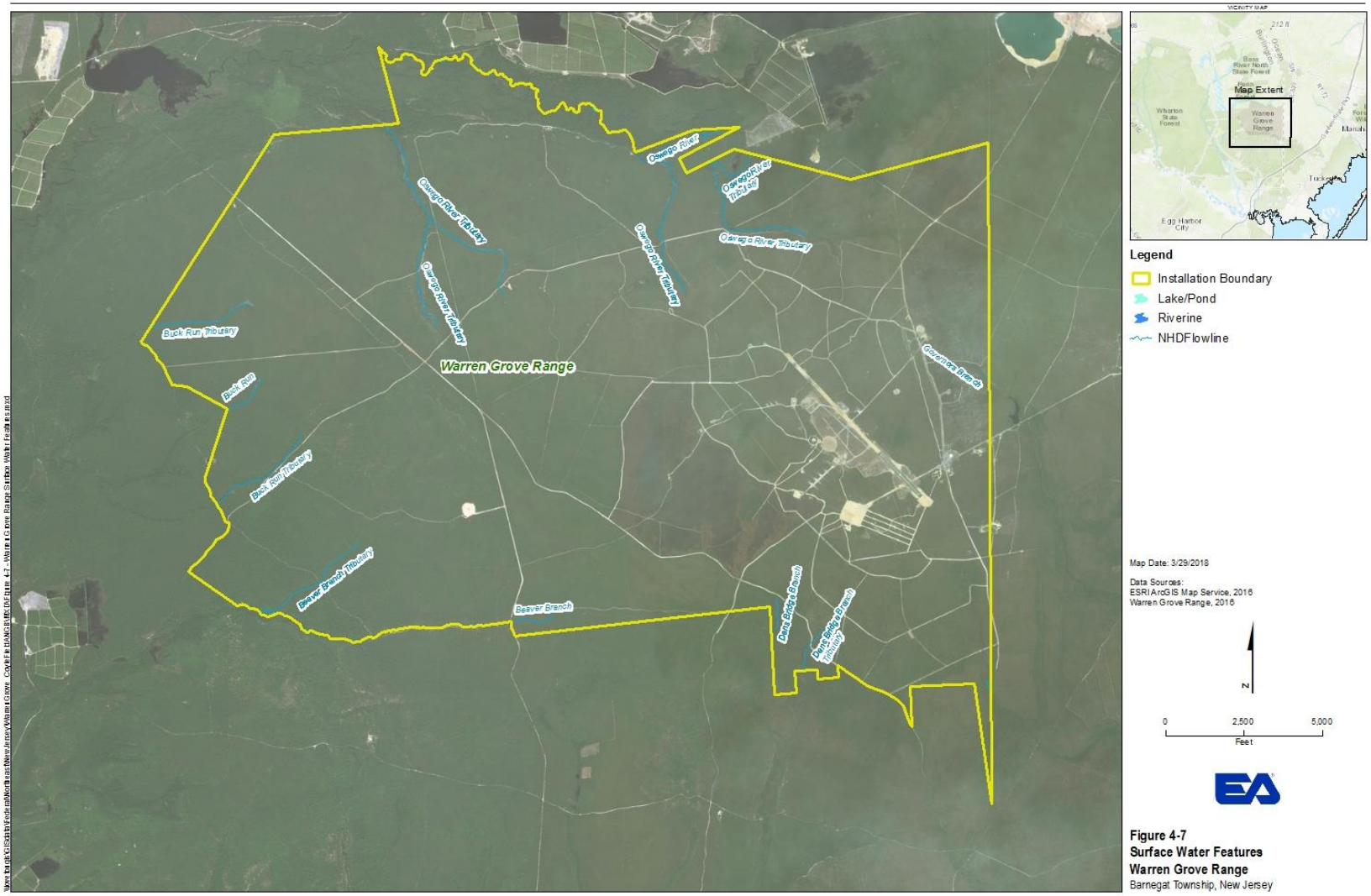

Figure 4-7
Surface Water Features
Warren Grove Range
Barnegat Township, New Jersey

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A study of surface water quality was performed in conjunction with a fish survey in late summer of 2004 (Bien 2004). Sampling sites were systematically located within WGR along a major drainage transect to the Oswego River, and surface water was tested for specific conductance (measure of water's capability to pass electrical flow), pH, dissolved oxygen, and temperature. Results from the survey indicate that surface water quality is similar to that of undisturbed Pine Barrens surface water bodies (e.g., low pH and low specific conductance). Results also were similar to those from a study of Oswego River water quality performed by NJPC in 2001 (Bien 2004). Based on the New Jersey 303(d) list, portions of the Oswego River and Westecunk Creek located downstream of WGR are not supporting fish consumption. Potential causes for this impairment include low dissolved oxygen and mercury (NJDEP 2016). Water quality is currently being monitored within 45 intermittent ponds found throughout WGR. Hydrology and precipitation strongly influence these pond hydroperiods.

Coyle Field

Coyle Field lies on a sloping upland area so that surface drainage is away from the area to either side of the upland. Most of the drainage is to the northeast or south. Sykes Branch drains a small portion of the west side of the upland area west of the airstrip. Sykes Branch then flows into Shoal Branch at a point 2 miles west. A portion of Coyle Field drains into Yellow Dam Branch. This branch flows southeast along the northeast side of State Highway 72. Most of Coyle Field drains south into small headwater tributaries that join to form Plains Branch, which flows south to the Oswego River.

Atlantic City ANGB

Drainage of developed areas of the installation is by overland flow to the storm drainage systems. The Aircraft Parking Apron is characterized by long, mildly sloping topography. Stormwater drainage enters the conveyance system through trench drains along the flight line. Drainage from the installation occurs via two streams that traverse portions of the adjacent Federal Aviation Administration property. Drainage to the south and west is to the South Branch of Absecon Creek and eventually into the Atlantic Ocean. Drainage to the north of the installation, including the alert area, drain to the North Branch of Absecon Creek.

4.4.2 Groundwater

The principal aquifer underlying WGR, Coyle Field, and Atlantic City ANGB is the Kirkwood-Cohansey aquifer system. This aquifer is composed of hydraulically connected sediments of the Kirkwood Formation, Cohansey Sand Formation, and recent overlying superficial deposits. The aquifer covers approximately 3,000 square miles and averages 100 ft in thickness. The Kirkwood-Cohansey aquifer system, designated the New Jersey Coastal Plain Sole Source Aquifer (53 Federal Regulation 23791), is estimated to contain 17 trillion gallons of water and, according to the United States Environmental Protection Agency (USEPA) Region 2, represents the "largest known pool of virtually untapped ground water in the world" (NJANG 2016). This aquifer also serves as the primary source of recharge for the rivers of the Pine Barrens.

Groundwater depth is relatively shallow (less than 5 ft in some areas) and commonly follows the surface topography. The depth to the water table increases slightly in areas of higher terrain. The shallow depth of the groundwater and the permeability of the sediments make the aquifer potentially vulnerable to surface discharges of liquids. Aeration of the surface waters above the

aquifer system results in the precipitation of iron, so the groundwater exhibits slightly higher iron concentrations.

The recharge area of the Kirkwood-Cohansey aquifer system covers 2,250 square miles and matches the dimensions of the Cohansey Sand Formation. The recharge rate from surface water infiltration is based on the moisture content, porosity, and permeability of the soil. WGR soils have mostly low moisture content, high porosity, and high permeability, making recharge rapid. With a high annual precipitation rate (44 in.) and a high infiltration rate, approximately half of the annual precipitation enters the aquifer as recharge (NJANG 1993).

Water quality near the surface of the aquifer is generally good, but contains relatively high iron concentrations and possesses an acidic pH similar to the local surface waters (average 3.6). The sole source of water used at WGR consists of a single well near the existing compound that reaches 125 ft. This well draws from groundwater found at depths substantially below the surface. The well is monitored quarterly for coliform and other bacteria and test results have been negative (NJANG 2016).

4.4.3 Stormwater – NPDES, Construction and Land Use Management

Water resources protection is important to natural resources management because it directly affects surface water quality and the value of aquatic habitats. Surface water and groundwater quality is directly related to land management practices that affect stormwater runoff. Stormwater runoff is produced when rainfall during a storm exceeds the infiltration capacity of the soil or encounters an impervious surface. Stormwater runoff can be a significant source of pollutants and sediment into surface waters, especially in areas where groundcover has been disturbed or with impervious surface cover. Water quality also may be negatively impacted by disturbances causing increased sedimentation to wetlands and stream channels. Sources of stormwater runoff and pollution on WGR could originate from the headquarters area or areas designated for fueling and maintenance activities. Stormwater runoff from impervious surfaces has a high potential to carry pollutants into wetlands, surface waters, and groundwater. Impervious surfaces at WGR include paved areas and buildings.

Sediment resulting from erosion affects surface water quality and aquatic organisms. Two main types of soil erosion exist: wind erosion and water erosion. Several factors affect water erosion. These factors include rainfall, slope steepness and length, soil texture or erodibility, cover protecting the soil, and special practices such as terracing or planting on the contour. Erosion is not severe at WGR for several reasons: high infiltration rate for water so there is minimal runoff which reduces ability to cause erosion; soil types that when vegetated are not easily eroded; few steep slopes; and limited training by ground forces.

Stormwater Best Management Practices (BMPs) for New Jersey are discussed in the *New Jersey Stormwater Best Management Practices Manual*, revised in 2016 are available at http://www.njstormwater.org/bmp_manual2.htm. Additionally, USEPA published *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, October 1992, EPA 833-R-92-001, to be used in construction activity. In New Jersey, when construction or other land-disturbing activity creates a minimum of 1 acre of soil disturbance, NJDEP must permit the activity with a construction site activity stormwater

National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit establishes the required erosion control and revegetation standards.

Improper stormwater control can potentially lead to Clean Water Act (CWA) violations, thus potentially resulting in fines and other penalties, which may ultimately compromise the integrity of WGR as a viable training installation. Regardless of regulatory compliance, appropriate soil conservation and erosion control are vital to the military mission. Unmanaged and extensive soil erosion can threaten the military mission and require diversion of funds from other priorities. Delays in managing the erosion can increase the cost to repair by several orders of magnitude. Some examples of the potential effects of poor soil and erosion management include:

- Undermining of roads
- Loss of topsoil and vegetation, which further accelerates erosion
- Impacts to streams or other aquatic habitats, potentially resulting in water quality impairment
- Creation of unusable areas due to erosion.

Several management concerns are associated with the loamy sands and sandy soils at WGR, which are loose, well-drained, nutrient-poor granular soils. Proper precautions should be taken to limit unnecessary loss or damage to equipment or facilities and to reduce water quality and erosion effects. Slope steepness and length of slope influences the amount of soil erosion locally because this factor is variable within a small area. In addition, the abundance of vegetative cover and root structure below the surface plays a vital role in the reduction of erosion. Machinery should be used only on erosive soil when the soil is firm enough to support the equipment. Maintaining vegetation on these soil types is the simplest way to control erosion.

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5. ECOSYSTEMS AND THE BIOTIC ENVIRONMENT

5.1 ECOSYSTEM CLASSIFICATION

WGR, Atlantic City ANGB, and Coyle Field are in the Eastern Broadleaf Forest (Oceanic) Province as described by Bailey et al. (1995). This province is characterized by a winter deciduous forest (sometimes called temperate deciduous forest) dominated by tall broadleaf trees that provide a dense, continuous canopy in summer and shed their leaves completely in winter. Lower layers of small trees and shrubs develop weakly. In spring, a luxuriant ground cover of herbs quickly develops, but is greatly reduced after trees reach full foliage and shade the ground. Forest vegetation is divided into three major associations: mixed mesophytic, Appalachian oak, and pine-oak. WGR is dominated by the pine-oak forest, or Pine Barrens, which occupy dry sandy soils that are frequently exposed to naturally occurring fires along the northern Coastal Plain. There is a thick shrub layer beneath the pines. Atlantic white-cedar swamps occur on mesic sites.

WGR and Coyle Field are within the New Jersey Pine Barrens National Reserve, and the general ecological landscape consists of terrestrial (90 percent), palustrine (9.8 percent), riverine (less than 1 percent), and lacustrine systems (less than 1 percent). WGR encompasses 9,400 acres of upland and lowland Pine Barrens habitats, including large areas of the East Pine Plains and Oswego River Lowlands priority sites which are recognized for their exceptional biodiversity (Bien et al. 2005).

The Pine Barrens, as a fire-dependent ecosystem, includes plants that are dependent upon recurring disturbance, particularly fire. Therefore, a prescribed fire program is essential at WGR to maintain ecosystem health.

5.2 VEGETATION

5.2.1 Historic Vegetative Cover

The historic vegetative cover was heavily influenced by frequent naturally occurring fires. Fire-adapted communities such as the Pine Barrens were, and still remain, the dominate cover on WGR.

5.2.2 Current Vegetative Cover

Warren Grove Range

Approximately 8,900 undisturbed acres function as safety buffers for the 500 disturbed acres that are impacted by military training activities on WGR. Due to the restricted access to most of the WGR, large tracts of native Pine Barrens habitat are protected and provide refuge for both common and rare plant species. Approximately 60 percent of the WGR habitat includes large portions of rare dwarf pine plains. Additionally, populations of certain rare, disturbance-dependent species respond positively to WGR's training activities (Bien et al. 2005). Drexel University performed a comprehensive floral survey from July 2002 through September 2004 (Bien et al. 2005), a non-native vascular plant survey from July 2004 and 2006 (Bien et al. 2007), and a rare plant monitoring study (Bien et al. 2011a). Results from the comprehensive survey identified 292 vascular plants belonging to 70 families, including 28 rare species. The survey conducted from 2004 to 2006 discovered four additional species bringing the total to 32 rare plant taxa: 27 vascular plants and 5 *Sphagnum* species (Bien et al. 2009). These include 19 special status species.

The non-native vascular plant survey inventoried 49 non-native vascular plants from 23 families. These included 34 herbs (70 percent), 8 grasses (16 percent), 3 trees (6 percent), 2 vines (4 percent), 1 sub-shrub (2 percent), and 1 sedge (2 percent) (Bien et al 2007). Three of these plants species were not observed during the comprehensive floral survey. None of the non-native species were considered a nuisance species; however, disturbance intensity was greatest in the areas containing high facilities use. Areas with high soil fertility and pH contained invasion intensity, community structure, and a number of invasive species. Overall, the total area containing non-native species within WGR is small and these isolated areas should be monitored to help control the spread of these species.

In summary, a total of 299 vascular plants belonging to 70 families have been observed at WGR to date. Appendix E includes a list of plant species documented on WGR.

Voucher specimens of common species were collected and deposited in herbariums at WGR, Drexel University, and The Academy of Natural Sciences in Philadelphia, Pennsylvania. Survey results have been compiled into an electronic herbarium (e-herbarium) in compact disc format that is a compilation of the more commonly occurring species or species of special interest with general habitat associations. The e-herbarium is open-ended so that new species can be added to the plant index as needed.

Vegetation communities on WGR can be split between more xeric, upland communities and more mesic, lowland communities. The upland communities include the dwarf pine plains, pine-oak barrens, and pine-oak woodlands, while the lowland communities include the pitch pine lowland forest, hydric pine plains, pitch pine-reedgrass savanna, Torrey's smoke grass grasslands, coastal plain Atlantic white cedar swamps, pitch pine swamps, red maple-black gum swamps and shrub swamps. Plant community descriptions are below and have been derived from Windisch (1999), Bien et al. (2005), and Bien et al. (2009).

Pine plains at WGR.
Photo by Walter F. Bien

The ***dwarf pine plains (or pine barrens)*** community is restricted to the outer coastal plain of New Jersey. The short stature of the vegetation is a result of the high fire frequency, which is influenced by the dry sandy soil, flat topography, and relative paucity of wetlands that act as firebreaks. This community occurs at elevations of 100–200 ft above sea level in gently rolling terrain. Soils are well-drained to poorly drained, with high permeability, and a sand to sandy loam subsoil (Woodmansie-Lakehurst association). The dominant trees are dwarf (less than 3.4 m), multiple stemmed pitch pine (*Pinus rigida*), blackjack oak (*Quercus marilandica*), and bear oak (*Quercus ilicifolia*). Pitch pine makes up 25–65 percent of the trees with the oak species making up the rest. Characteristic shrubs include mountain laurel (*Kalmia latifolia*), sheep laurel (*Kalmia angustifolia*), sweet fern (*Comptonia peregrine*), and sandmyrtle (*Leiophyllum buxifolium*). The ground layer is comprised of dwarf-shrubs, forbs and grasses, including eastern teaberry (*Gaultheria procumbens*), kinnikinnick

(*Arctostaphylos uva-ursi*), flowering pixiemoss *(Pyxidanthera barbulata*), trailing arbutus (*Epigaea repens*), golden heather (*Hudsonia ericoides*), Pennsylvania sedge *(Carex pensylvanica)*, little bluestem (*Schizachyrium scoparium*), broomsedge bluestem (*Andropogon virginicus*), poverty oatgrass (*Danthonia spicata*), western brackenfern (*Pteridium aquilinum*), longbranch frostweed (*Helianthemum canadense*), orangegrass (*Hypericum gentianoides*), and coastal jointweed (*Polygonella articulate*). Broom crowberry is common in places. Lichens, such as *Cladonia caroliniana* and *Cladonia strepsilis*, sparsely cover the ground.

The ***pitch pine-scrub oak barrens*** community is highly fire-dependent and occurs most frequently on warmer upland microclimates where it is least affected by cold air drainage. The open canopy is strongly dominated by pitch pine, with very low cover of deciduous trees. Oaks, when present, may include post oak (*Quercus stellata*). The understory is dominated by blackjack oak, with lesser cover of bear oak. A low heath shrub layer is dominated by Blue Ridge blueberry (*Vaccinium pallidum*) and black huckleberry (*Gaylussacia baccata*). The herbaceous layer is of variable cover, depending on fire frequency and intensity. Flowering pixiemoss is characteristic of this type, although may not be present in all stands. Other herbaceous associates include little bluestem, broomsedge bluestem, Pennsylvania sedge, pine barren stitchwort (*Minuartia caroliniana*), eastern teaberry, western brackenfern, Virginia tephrosia (*Tephrosia virginiana*), longbranch frostweed, and pinweed (*Lechea* spp.).

The ***pitch pine-oak woodland (or pine barrens oak woodland)*** community is an upland community that is typically dominated in the canopy by pitch pine and shortleaf pine (*Pinus echinata*). Oaks are a negligible component of the canopy and subcanopy, but black oak (*Quercus velutina*), chestnut oak (*Quercus montana*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), and post oak are all found in the pine barrens forest communities. The shrub layer includes black huckleberry, piedmont staggerbush (*Lyonia mariana)*, blue huckleberry (*Gaylussacia frondosa*), and cat greenbrier (*Smilax glauca*). Other plant species include golden heather, western bracken fern, blue wild indigo (*Baptisia australis*), Virginia tephrosia, and longbranch frostweed.

The ***pitch pine-red maple swamp*** community is a lowland community that is typically open canopy with a bi-layered wet vegetation. The canopy is dominated by red maple (*Acer rubrum*), although blackgum (*Nyssa sylvatica*), sweetbay (*Magnolia virginiana*), and, less frequently, gray birch (*Betula populifolia*) do occur. Highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), blue huckleberry, and coastal sweetpepperbush (*Clethra alnifolia*) are present in this community as well.

The ***pitch pine lowland forest*** community is characterized by subhydric conditions. Soils are saturated sands, but the water table is often below the soil surface. Pitch pine forms an open canopy, with a well-developed shrub layer of black huckleberry, blue huckleberry, and sheep laurel, with other less frequent associates such as inkberry (*Ilex glabra*), piedmont staggerbush, highbush blueberry, and sandmyrtle. The ground cover is characterized by western brackenfern, flowering pixiemoss, eastern turkeybeard (*Xerophyllum asphodeloides*), pine barren sandreed (*Calamovilfa brevipilis*), and little bluestem.

The ***pitch pine-reedgrass savanna (or pine barrens sandreed savanna)*** community is a saturated wetland dominated by pine barren sandreed. Other herbaceous associates include pine barren gentian (*Gentiana autumnalis*), rice button aster (*Symphyotrichum dumosum*), goldenrod species (*Solidago* spp.), and others. Shrubs are widely scattered, with dwarf huckleberry (*Gaylussacia dumosa*) the most common. Other shrubs may include highbush blueberry, piedmont staggerbush, leatherleaf (*Chamaedaphne calyculata*), black huckleberry, blue huckleberry, and sheep laurel. This community is maintained by frequent fire.

The ***pine barrens shrub swamp*** community is a lowland community that consists of wet to dry stands of shrubby vegetation. The vegetation within this community is typically 1 to 4 meters in height and consists of blue huckleberry, piedmont staggerbush, highbush blueberry, and black chokeberry (*Pyrus melanocarpa*) in taller shrub stands. Herbaceous species include the eastern showy aster (*Aster [Eurybia] spectabilis*), common sheep sorrel (*Rumex acetosella*), broomsedge bluestem, thin paspalum (*Paspalum setaceum*), and deertongue (*Panicum [Dichanthelium] clandestinum*).

The ***coastal plain Atlantic white cedar swamp*** community occurs in organic soils (usually peat) along streams and in poorly drained depressions. The characteristic tree is Atlantic white cedar (*Chamaecyparis thyoides*), typically 15–20 meters high. Pitch pine and a few hardwoods, primarily red maple and blackgum, are infrequent tree associates. Characteristic small trees and shrubs include coastal sweetpepperbush, inkberry, northern bayberry (*Morella pensylvanica*), blue huckleberry, swamp doghobble (*Leucothoe racemosa*), and highbush blueberry. Characteristic herbs, typically sparsely distributed or confined to sunny openings in the swamp, may include cinnamon fern (*Osmunda cinnamomea*), eastern marsh fern (*Thelypteris palustris*), chainfern (*Woodwardia* spp.), eastern teaberry, spoonleaf sundew (*Drosera intermedia*), purple pitcherplant (*Sarracenia purpurea*), dragon's mouth (*Arethusa bulbosa*), snakemouth orchid (*Pogonia ophioglossoides*), swamppink (*Helonias bullata*), partridgeberry (*Mitchella repens*), and sedges such as Walter's sedge (*Carex striata*), Collins' sedge (*Carex collinsii*), and prickly bog sedge (*Carex atlantica*). The ground cover is predominately Sphagnum species including *Sphagnum flavicomans, S. magellanicum, S. pulchrum,* and *S. recurvum*.

The ***switch grass-Torrey's smoke grass palustrine grassland*** community is a seasonally flooded grassland dominated by New Jersey muhly (*Muhlenbergia torreyana*).

The ***red maple-black gum swamp*** community that occurs on WGR occurs where there is an abandoned cranberry bog. This successional community is characterized by standing water surrounded on its edges by shrubby vegetation, which is in turn surrounded by red maple hardwood swamp. The vegetation within the open water consists of swaying bulrush (*Schoenoplectus subterminalis*), Robbin's spikerush (*Eleocharis robbinsii*), water lily (*Nymphaea* spp.), eastern purple bladderwort (*Utricularia purpurea*), and water-shield (*Brasenia schreberi*). The shrubby vegetation found around the edges of open water consists of cranberry (*Vaccinium macrocarpon*), piedmont staggerbush, highbush blueberry, coastal sweetpepperbush, and sheep laurel. The taller canopy vegetation surrounding the shrub layer includes red maple and blackgum, with gray birch and sweetbay occurring less frequently.

Coyle Field
No vegetation surveys have been completed at Coyle Field.

Atlantic City ANGB
No vegetation surveys have been completed at Atlantic City ANGB.

5.2.3 Turf and Landscaped Areas

Landscaped areas are limited on WGR and restricted to the immediate vicinity of the Range facilities.

Areas surrounding the Coyle Field drop zone are covered in turf grass. No vegetation surveys have been completed at Coyle Field.

The majority of Atlantic City ANGB consists of turf grass and ornamental landscaped plants, including around the maintenance, training, and administrative buildings, as well as alongside the roads and runways.

5.3 FISH AND WILDLIFE

Information from fauna surveys and studies conducted at WGR is presented below. There have been no fauna surveys conducted within Coyle Field or Atlantic City ANGB.

5.3.1 Birds

Drexel University conducted a 2-year Comprehensive Avian Survey from March 2006 to February 2008 at WGR in nine different habitat types. Habitats included pine-oak upland forest, dwarf pine plains, disturbed dwarf pine plains, dry grassland, wet grassland, pitch pine lowlands, Atlantic white-cedar bog, hardwood swamp, and lakeside community. This survey was the first avifauna study completed for WGR. Survey results identified 82 species, which encompassed 52.9 percent of known New Jersey Pineland species (residents and migrants) (Bien et al. 2008). Appendix E includes a list of avian species documented at WGR.

Eastern towhee
Photo by Bob Birdsell

The eastern towhee (*Pipilo erythrophthalmus*) was the most commonly observed species, followed by the mourning dove (*Zenaida macroura*) and blue jay (*Cyanocitta cristata*). Six species occurred in all nine habitat types: blue jay, brown thrasher (*Toxostoma rufum*), eastern towhee, field sparrow (*Spizella pusilla*), mourning dove, and pine warbler (*Dendroica pinus*). Disturbed dwarf pine plains habitat had the highest number of species observed (species richness) (62 species observed) and species richness encounter rate (0.43 species/minute), while the lakeside community had the highest observation encounter rate (1.14 observations/ minute) (Bien et al. 2008).

The number of species observed was greater in the Target Zone (71 species observed) than the Buffer Zone (51 species observed). The Target Zone is approximately 500 acres and includes the area where the majority of military operations occur. The Target Zone includes an open disturbed area in the East Pine Plains where the forest has been cleared for conventional air-to-ground gunnery training. Disturbance in the Target Zone includes maintenance activities, mission operations, and prescribed burning. The Buffer Zone includes approximately 8,900 acres. The Buffer Zone is comprised of intact uplands and lowlands that include a section of the East Pine Plains and Oswego River Lowlands, two areas recognized by the New Jersey Natural Heritage Program as Priority Sites for Biodiversity Conservation within the New Jersey Pine Barrens. The East Pine Plains is a fire-maintained ecosystem where plant and animal species are well adapted to the high frequency of forest fires common to the region (Bien et al. 2008).

Of the species inventoried at WGR, approximately 39 percent are in decline throughout their range in the eastern United States. Species in decline, such as the blue jay, brown-headed cowbird (*Molothrus ater*), field sparrow, brown thrasher, Carolina chickadee (*Poecile carolinensis*), and eastern towhee, were among the most frequently documented species at WGR. These species along with other grassland and shrub-dependent birds were commonly observed in open disturbed areas at WGR. Periodic prescribed burning and mowing of open fields in these areas maintains open habitat that is dominated by early successional grasses, forbs, and shrubs that is preferred habitat for several shrub and grassland avifauna. A periodic disturbance cycle is important for preventing a change in habitat vegetation structure. Thus, frequent prescribed burning is essential for maintaining open early successional habitats.

Primary considerations with regard to migratory bird management are in compliance with the Migratory Bird Treaty Act; implementation of migratory bird management actions in accordance with EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*; and support, contribution, and compatibility with the goals and efforts of numerous regional migratory and game bird conservation programs. The Migratory Bird Treaty Act controls many actions that may negatively affect migratory birds, particularly collection and transportation of birds. Special purpose permits may be requested and issued that allow for the relocation or transport of migratory birds for management purposes.

5.3.2 Mammals

A total of 14 species of mammal have been documented or observed on WGR (NJANG 2016, Buchanan and Bien 2007). Species include four carnivores, one ungulate, and nine small mammals, which are discussed further below. A list of additional mammals documented at WGR is provided in Appendix E.

Carnivores

Common carnivores observed or documented as occurring on WGR include red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), eastern coyote (*Canis latrans*), and striped skunk (*Mephitis mephitis*). These species are an important component of local ecosystems. These predators prey on rodents, rabbits, and insects, providing a natural means of controlling potential pest populations. They might also effectively remove nesting and flocking birds. In addition, studies have shown that removing high-level predators, such as the coyote, could indirectly lead to increased animal strikes involving prey species as their populations increase (Watson 1997).

Subsequently, this increase in prey species might attract high BASH risk avian species, such as large raptors.

Ungulates

White-tailed deer (*Odocoileus virginianus*), occur throughout the Pine Barrens, including the undeveloped (i.e., no targets, roads, facilities) portions of WGR. WGR has a relative lack of adequate forage for deer, especially when compared to other portions of the Pine Barrens.

Small Mammals

Small mammal surveys were conducted during 2004 and 2005 (Buchanan and Bien 2007) Nine small mammal species were identified: eastern chipmunk (*Tamias striatus*), masked shrew (*Sorex cinereus*), meadow vole (*Microtus pennsylvanicus)*, meadow jumping mouse (*Zapus hudsonius*), pine vole (*Microtus pinetorum*), red-back vole *(Clethrionomys gapperi*), southern bog lemming (*Synaptomys cooperi)*, short-tail shrew (*Blarina brevicauda*), and white-footed mouse (*Peromyscus leucopus*). Southern bog lemmings and meadow jumping mice were found in several wetland areas on WGR. Southern bog lemmings primarily fed on *Sphagnum* moss, sedges, and rushes. Meadow jumping mice fed on berries, insects, and fungus. These species hold undetermined status in New Jersey. This status is used when insufficient information exists to determine if the species is known to be endangered, threatened, or extinct.

Southern bog lemming.
Photo by Alicia Shenko

Currently, upland areas of WGR are low in diversity and primarily dominated by white-footed mice. White-footed mice are an extremely hardy species that can survive in a variety of habitats, and are known to be early colonizers when niche space becomes available. The pygmy forest regions that constitute the upland areas of WGR are a difficult environment, poor in food sources and prone to both prescribed and wild fires (White 1961). Small mammal diversity was highest in the wetland regions along the northern border of WGR, coinciding with the drainage regions of the Oswego River.

5.3.3 Reptiles and Amphibians

Available habitat at WGR supports a significant herpetofauna population. An inventory of amphibians and reptiles was performed from 2002 to 2006 at WGR. The survey documented 29 herpetofaunal species at WGR: 3 salamanders, 6 anurans, 6 turtles, 13 snakes, and 1 lizard species. Common amphibian species identified include the southern leopard frog (*Lithobates sphenocephalus*) and green frog (*Lithobates clamitans*). Common reptiles observed on the Range include the northern black racer (*Coluber constrictor*), the eastern fence lizard (*Sceloporus undulatus*), and the painted turtle (*Chrysemys picta).* A list of additional reptiles and amphibians documented at WGR is provided in Appendix E.

Southern leopard frog at WGR.
Photo by Walter F. Bien

5.3.4 Fish

A fish survey was conducted along the Oswego River downstream of WGR from July to August 2004. Due to the relatively high acidity and low nutrient concentrations of Pine Barrens waters, the number of native fish species is limited (ranges from 13 to 16 species). Sixty-two individuals were collected during the survey including 10 native Pine Barrens species. The swamp darter (*Etheostoma fusiforme*) and eastern mudminnow (*Umbra pygmaea*) were the most frequently collected species. Pirate perch (*Aphredoderus sayanus*), redfin pickerel (*Esox americanus*), chain pickerel (*Esox niger*), blackbanded sunfish (*Enneacanthus chaetodon*), bluespotted sunfish (*Enneacanthus gloriousus*), mud sunfish (*Acantharchus pomotis*), yellow bullhead (*Ameiurus natalis*), and creek chubsucker (*Erimyzon oblongus*) were also collected. There were no non-native fish species caught during the survey. At the time the survey was conducted, there were extremely low water levels and drought conditions which prohibited surveys in other streams and wetlands that potentially harbor fish species at WGR (NJANG 2004). A list of additional fish documented at WGR is provided in Appendix E.

5.3.5 Insects

Skipper sp.
Photo by Walter F. Bien

Insects are a highly diverse component within the Pine Barrens ecosystem. A Lepidoptera survey was conducted from 2008 to 2010 to inventory common and rare species and to determine if the state-endangered arogos skipper (*Atrytone arogos arogos*) occurred on WGR. The survey was completed in four different habitat types including Atlantic-white cedar/bog savanna, restored dwarf pitch pine forest, pitch pine lowland, and wet successional grassland. While the arogos skipper was not found, 72 Lepidoptera were inventoried comprising 13 different families, including three New Jersey State-endangered species, the Georgia satyr (*Neonympha areolate*), Hessel's hairstreak (*Callophrys hesseli*), and the hoary elfin (*Callophrys polios*). Wet successional grassland habitat within the Target Zone had the highest species encounter rate, followed by pitch pine lowland habitat. Atlantic-white cedar swamp supported the greatest individual encounter rate followed by dry-grassland habitat in the Target Zone. The greatest number of species found were in the pen wet successional grassland habitat (35 species found) and pitch pine lowland habitat (33 species found). These data suggest that the diverse habitats at WGR supports a rich suite of Pine Barrens Lepidoptera (Bien et al. 2011b). A list of additional insect species documented at WGR is provided in Appendix E.

A preliminary comprehensive insect survey was conducted in four areas of WGR in 2015 from spring through fall. Insect community composition was different between recently burned and unburned areas, particularly with regards to wood-boring beetles. The final results of this study are not available at this time.

5.4 THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

Information on threatened and endangered species at WGR is provided below.

5.4.1 Federally Listed Species

Federal status, as a threatened or endangered species, is derived from the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) and is administered by USFWS. Federally listed species with known occurrence in Burlington County, New Jersey include the threatened bog turtle (*Clemmys muhlenbergii*), threatened northern long-eared bat (*Myotis septentrionalis*), endangered American chaffseed (*Schwalbea americana*), threatened Knieskern's beaked rush (*Rhynchospora knieskernii*), and threatened swamppink (*Helonias bullata*) (Table 5-1) (USFWS 2017). No critical habitat exists on WGR.

Table 5-1. Federally Listed Species Known to Occur in Burlington County, New Jersey

Common Name	Scientific Name	State Status	Federal Status
American chaffseed	*Schwalbea americana*	E	E
Bog turtle	*Clemmys muhlenbergii*	E	T
Knieskern's beaked rush**	***Rhynchospora knieskernii***	**E**	**T**
Northern long-eared bat	*Myotis septentrionalis*	-	T
Swamppink	*Helonias bullata*	E	T

Note: **Species has been documented at WGR.
FEDERAL STATUS
E = Endangered = Danger of extinction throughout range.
T = Threatened = Likely to become endangered in foreseeable future throughout range.
STATE STATUS
E = Endangered = Applies to a species whose prospects for survival within the state are in immediate danger due to one or several factors, such as loss or degradation of habitat, over-exploitation, predation, competition, disease or environmental pollution, etc. An endangered species likely requires immediate action to avoid extinction within New Jersey.

Sources: USFWS (2017), NJDEP (2012a).

Knieskern's beaked rush.
Photo by Alicia Shenko

Knieskern's beaked rush has been observed during previous flora surveys at WGR. Although swamppink has not been found on WGR, a small stand of plants was discovered in 2010 immediately off range property in a wetland that drains from WGR (Governor's Run). Thus, it is probable that habitat for this species exists close to WGR and future surveys may discover yet undocumented occurrences on WGR (Bien et al. 2011a). The bog turtle, a federally listed threatened species, has also been documented to occur in the Oswego River lowlands. A Phase I bog turtle habitat survey was completed in 2009 at four wetland drainages that flow into the Oswego River from WGR and within two open bogs. None of the surveyed drainages or bogs supported suitable habitat for bog turtles and therefore it is unlikely that bog turtles occur on WGR (Bien et al. 2011b).

5.4.2 State Listed Species

The Endangered and Nongame Species Conservation Act (New Jersey Statutes Annotated 23:2A-1 et seq.) and the Endangered Plant Species List Act (New Jersey Permanent Statutes 13:1B-15.151 et seq.) regulate state listed species in New Jersey. Endangered wildlife species are defined as "any species or subspecies of wildlife whose prospects of survival or recruitment are in jeopardy or are likely within the foreseeable future to become so due to any of the following factors: (1) the destruction, drastic modification, or severe curtailment of its habitat, or (2) its over-utilization for scientific, commercial or sporting purposes, or (3) the effect on it of disease, pollution, or predation, or (4) other natural or manmade factors affecting its prospects of survival or recruitment within the state, or (5) any combination of the foregoing factors. The term shall also be deemed to include any species or subspecies of wildlife appearing on any Federal endangered species list" (New Jersey Permanent Statutes 23:2A-1).

Endangered plant species are defined as "any native plant species whose survival in the state or the nation is in jeopardy, including, but not limited to, plant species designated as listed, proposed, or under review by the Federal Government as endangered or threatened throughout its range in the United States pursuant to the "Endangered Species Act of 1973," Public Law 93-205 (16 U.S.C. 1533), any additional species known or believed to be rare throughout its worldwide range, and any species having five or fewer extant populations within the state" (New Jersey Permanent Statutes 13:1B-15.151). The Endangered Plant Species List is maintained under New Jersey Administrative Code (NJAC) 7:5C-5.1. In addition, the New Jersey Pinelands Commission maintains a list of additional plant species that receive protection under NJAC 7:50-6.27.

New Jersey State listed species include 357 state listed endangered plant species (NJAC 7:5C-5.1), an additional 36 plant species designated endangered or threatened in the Pine Barrens (NJAC 7:50-6.27), 57 endangered faunal species, 37 threatened faunal species, 10 candidate species, and 109 faunal species of concern (NJDEP 2012a, NJDEP 2012b). Of these species, 45 state listed species have been documented on WGR, including 3 amphibians, 15 birds, 3 invertebrates, 32 plants, and 6 reptiles. No state listed fish or mammal species have been documented to date at WGR. Table 5-2 presents a list of state listed and Pinelands Commission listed species known to occur on WGR.

During the 2002 to 2006 reptile and amphibian survey (Smith and Bien 2005a), a total of nine species were observed that have state endangered, threatened, or species of concern status: the Pine Barrens treefrog, carpenter frog (*Lithobates virgatipes*), Fowler's toad (*Anaxyrus fowleri*), northern pine snake (*Pituophis melanoleucus*), timber rattlesnake (*Crotalus horridus*), eastern kingsnake (*Lampropeltis getula*), eastern milk snake (*Lampropeltis triangulum*), spotted turtle (*Clemmys guttata*), and eastern box turtle (*Terrapene carolina*) (Table 5-3). The Pine Barrens treefrog, northern pine snake, and timber rattlesnake populations are apparently stable and are widely distributed at WGR (Smith and Bien 2005a). The corn snake (*Pantherophis guttatus*) is a state endangered species with known populations

Pine barrens tree frog.
Photo by Walter F. Bien

occurring in areas adjacent to WGR. Potential habitat for the corn snake exists on WGR property; however, due to the secretive nature of this species a longer study time may be required to find existing populations.

An avifauna survey was conducted from 2006 to 2008 at WGR. A total of 15 avian species with special status in New Jersey were documented during the survey. The bald eagle was not observed during the survey (Bien et al. 2008). A lepidoptera survey was completed from 2008 to 2010 to determine if the state-endangered arogos skipper occurs at WGR. While the arogos skipper was not found, three New Jersey State-endangered species, the Georgia satyr (*Neonympha areolate*), Hessel's hairstreak (*Callophrys hesseli*), and hoary elfin (*Callophrys polios*) were observed (Bien et al. 2011b). Flora inventories have occurred from 2002 to 2006. Over these years, a total of 32 rare plant taxa—27 vascular plants and 5 *Sphagnum* species—have been documented at WGR (Bien et al. 2009) (Table 5-3).

Additional state listed species may be documented during future studies as extensive surveys for large mammals, fish, and aquatic invertebrates have not occurred to date at WGR. In addition, listed species are often difficult to survey for because they are rare and often ephemeral.

For additional information on the status of a specific fish and wildlife species in New Jersey, refer to the Division of Fish and Wildlife's *Checklists of New Jersey Wildlife* on the NJDEP website at http://www.state.nj.us/dep/fgw/chklists.htm. This site provides checklists for birds, mammals, amphibians, reptiles, and fish that identify whether a species is endangered, threatened, a species of concern, a regional priority, stable, or of underdetermined status.

No rare, threatened, or endangered surveys have been completed at Coyle Field or Atlantic City ANGB.

Table 5-2. State Listed Species Known to Occur at WGR

Common Name	Scientific Name	State Status
Amphibians		
Carpenter frog	*Lithobates virgatipes*	SSC
Fowlers toad	*Anaxyrus fowleri*	SSC
Pine barrens treefrog	*Hyla andersonii*	T
Birds		
American kestrel	*Falco sparverius*	T
Barred owl	*Strix varia*	T
Black billed cuckoo	*Coccyzus erythropthalmus*	SSC (BR)
Blackburnian warbler	*Dendroica fusca*	SSC (BR)
Brown thrasher	*Toxostoma rufum*	SSC (BR)
Common night hawk	*Chordeiles minor*	SSC
Coopers hawk	*Accipiter cooperii*	SSC (BR)
Eastern meadowlark	*Sturnella magna*	SSC
Hooded warbler	*Wilsonia citrina*	SSC (BR)
Horned lark	*Eremophila alpestris*	T (BR) / SSC (NB)
Kentucky warbler	*Oporornis formosus*	SSC
Northern harrier	*Circus cyaneus*	E (BR) / SSC (NB)
Northern parula	*Parula Americana*	E (BR) / SSC
Osprey	*Pandion haliaetus*	T (BR)
Red shouldered hawk	*Buteo lineatus*	E (BR) / SSC (NB)
Sharp shinned hawk	*Accipiter striatus*	SSC

Common Name	Scientific Name	State Status
Veery	*Catharus fuscescens*	SSC (BR)
Whip-poor-will	*Caprimulgus vociferus*	SSC (BR)
Mammals		
Meadow jumping mouse	*Zapus hudsonius*	SSC
Invertebrates		
Dusted skipper	*Atrytonopsis hiana*	SSC
Georgia Satyr	*Neonympha areolata septentrionalis*	SSC
Hessel's Hairstreak	*Callophrys hesseli*	SSC
Hoary Elfin	*Callophrys polios*	SSC
Monarch	*Danaus plexippus*	SSC
Reptiles		
Eastern box turtle	*Terrapene carolina carolina*	SSC
Eastern kingsnake	*Lampropeltis getula getula*	SSC
Northern pine snake	*Pituophis melanoleucus melanoleucus*	T
Spotted turtle	*Clemmys guttata*	SSC
Timber rattlesnake	*Croatalus horridus*	E
Plants		
Barratt's sedge	*Carex barrattii*	LP
Bog asphodel	*Narthecium americanum*	E/ LP
Broom crowberry	*Corema conradii*	E / LP
Bunched beaksedge	*Rhynchospora cephalantha*	LP
Canby's lobelia	*Lobelia canbyi*	LP
Coastal false asphodel	*Triantha racemosa*	E / LP
Crested yellow orchid	*Platanthera cristata*	LP
Eastern purple bladderwort	*Utricularia purpurea*	LP
Knieskern's beaked rush	*Rhynchospora knieskernii*	FT/ E / LP
Little curlygrass fern	*Schizaea pusilla*	LP
Little ladies'-tresses	*Spiranthes tuberosa*	LP
Narrowleaf primrose-willow	*Ludwigia linearis*	LP
New Jersey muhly	*Muhlenbergia torreyana*	LP
New Jersey rush	*Juncus caesariensis*	E / LP
Pickering's Reedgrass	*Calamagrostis pickeringii*	E / LP
Pine barren reedgrass	*Calamovilfa brevipilis*	LP
Pine barren gentian	*Gentiana autumnalis*	LP
Reticulated Nut-rush	*Scleria reticularis*	LP
Slender nutrush	*Scleria minor*	LP
Wand goldenrod	*Solidago stricta*	LP

Notes: STATE STATUS

E = Endangered = Applies to a species whose prospects for survival within the state are in immediate danger due to one or several factors, such as loss or degradation of habitat, over-exploitation, predation, competition, disease or environmental pollution, etc. An endangered species likely requires immediate action to avoid extinction within NJ.

T = Threatened = Applies to species that may become Endangered if conditions surrounding it begin to or continue to deteriorate. Thus, a Threatened species is one that is already vulnerable as a result of, for example, small population size, restricted range, narrow habitat affinities, significant population decline, etc.

SSC = Species of Special Concern = Applies to species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.

LP = Listed by Pinelands Commission as endangered or threatened in their legal jurisdiction per NJAC 7:50-6.27.

BR = Breeding population only.

NB = Non-breeding population only.

Sources: Bien (2004), Smith and Bien (2005a, 2005b), Buchanan and Bien (2007), Bien et al. (2008, 2009, 2011a), NJDEP (2012a, 2012b), NJAC 7:5C-5.1, NJAC 7:50-6.2.

5.4.3 Priority Special Status Species

Seven of the rare species discussed above are considered priority species at WGR. These species include four rare plants, one frog and two rare snakes:

- federally threatened and state endangered Knieskern's beaked rush
- state endangered bog asphodel
- state endangered broom crowberry
- pineland-listed endangered Pine Barren gentian
- state threatened pine barrens treefrog
- state endangered timber rattlesnake
- state threatened northern pine snake.

Northern pine snake.
Photo by Alicia Shenko

5.4.4 Rare Vascular Plants

Research on the Knieskern's beaked rush, bog asphodel, broom crowberry, and pine barren gentian is limited to their life histories, reproductive biology, and ecology, while effects on population dynamics are for the most part unknown. To gain a better understanding on the populations of these four species at WGR, a rare plant monitoring survey was conducted to provide baseline data for managing rare plant populations at WGR, and evaluating changes in habitat, population size, and effects from management objectives implemented. Monitoring priorities were based on three criteria: (1) location and proximity to areas of high levels of potential disturbance; (2) federal and state species conservation status; and (3) other special conditions (e.g., species restricted to or occurring in Oswego River Lowlands (Bien et al. 2011a).

Plant profile sheets for these four species as well as the federally threatened swamppink, are included in the rare plant monitoring report by Bien et al. (2011a). The swamppink, as noted above, has not been observed at WGR, but it was discovered immediately adjacent to WGR property and suitable habitat occurs on the range. Therefore, monitoring should be continued for the swamppink. Plant profile sheets provide regional distribution and life history information on these rare vascular plants. For the four rare species known to occur at WGR, additional information on their population distribution at WGR and management of these species is provided below.

Knieskern's beaked rush

Species Description: Knieskern's beaked rush is a federally threatened grass-like species in the sedge family. It grows up to 24 in. tall with a slender stem and narrow leaves.

Knieskern's beaked rush.
Photo by Alicia Shenko

Habitat: Knieskern's beaked rush is an obligate wetland species that occurs in successional habitats. Many studies have been conducted at WGR on the Knieskern's beaked rush by Drexel University. Recently a study on seed banking, seed dispersal, and fire effects in Knieskern's beaked rush was completed. This species was found to be more dominant in habitats that were recently burned in the prior year. Persistent seed banks were also found at all sampled sites and were found to be dispersed widely through wind, water, and animal dispersal mechanisms. Deer dispersal is the most likely mechanism for long-distance dispersal. Surveying current populations and developing a habitat suitability model was used to map areas that Knieskern's beaked rush would likely expand through seeding or transplanting adult plants.

Distribution: Knieskern's beaked rush is found only in the New Jersey Pine Barrens. Bien et al. (2011a) monitored Knieskern's beaked rush for 6 years (2005 to 2010) at WGR. This species was found to be widely distributed, and in all instances occurred in areas that had experienced some mechanical disturbance. The population was first measured in 2005 when the canopy was more open. A prescribed burn was conducted in 2004. Since this time, the canopy has closed in due to increased grass cover and pine branches. The population has steadily declined over the 6 years, and is considered highly vulnerable. Potential causes of decline include increased canopy cover or variable precipitation levels.

An additional study to learn how Knieskern's beaked rush responds to disturbance and allocates and utilizes soil nutrients such as nitrogen and phosphorus was conducted to assist in developing a conservation plan for this species. Soil and plant samples were collected during flowering, fruiting, and senescence. Knieskern's beaked rush was found to preferentially allocate nitrogen and phosphorus resources to reproduction; however, when nitrogen availability increased, the plants allocated the nitrogen for storage. There was no change in phosphorus allocation when an increase in phosphorus was available; therefore, when nutrients are limited this strategy could provide phosphorus essential for germinating seedlings and survivorship. This study also found that plant density was highest when gravimetric soil moisture levels were 10 percent, and sites where prescribed burns occurred had taller plants and larger fruiting populations.

Bog asphodel

Species Description: Bog asphodel is a perennial herb in the lily family that grows up to 16 in. tall. It has narrow, basal leaves and yellow flowers in summer and a reddish-brown seed capsule in the fall.

Habitat: Bog asphodel grows in open, wet savannas, typically along streams and creeks.

Distribution: Bog asphodel historically occurred in New Jersey, Delaware, North Carolina, and South Carolina, but is considered extirpated from Delaware and South Carolina, and may be extirpated from North Carolina.

Bog asphodel
Photo by Walter F. Bien

Bien et al. (2011a) monitored bog asphodel for 3 years (2008 to 2010) at WGR. This wetland species is state endangered and is now restricted to the New Jersey Pine Barrens. Out of the four priority vascular plant species, bog asphodel has the most restricted distribution. The population appears to be stable under current hydrological conditions. Based on other rare plants in similar habitats, maintaining the current hydrologic regime is likely essential for maintaining the bog asphodel population.

Broom crowberry

Species Description: Broom crowberry is a small shrub in the heath family that brows up to 24 in. tall. The leaves are linear and needle-like, and the flowers are red or purple in color.

Habitat: Broom crowberry grows in sandy soils of the coastal plain. It is a fire-adapted species that grows in forest openings and disturbed areas.

Distribution: Broom crowberry ranges from eastern Canada, south to New Jersey.

Broom crowberry
Photo by Walter F. Bien

Bien et al. (2011a) monitored broom crowberry (*Corema conradii*) for 3 years (2008 to 2010) at WGR. This species is found mostly within the WGR Target Zone area. The population appears to be stable but vulnerable to direct anthropogenic disturbance or stand killing fires.

Pine Barrens gentian.
Photo by Alicia Shenko

Pine barren gentian

Species Description: Pine barren gentian is a fall flowering perennial that grows 1–2 ft tall.

Habitat: Pine barren gentian occurs in moist, open, sandy habitats, including pitch pine lowlands and stream banks.

Bien et al. (2011a) monitored endangered pine barren gentian for 4 years (2007 to 2010) at WGR. The pine barren gentian thrives in early successional habitats. At WGR, the population appears to be stable and widely distributed. There is a population located within the Target Zone where there are high levels of disturbance including mowing. The existing prescribed fire and mowing activities appear to maintain early-successional habitat, which benefits this species.

Distribution: Pine barren gentian ranges from New Jersey to Georgia.

5.4.5 Rare Herpetofauna

The timber rattlesnake, northern pine snake and Pine Barrens treefrog appear to have stable populations and are widely distributed at WGR (Smith and Bien 2005a). As noted above, potential habitat for the state endangered corn snake exists at WGR.

A summary of life history traits and population distribution for the three special status species known to occur at WGR are provided below.

Timber Rattlesnake

Species Description: There are two color variations in New Jersey: (1) yellow variation: black or dark brown cross bands on a background of yellow or brown where the crossbands may be V-shaped and break up into spots down its back; and (2) black (melanistic) variation: a heavy stippling of black or very dark brown that hides much of the lighter pigment. Completely black individuals are also possible. Adults measure 36 to 60 in. in length. The tail is relatively short and its underside has a single row of transverse scales. A facial pit, or hole in the side of the face, is present between the nostril and the eye. This pit gives the name "pit vipers" to the taxon. The eye has a vertically elliptical pupil.

Timber rattlesnake
Photo by Walter F. Bien

Habitat: The timber rattlesnake has two distinct populations and habitat requirements in New Jersey, unrelated to their color variation. In northern New Jersey, timber rattlesnakes are found in rocky, wooded ledges where they den in south-facing slopes. In the Pine Barrens, timber rattlesnakes utilize more habitats than rattlesnake populations found in other parts of their range, and are reported to utilize both upland and lowland habitats for foraging, thermoregulation, digestion, breeding, denning, brooding, and birthing (Zappalorti 2000, Reinert and Zappalorti 1988). Timber rattlesnakes are migratory. In late spring after emerging from their hibernacula,

timber rattlesnakes will migrate to upland areas to forage (Zappalorti 2000). Timber rattlesnakes breed in the summer. Pregnant females can typically be found in open areas, such as fields and edges of roads within the Pine Barrens.

Distribution: This is the only rattlesnake in New Jersey and in most of the Northeast. Smith and Bien (2005a) observed the timber rattlesnake in bog savanna, cedar swamp, hardwood swamp, disturbed open, pitch pine lowland, and pitch pine scrub oak barren habitats of the Range. The Oswego River drainage was determined to be a critical area for populations of timber rattlesnakes on WGR. A study was conducted from 2002 to 2004 to better understand the spatial ecology of timber rattlesnakes and to determine if military operations impacted their population at WGR. When active, timber rattlesnakes were found in wetland habitats 69 percent of the time. They utilized hardwood swamp habitat proportionately more than the other habitat types at WGR. Hibernacula occurred 92 percent of the time in hardwood swamps and 8 percent of the time in pitch pine lowlands (Smith and Bien 2005b). Timber rattlesnakes were found to utilize disturbed open areas throughout their established home ranges. Military operations did not seem to impact the population of this species.

Northern Pine Snake

Species Description: Adults range in length from 48 to 100 in. (122 to 254 centimeters). Northern pine snakes have a small head, but a large powerfully built body. This snake is light-colored with black, brown, or reddish-brown blotches on its back and sides. The snout is somewhat pointed, with an enlarged scale extending up between the internasal scales.

Northern pine snake
Photo by Walter F. Bien

Habitat: Northern pine snakes are commonly found in pitch pine and scrub oak forest types with well-drained, loose, sandy soils that are ideal for burrowing. Pine snakes will use both undisturbed and open, disturbed upland forest types. Disturbed open areas are important for nesting, basking, and digestion. Nesting sites are usually located in open clearings to allow adequate sunlight penetration during the day.

Distribution: The Northern pine snake is largely limited to the southeastern Atlantic states, and the New Jersey population represents a disjunct population at the northern limit of its range. A population density model was developed to estimate the total number of northern pine snakes at WGR. There are an estimated 229 adult northern pine snakes within WGR, which is approximately 1 individual per 16.9 hectares. A radio telemetry study tracked northern pine snakes in 2005 and 2006 throughout WGR. This study found that northern pine snakes mated, nested, fed, and hibernated both inside and outside the Target Zone area. Smith and Bien (2005a) observed northern pine snakes in disturbed open, pitch pine lowland, pitch pine scrub oak barren, and pygmy forest habitats throughout WGR. Snakes were found to inhabit upland areas 92 percent of the time during the active season, while their hibernacula occurred 70 percent of the time in pitch pine scrub oak barrens and 30 percent of the time in disturbed open areas. This study's findings suggest the northern pine snake is benefiting from range activities by creating suitable habitat for hibernating, aestivating, and nesting (Smith and Bien 2005a, 2005b).

An additional study looked at microhabitat use by northern pine snakes. Results indicated that microhabitat use varied between sexes, as males choose cooler microhabitats with less leaf litter than females. Male microhabitat selection also varied more before and after mating, while there was no change in selection for females. A radio telemetry study was also performed on neonate northern pine snakes. Results indicated that neonate pine snakes traveled up to 300 meters from their nest sites and preyed upon small rodents.

Pine Barrens Treefrog

Species Description: The Pine Barrens treefrog is a small, delicate member of the treefrog family, Hylidae. It has a short body with relatively short legs and well-developed pads on its feet (Boyd 1991). The Pine Barrens treefrog is emerald green with a broad lavender stripe on either side of the body. This stripe has a thin, white outline. The concealed portions of the legs and inner thigh are bright orange with numerous yellow dots. Their call is a repetitious low, nasal "*quonk*" (Boyd 1991).

Pine barrens tree frog.
Photo by Walter F. Bien

Habitat: The Pine Barrens treefrog is locally common to abundant in Atlantic white cedar and sphagnum bogs and swamps of the New Jersey Pine Barrens (Boyd 1991). Pitcher plants, sundews, and terrestrial orchids are species that typify this habitat type and also require the acidic, open conditions of these bogs. The tree frog prefers early successional ponds and vernal pools, but is commonly found calling from shallow borrow pits, temporary streams, and the edges of permanent impoundments. They typically call from trees standing in or near water, but also from within the water or on the ground nearby. They become more terrestrial following breeding season from mid-May through mid-June (Boyd 1991).

Distribution: Smith and Bien (2005a) observed Pine Barrens treefrogs in bog savanna, cedar swamp, cranberry bog, hardwood swamp, shrub thicket, pitch pine lowland, and pitch pine scrub oak barren habitats. This frog was widely distributed. Breeding populations occurred through the WGR property. Disturbances in the impact zone created by military training have enhanced Pine Barrens treefrog habitat by creating temporary pools of water with no fish predators that would potentially eat tadpoles.

5.5 WETLANDS AND FLOODPLAINS

5.5.1 Wetlands/Waters of the United States

Wetlands are an important natural system because of the diverse biological and hydrologic functions they perform. These functions may include water quality improvement, groundwater recharge, pollution treatment, nutrient cycling, the provision of wildlife habitat and niches for unique flora and fauna, stormwater storage, and erosion protection. The United States Army Corps of Engineers (USACE) defines wetlands as "those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 Code of Federal Regulations [CFR] 328)."

New Jersey's freshwater wetlands are divided into three classifications based on resource value: exceptional, optimal, or intermediate resource value (NJAC 7:7A-2.5). *Exceptional wetlands* are the highest quality wetlands based on their ecosystem functions and the value they provide to the ecosystem and society. *Optimal wetlands* are fully functional wetlands that have less of a value to society. *Intermediate wetlands* are those that have a lesser functional role in the ecosystem and provide less of a value to society. The classification of a particular wetland is a factor in, among other things, considering alternatives to the proposed regulated activity, determining the size of the transition area, and assessing mitigation.

Wetlands are protected as a subset of the "waters of the United States" under Section 404 of the CWA. The term "waters of the United States" has broad meaning under the CWA and incorporates deep water aquatic habitats and special aquatic habitats (including wetlands). Jurisdictional waters of the United States are areas regulated under the CWA and may also include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, and other waters, that if degraded or destroyed could affect interstate commerce. For an area to be classified as a jurisdictional wetland, three conditions must be present: (1) wetland hydrology, (2) hydric soil, and (3) hydrophytic vegetation. Areas that may be periodically wet, but that do not meet the requisite criteria, are not classified as "jurisdictional" wetlands.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill into the "waters of the United States," including wetlands. Section 401 of the CWA gives the State of New Jersey the authority to regulate, through the state water quality certification program, proposed federally permitted activities that may result in a discharge to water bodies, including wetlands. Physical disturbances to wetlands and disturbances to both perennial and intermittent streams (e.g., stream crossings) are regulated by the CWA under Sections 404 and 401. Most proposed activities within streams or wetlands (such as filling, dredging, or clearing of ditches) require either a general or individual permit. A Local Operating Procedure agreement between the USACE and NJPC delegated authority to the New Jersey Pinelands Commission to regulate waters and wetlands within the boundary of the New Jersey Pineland Area (Appendix G). Delineations verified NJPC will be accepted by the USACE except if there are unusual circumstances concerning a jurisdictional determination (USACE 2000). The Pinelands Commission should be consulted prior to any activities that could potentially affect wetlands or water bodies to determine permitting requirements. General or individual permits may be required for such activities and are subject to additional requirements under the Pinelands Comprehensive Management Plan (NJAC 7:50-6).

Wetlands are also protected under EO 11990, *Protection of Wetlands* (43 CFR 6030). The purpose of EO 11990 is to reduce the adverse impacts associated with the destruction or modification of wetlands through federal actions. EO 11990 (*Protection of Wetlands*) requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the beneficial values of wetlands.

The New Jersey Freshwater Wetlands Protection Act protects freshwater wetlands and transition areas or buffers around freshwater wetlands. Typically, the width of the transition area can vary from 150 ft to no transition area, dependent upon the value of the particular wetland. A transition area is required adjacent to freshwater wetlands of exceptional resource value (standard

width of 150 ft) and of intermediate resource value (standard width of 50 ft). A transition area is not required adjacent to freshwater wetlands of ordinary resource value or adjacent to state open waters. The Pinelands Commission requires a 300 foot buffer for all wetlands within the Pinelands Preservation Area District. The Pinelands Commission provides a *Buffer Delineation Model for the New Jersey Pinelands Wetlands*, which contains site- and wetland-specific calculations to determine if a wetland buffer reduction would result in an adverse impact to a wetland.

Vernal pools are protected pursuant to the New Jersey Freshwater Wetlands Protection Act, which applies to all General Permit Authorizations [NJAC 7:7A- 4.3(b)(16)] under the CWA. Wetlands associated with the Oswego River are priority wetlands as designated by USFWS pursuant to the Emergency Wetlands Resources Act of 1986 (100 Stat. 3582; 16 USC 3901-3932) because of National Significance.

As a result of the federal and state regulations, as well as DoD and USAF policy, the 177 FW is responsible for identifying and locating jurisdictional Waters of the United States (including wetlands), where these resources have the potential to be impacted by activities at the WGR. Such impacts could include construction of roads, buildings, runways, taxiways, navigational aids, and other appurtenant structures or activities as simple as culvert crossings of small intermittent streams, riprap placement in stream channels to curb accelerated erosion, and incidental fill and grading of wet depressions.

Warren Grove Range

Surveys to characterize wetlands at WGR have been conducted over the years using different methods with varying degrees of accuracy. NJDEP performed remote-sensing freshwater wetland delineations for WGR on 1986 orthophoto quarterquad basemaps (1:12000) by photointerpretation of 1986 color infrared photos. Approximately 806.21 acres of the 9,416 acres at WGR were mapped as wetlands by NJDEP and the National Wetlands Inventory (NJANG 1998).

Freshwater wetland delineations were performed at WGR in May 2002 for wetlands and their buffers that intersect roads or firebreaks (NJANG 2003a), by applying the Routine Determination Method, Onsite Inspection outlined in the *New Jersey Pinelands Commission Manual for Identifying and Delineating Wetlands* (NJPC 1991). A total of 118.96 acres of wetlands were delineated as part of the field effort.

Atlantic cedar wetland at WGR
Photo by Walter F. Bien

The most recent wetland delineation was conducted from April to September (2004 to 2006). Wetlands delineated in the 2003 report were resurveyed and wetland habitat types along major drainages were classified using the Cowardin et al. (1979) classification system and NJDEP wetland classification system. This survey identified nine wetland drainages comprising approximately 147.35 acres (Smith and Bien 2007). These wetlands are dominated by five

different habitat types or subsystems of the palustrine system: shrub thicket, pitch pine lowland, hardwood swamp, bog savanna, and cedar swamp (Smith and Bien 2007). A summary of wetlands delineated during the survey effort at WGR is presented in Table 5-3. Figure 5-1 shows the location of these wetlands areas on WGR. Wetlands at WGR sustain a large number of sensitive animal and plant species A more recent study conducted at WGR identified a total of 45 intermittent ponds, all lacking fish which support amphibian breeding. Results of this study have not been finalized at this time. WGR does not have a Jurisdictional Determination for wetlands at this time.

Coyle Field

No wetland delineations have been performed at Coyle Field.

Atlantic City ANGB

No wetland delineations have been performed at Atlantic City ANGB.

Table 5-3. Summary of Wetlands Delineated at WGR

Wetland Habitat	Acreage	Description	WGR Wetland(s)	Cowardin Classification
Shrub Thicket	17.79	Contain thick growths of leatherleaf, highbush blueberry, piedmont staggerbush, and sheep laurel (McCormick 1979). The ground ranged from saturated to well drained and was typically covered by sphagnum moss.	1, 2, 4, 8, and 9	PFO4E, PSS1D
Pitch Pine Lowland	58.93	The most abundant wetland type at WGR is dominated by pitch pine. They may also have hardwoods scattered throughout (i.e., red maple and blackgum) (McCormick 1979). These areas are abundant with different species of shrubs such as highbush blueberry, sheep laurel, black huckleberry, blue huckleberry, and leatherleaf.	1 –9 (found in all WGR wetlands)	PFO4B, PFO4D
Hardwood Swamp	38.20	Dominated by red maple and blackgum, but pitch pine can also be found. There is a variety of shrub types (i.e., highbush blueberry, black huckleberry, blue huckleberry, sheep laurel, and coastal sweetpepperbush) found in hardwoods swamps, but the density of these shrubs is often lower than in pitch pine lowland habitat (McCormick 1979).	1, 3, 4, 5, 6, 7, and 9	PFO1B, PFO1D, PFO1E
Bog Savanna	22.00	Open canopy areas that typically flooded or saturated with water early in the season and began to dry as summer progressed. Vegetation includes rushes, sedges, and grasses (McCormick 1979). The edges for most of the bog savannas were thick with leatherleaf as natural succession progresses, gradually reducing the size of the savanna.	1, 2, 3, 4, and 9	PEM1B, PEM2B, PEM2D, PEM2E
Cedar Swamp	1.58	Atlantic white cedar stands are typically very dense and progressively thin as the forest matures (McCormick 1979). Often scattered within the cedar swamps are hardwoods (i.e., red maple and blackgum), highbush blueberry, coastal sweetpepperbush, and blue huckleberry. The ground is often saturated and covered with sphagnum moss. A few stands of Atlantic white cedar were observed within the wetlands of WGR; however, these areas were typically dominated by other vegetation type (i.e., hardwoods or shrubs).	1 and 2	PFO4B

Source: Smith and Bien (2007).

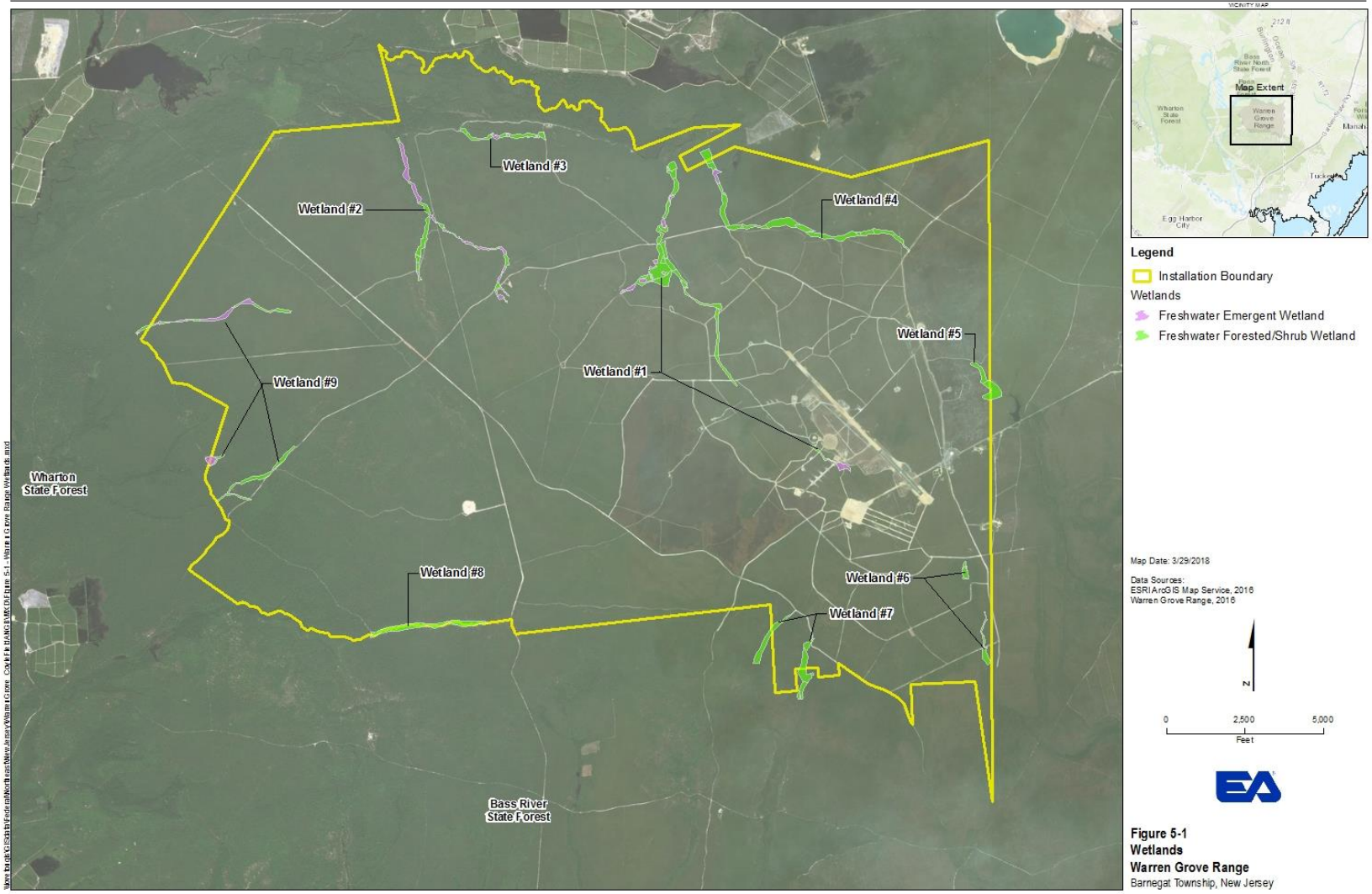

Figure 5-1
Wetlands
Warren Grove Range
Barnegat Township, New Jersey

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5.5.2 Floodplains

Floodplains generally are areas of low, level ground present on one or both sides of a stream channel that are subject to either periodic or infrequent inundation by flood waters. Floodplains are typically the result of lateral erosion and deposition that occurs as a river valley is widened. The porous material that composes the floodplain is conducive to retaining water that enters the soil via flooding events and elevated groundwater tables. Inundation dangers associated with floodplains have prompted federal, state, and local legislation limiting the development in these areas to recreation, agriculture, and preservation activities. Floodplains are protected under EO 11988, *Floodplain Management*. The purpose of EO 11988 is for federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impacts of flooding, and restore and preserve the natural and beneficial values of floodplains when acquiring, managing or disposing of Federal lands. Floodplains are regulated by the Federal Emergency Management Agency (FEMA) with standards outlined in 44 CFR Part 60.3. EO 11988 (*Floodplain Management*) requires agencies to assess the effects that their actions may have on floodplains and to consider alternatives to avoid adverse effects and incompatible development on floodplains. If impacts to FEMA floodplains are unavoidable, then the 177 FW must obtain a permit from the NJDEP prior to initiating work within a floodplain.

FEMA has identified 100-year and 500-year floodplains within the WGR as shown on the FEMA Flood Insurance Rate Maps (FIRMs) 3400850025B and 3400850015B, effective 4 April 1983 (FEMA 1983). The 100-year floodplains are located along the Oswego River in the northern portion of WGR, and the 500-year floodplains are located along Beaver Branch, Buck Run, and two unnamed tributaries of Buck Run in the western portion of WGR (Figure 5-2). The 100-year and 500-year floodplains comprise approximately 395 acres and 43 acres, respectively, of WGR.

The 100-year floodplains for Coyle Field are shown on FIRM 34055100010A, effective 20 January 1982 (FEMA 1982). The 100-year floodplains are located at Sykes Branch, the drainage into the Yellow Dam Branch, and the drainage to the Plains Branch (Figure 5-3).

The 100-year floodplain for Atlantic City ANGB is shown on FIRM 3400080045B, effective May 2, 1983 and FIRMs 3400070001B and 3400070002B, effective February 16, 1983.. Atlantic City ANGB does not occur within the 100-year or 500-year floodplain (Figure 5-4).

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Warren Grove Range
Wharton State Forest
Bass River State Forest
VICINITY MAP
Map Extent
Legend
Installation Boundary
100 yr Floodplain
Map Date: 3/29/2018
Data Sources:
ESRI ArcGIS Map Service, 2016
Warren Grove Range, 2016
USFWS, 2016
N
0
0.5
1
Miles
EA
Figure 5-2
Floodplains
Warren Grove Range
Barnegat Township, New Jersey

Figure 5-3
Floodplains
Coyle Field
Barnegat Township, New Jersey

Figure 5-4
Floodplains
Atlantic City ANGB
Egg Harbor Township, New Jersey

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5.6 OTHER NATURAL RESOURCE INFORMATION

All biological surveys and studies that have been conducted at WGR have been incorporated into the sections above. Additional natural resource surveys are underway at WGR, Coyle Field, and Atlantic City ANGB under the Fiscal Year 16 INRMP Support Contract. The information gained from these surveys will be incorporated into the INRMP during the next revision.

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6. MISSION IMPACTS ON NATURAL RESOURCES

6.1 NATURAL RESOURCES CONSTRAINTS TO MISSIONS AND MISSION PLANNING

This INRMP integrates aspects of natural resources management into the military mission. As such, it becomes the primary tool for ecosystem management at WGR while ensuring the successful, efficient accomplishment of the military mission. A multiple-use ecosystem management approach will be implemented to accommodate mission-oriented activities and provide for good stewardship, thereby maintaining and improving the quality, aesthetic values, and ecological relationships of the environment.

The Sikes Act requires that INRMPs provide for "…no net loss in the capability of military installation lands to support the military mission of the installation" (16 USC §670 et seq.). The INRMP enables the installation to meet the requirements of the military mission within the limitations and legal restrictions of the baseline natural resources at WGR and Coyle Field.

The 177 FW requires open areas in the vicinity of the strafe pit, target area, and landing strips and landing zones. The 177 FW requires a safety buffer around these primary training areas. Ideally, the safety buffer is a healthy ecosystem that can withstand or even benefit from wildfires that will occur occasionally with military training and which does not require extensive management or intervention. Degraded training land and vegetation, soil erosion, silted streams or other water bodies, and flooded training areas would prevent sustainable long-term training. Degradation of natural resources can result in unintended impacts to the military mission, impaired readiness, and funds spent on natural resources crisis management and interventions rather than training. Healthy ecosystems are resilient and can support long-term training needs. The 177 FW needs the land and its natural resources to function together in a healthy ecosystem to support training.

All the landscapes at WGR are important in supporting training activities. Military training is done in conjunction with the existing landscape and when necessary the landscape is modified to better support the training mission needs, such as establishing a riparian corridor around lakes to reduce erosion. Management activities in this INRMP are designed to support the desired habitats and ecosystem functions.

WGR will manage environmental constraints during training and mission activities. Natural resources that have the ability to limit activity on the installation are shown in Figure 6-1. The most significant constraints on WGR are related to water resources, such as floodplains, wetlands, streams and ponds. Activities in and around wetland areas are limited because impacts such as filling, modifying, draining, or construction may require federal, state, and local permits, and mitigation to offset permitted impacts. Any new training within these areas should be coordinated with the installation's environmental staff to ensure that actions are in compliance with all applicable laws.

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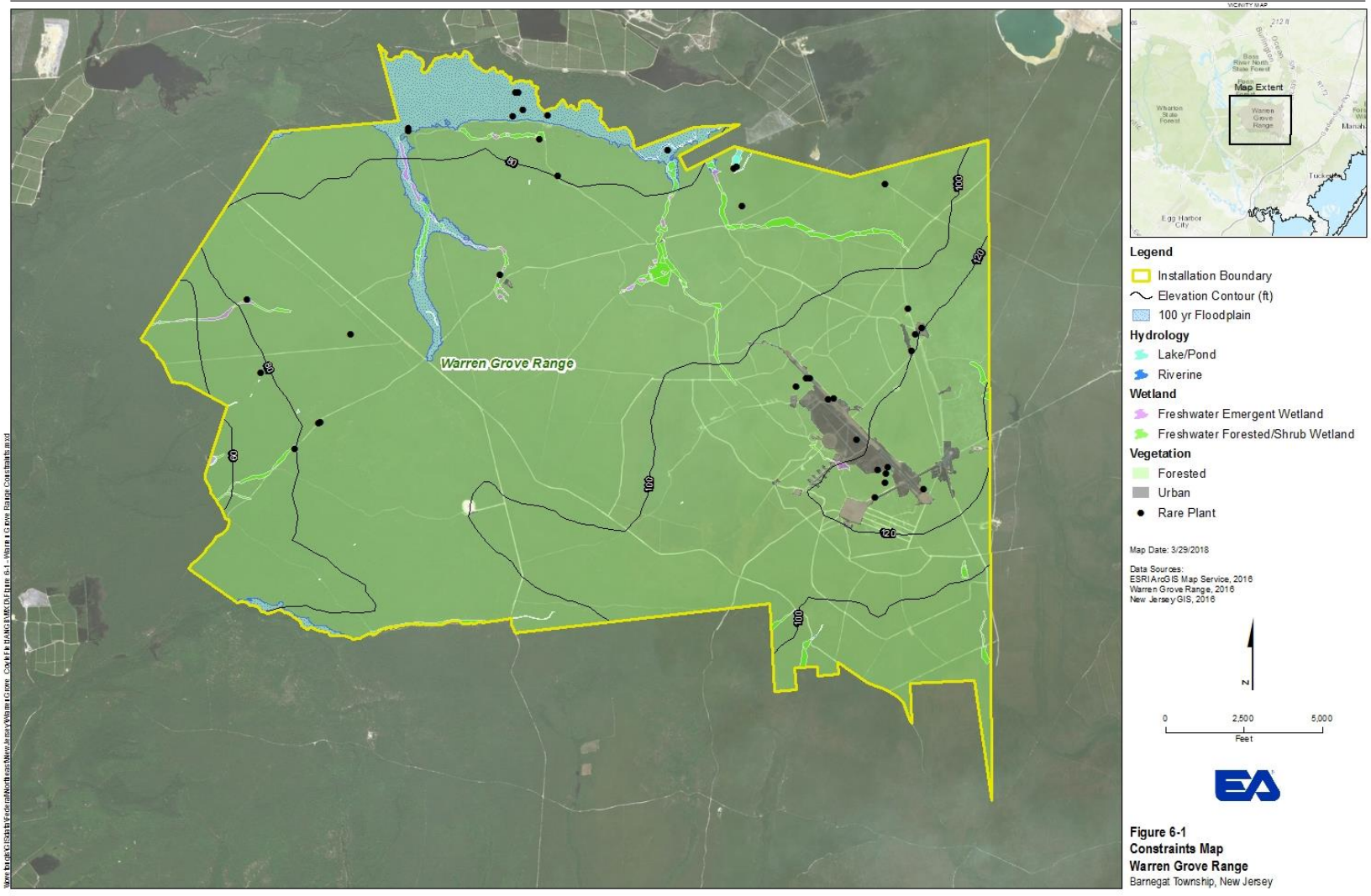

Figure 6-1
Constraints Map
Warren Grove Range
Barnegat Township, New Jersey

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Construction within the 100-year floodplain should also be avoided or minimized to prevent future damage to installation property. There are no major topographic or vegetative features that limit the military mission on WGR. There are currently no constraints from threatened and endangered species, but any new activities or infrastructure would be limited in areas where listed species are present. However, if there is potential for impacts to threatened and endangered species to occur in the future, consultation with the USFWS (federal species) or NJDEP (state species) should occur.

6.2 LAND USE

Warren Grove Range

WGR consists of approximately 9,416 acres with approximately 500 acres designated for tactical and conventional air-to-ground gunnery training. Approximately 16 acres of WGR has been developed and is considered either improved or semi-improved and is used for range operations and maintenance activities. The remaining approximately 8,900 acres are managed as a safety buffer. A summary of land use categories and facilities at WGR is provided in Table 6-1.

Military personnel performing training at WGR.
Photo from WGR archives

Improved grounds are developed areas that have either an impervious surface (e.g., sidewalks and buildings, excluding runway and apron areas) or limited landscape plantings that require intensive maintenance and upkeep. Improved grounds at WGR consist of the main operational headquarters (8,400 square feet on 0.2 acre), Pole Barn, Main and Flank Towers, and a munitions storage building.

Table 6-1. Land Use Categories and Facilities on WGR

Land Use Category	Acreage	Description
Improved Grounds	0.2	Developed area with impervious surface or limited landscaping with intensive upkeep. Includes the WGR command and support area (operational headquarters, main tower, and eastern support tower.
Semi-Improved Grounds	16	Areas with periodic grading or maintenance for operations purposes. Includes the WGR dirt access road, 4,500-foot helicopter runway, vehicle parking, equipment and material storage, internal roads, and operations and maintenance compound.
Unimproved Grounds	9,400	Areas that receive little to no grounds maintenance. They make up the bulk of WGR and include streams, wetlands, forests, shrublands, and grasslands. This area includes 500 acres of designated for tactical and conventional air- to-ground gunnery training (impact area), and 8,900 acres managed as a safety buffer.

The main operations building incorporates office space for range members and various support facilities, a vehicle maintenance bay, and a parking garage for two wildland firefighting vehicles. The range does not have a range residue facility or target fabrication facility as authorized. WGR does not have covered areas for vehicle parking or equipment storage. WGR security consists of fencing that encompasses the main range complex (main building, parking area, and Pole Barn),

the munitions storage building, and the Bomb Dummy Unit 33 range residue area. The range boundary perimeter is not fenced due to fiscal and environmental constraints (NJANG 2008a).

Semi-improved grounds occupy approximately 16 acres. These are grounds where periodic grading or maintenance is performed for operational reasons. Operations and maintenance facilities are near the entrance to WGR along its eastern border and include the dirt access road, 4,500-ft helicopter runway, and fenced operations and maintenance compound (approximately 1 acre). It contains the main operations building and maintenance shed. The remainder of the semi-improved grounds is used for vehicle parking, equipment and material storage, internal roads, and maintenance activities.

Unimproved grounds account for approximately 9,400 acres of the range and include the impact area (500 acres) and safety buffer zone (8,900 acres). Both areas are dominated by the pygmy forest vegetation characteristic of the East Plains region of the Pine Barrens. The impact area is on the east-central edge of WGR; it is designated for tactical and conventional air-to-ground gunnery training. Air-to-ground training is centered on an 1,800-ft runway with the balance being a mock dirt strip and target scenarios placed west of the main tower. The runway is not certified nor maintained for landing any aircraft; it only exists for visual recognition and delineation of the impact area. The target scenarios include strafe pits, bunkers, communications stations, a mock convoy of various sized tanks, and mock aircraft. Also, the Widgeon Helicopter Landing Zone is within the impact area; however, this area is infrequently utilized by the operational mission. The remainder of this land use category is comprised of the safety buffer zone. The safety buffer area is closed to visitors except when escorted by WGR personnel.

Coyle Field

Coyle Field is approximately 256 acres located adjacent to Route 72, Barnegat Road. The site includes a rectangular shaped parcel of land used as an active military drop zone. The site contains three gravel runways that are designated north-south, northeast-southwest, and northwest-southeast. There are two drop zone targets established adjacent to the runways. Coyle Field is owned and operated by the NJFFS. Other agencies also use portions of Coyle Field. A State Police Demolition Area is located in the southwest corner of the site. Other buildings on Coyle Field include the New Jersey State Maintenance Facility, concrete ramp, and former Air Force Reserve Building, all located immediately adjacent to Route 72. An access road runs from these buildings to the drop zone.

Atlantic City ANGB

Atlantic City ANGB is approximately 296 acres located within Atlantic City International Airport. The installation leases two parcels of land from the Atlantic City Airport Authority. The main cantonment area, approximately 230 acres, is located west of the airport commercial service terminal and parking facilities and south of the airfield. The base includes a headquarters building, operations building, civil engineering facility, multiple support buildings, aircraft maintenance hangars, alert hangars, and engine shop. The Ammunition Area, approximately 65 acres, is located northwest of the airport terminals.

6.3 CURRENT MAJOR IMPACTS

The primary mission of WGR is to provide a quality combat training environment for all United States and Allied air and ground forces. WGR is a fully manned facility with an RCO for aircraft access and range personnel who provide ground scoring during gunnery operations, maintenance, and fire protection. WGR supports the following training activities: 25 scorable target scenarios for delivery of inert and training bombs, rockets, and aerial gunnery; TGM-65 training; laser targets; laser target designation; air-drop of cargo; electronic combat; defensive countermeasures; and communications jamming.

There are two primary areas of potential impacts to natural resources from the military mission at WGR: impacts to migratory birds and ignition of wildfires. Impacts to migratory birds are managed through a variety of BASH-related measures (Component Plan B) and are generally minimal at WGR. Wildfires have an impact on WGR and, in the past, have impacted neighboring properties and the military mission itself. However, wildland fire is an essential part of the ecosystem on WGR. Military training does cause wildfires and the 177 FW must be able to manage fuel load to reduce the likelihood of uncontrollable wildfires. This requires an active prescribed fire program and support from the NJFFS to implement the program. The presence of both wildfires from military training and an active prescribed fire program have contributed significantly to the current healthy condition of the habitat on WGR.

In addition, natural resources management issues have been identified as having the potential to impact the military mission. WGR does not have a Natural Resources Manager. Natural resources issues are handled by a variety of sources, including the 177 FW Environmental Manager, NGB/A4AM Natural Resources Manager, WGR personnel, and government contractors. Reports and data regarding various natural resources need to be centralized and managed at WGR headquarters. Lack of geographic information system (GIS) capability limits and delays the analysis of potential natural resources impacts at WGR and potentially prevents identification of suitable mitigation, when warranted.

6.4 POTENTIAL FUTURE IMPACTS

Specific military missions and training requirements are fluid and change from time to time with realignments, transformations, and changes in equipment and tactics. This requires the establishment of basic underlying natural resource management principles and practices that have broad application and can be adapted in multiple situations, such as is the case with surface water and soil management practices. Implementation of this INRMP at WGR and Coyle Field will successfully promote adaptive stewardship practices that protect and enhance natural resources for multiple use, sustainable yield, and biological integrity, while supporting the military mission. Future development of WGR to meet the training needs of the 177 FW is addressed in the WGR Comprehensive Range Plan (NJANG 2008a).

Projects, activities, new development, and mission changes are typically reviewed by multiple entities within the 177 FW, including the 177 FW Environmental Manager (EM). New construction projects are reviewed by the 177 FW Facility Board. If there is the potential for environmental impacts, the National Environmental Policy Act (NEPA) process is started. The initial step in compliance with NEPA for any activity that might impact the environment by the

177 FW is to complete USAF Form 813: Preliminary Environmental Impact Analysis. The form is prepared to aid in the development of the assessment, providing information on the proposed action and its alternatives, purpose, and potential environmental effects. If there are additional environmental compliance requirements, the WGR Natural Resources Manager facilitate any required consultation or permit applications.

6.5 NATURAL RESOURCES NEEDED TO SUPPORT THE MILITARY MISSION

The primary purpose of the natural resources management at WGR is to support the military mission by maintaining sustainable natural resources as a critical asset upon which to accomplish the mission of WGR. Overall goals of natural resource management include:

- No net loss in the capacity of the installation lands to support existing and future military operations at WGR

- Ensure military operations are not interrupted due to non-compliance with applicable laws.

This INRMP integrates the various aspects of natural resources management into the military mission, and is the primary tool for ecosystem management at WGR while ensuring the successful, efficient accomplishment of the military mission. A multiple-use approach will be implemented through the INRMP to accommodate the presence of mission-oriented activities and provide for good stewardship, thereby maintaining and improving the quality, aesthetic values, and ecological relationships of the environment. Implementation of this INRMP will promote stewardship practices that protect and enhance natural resources for multiple use and biological integrity, while supporting the military mission. Mission activities at WGR are to provide a quality combat training environment. The mission of WGR does not require consumption or use of natural resources on the installation.

7. NATURAL RESOURCES PROGRAM MANAGEMENT

7.1 NATURAL RESOURCES PROGRAM MANAGEMENT

This INRMP has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of WGR and Coyle Field. The Sikes Act requires that INRMPs provide for no net loss in the capability of military installation lands to support the military mission of the installation. Professionally trained natural resources management staff and natural resources enforcement are required to implement this INRMP. As defined in paragraph 2.10 of AFI 32-7064, "installations will use professionally trained natural resources management personnel to develop, implement and enforce their INRMPs." WGR does not have a Natural Resources Manager. This position is currently equally filled by the 177 FW Environmental Manager and the ANG Natural Resources Program Manager (NGB/A4AM). In addition, natural resources issues at the installation are also handled by a variety of sources, including the 177FW, WGR/Coyle Field installation personnel and government contractors. In addition to NGB/A4AM, WGR/Coyle Field, and government contracted personnel, NJANG personnel will be required to implement this Plan. The Sikes Act also states that if an installation cannot retain a professional natural resources staff, related federal or state agencies be given the opportunity to assume these tasks. Responsibilities of the various organizations on WGR for the implementation of the INRMP are described below.

- **INRMP Working Group—**The INRMP Working Group will be responsible for the overall implementation of the INRMP. The INRMP Working Group will be made up of the key WGR personnel from the host unit (177 FW), the NGB/A4AM, and all tenant organizations and will assume an oversight role to ensure the effective implementation of this INRMP. The WGR Natural Resource Manager and/or his/her designee shall chair this organization and establish subcommittees to focus on high-priority natural resources management issues, such as wildland fire. Top and mid-level management representation, as well as representation from several individuals with day-to-day on-Range field experience, will provide the INRMP Working Group with the leadership and structure necessary for the successful implementation of this INRMP. The INRMP Working Group is also essential for internal environmental awareness.

- **Commander – 177 FW CC—**The Commander of the 177 FW (177 FW CC) serves as the Chairman of the Environmental Safety and Occupational Health Council. The 177 FW CC is the official signatory for the INRMP.

- **Range Commander– 177 FW DET/CC—**The Range Commander (177 FW DET/CC) will ensure the implementation of the INRMP to the fullest extent practicable based on funding and manpower availability.

- **NGB/A4AM Natural Resources Manager—**The NGB/A4AM Natural Resources Manager equally shares the duties of the installation Natural Resources Manager with the WGR Natural Resources Manager. In addition, the NGB/A4AM Natural Resources Manager tracks DoD and USAF policies and approves funding for projects or studies identified as a priority in this INRMP. Deviation from the projects proposed in this Plan will be independently reviewed by the NGB/A4AM Natural Resources Manager. The

NGB/A4AM Natural Resources Manager acts as a technical point-of-contact or contact on all natural resource-related activities.

- **Environmental Manager – 177 FW EM—**The 177 FW EM with equal assistance from the NGB/A4AM Natural Resources Manager currently serves as the acting WGR Natural Resources Manager and is responsible for ensuring that activities associated with the implementation of this INRMP adhere to applicable federal, state, local, and USAF environmental regulations and policies.

- **WGR Natural Resources Manager—**Currently there is no WGR Natural Resources Manager, both the 177 FW EM and NGB/A4AM equally fill this position. Together, the WGR Natural Resource Manager and NGB/A4AM Natural Resources Manager are responsible for ensuring that activities associated with the implementation of this INRMP adhere to applicable federal, state, local, and USAF environmental regulations and guidelines. Projects proposed in this INRMP are reviewed by the WGR Natural Resource Manager and the NGB/A4AM Natural Resources Manager for funding and scheduling projects outlined in Chapter 8 and 10. The WGR Natural Resource Manager, NGB/A4AM Natural Resources Manager, and Public Affairs Office (177 FW PA are responsible for establishing and implementing a conservation education program to instruct WGR personnel on the protection and enhancement of biological diversity. The WGR Natural Resource Manager and NGB/A4AMN Natural Resources Manager direct most of the ongoing natural resources management activities presented in this INRMP. However, for those activities that fall outside of natural resource management such as the 177 FW's BASH Plan and Integrated Pest Management (IPM) Plan the leads for those programs, Flight Safety Officer and Installation Pest Management Coordinator, will have to be included in discussions regarding projects to be implemented at WGR. The WGR Natural Resource Manager and NGB/A4AM equally acts as a technical point-of-contact for all natural resource-related activities.

- **Range Control Officer – 177 FW RCO—**The WGR Range Control Officer (RCO), in conjunction with the 177 FW Flight Safety Officer (SE), is responsible for implementing activities presented in this INRMP that pertain to the BASH Reduction Program. In addition, the WGR RCO is responsible for obtaining necessary bird/wildlife deterrent equipment (e.g., bird spikes, pyrotechnics), and ensuring that WGR personnel are trained in their proper use. The WGR RCO will obtain the required depredation permits and comply with any conditions and reporting requirements as listed in the permit in the event of an incidental take of a listed species occupying the airfield. The RCO is also responsible for approving any WGR improvement or construction projects.

- **Flight Safety Officer – 177 FW SE—**The 177 FW Flight SE, in conjunction with the WGR RCO, is responsible for implementing all activities presented in this Plan that pertain to the BASH Reduction Program. The 177 FW SE also ensures that bird/wildlife strikes resulting from aircraft assigned to host tenant transient units at WGR are accurately documented and reported to the USAF BASH Team, Kirtland Air Force Base, New Mexico. In addition, the 177 FW SE ensures that the Bird Hazard Working Group conducts meetings to evaluate and refine strategies for the reduction of the BASH threat on the WGR.

- **Legal – 177 FW LG—**The NGB Judge Advocate (JA) in cooperation with 177 FW legal office is responsible for ensuring that the implementation of the management objectives contained within this INRMP meet all of the NJANG's and the 177 FW's regulatory and statutory requirements that pertain to natural resources management. The legal office will review any future natural resources management proposals and alert the 177 FW DET/CC, 177 FW EM, and 177 FW RCO should there be any regulatory conflicts or shortfalls. In addition, the legal office will keep the 177 FW DET/CC, 177 FW EM, and 177 FW RCO informed of any new statutes or regulations that might affect natural resources management on the WGR.

- **Judge Advocate – NGB-JA—**The Office of Chief Counsel provides legal services, counsel, and opinions regarding the Air National Guard to the Chief, NGB, the Director of NGB Joint Staff, and Directors of the Air National Guard and their respective staff. The NGB-JA provides counsel regarding military actions under both federal and state laws. In addition, the NGB-JA provides legal advice and opinions on environmental issues including the protection of natural resources.

- **Public Affairs – 177 FW PA—**The Public Affairs office is responsible for the coordination of public access for events at WGR. Public Facilities/Recreation land use is oriented to providing recreational opportunities to assigned WGR personnel, members of reserve components and their families, active and retired military, and civil service personnel. The military mission and the limited amount of resources on WGR preclude open public recreational use of WGR. However, there are several opportunities for certain groups (e.g., Boy Scouts, birding groups) to utilize WGR. The 177 FW PA serves as the point-of-contact to interface between the Commander and civilian groups interested in using WGR for environmental, educational, or other purposes.

- **Operations and Maintenance – 177 FW CEM—**The Operations and Maintenance Office (177 FW CEM) is responsible for all grounds maintenance activities on WGR. In addition, this office will ensure that the habitat management protocols established in this INRMP for the conservation and enhancement of biodiversity on WGR are followed. Range Operations and Maintenance are performed by WGR personnel with the exception of the building facility itself. Sometimes WGR receives support assistance from the 177 FW CEM for building maintenance. WGR's equipment is driven by the WGR specific Training Area for allocation and 177th Vehicle Ops. The 177 FW CEM will also periodically review the types and condition of grounds maintenance equipment to determine if new or additional equipment is needed for the proper maintenance of landscapes. WGR has its own Operations and Maintenance Budget as it is provided by the 177 FW.

- **United States Department of Agriculture – Wildlife Services (USDA-WS)—**While under contract with WGR, USDA-WS is responsible for monitoring nuisance wildlife that have the potential to create a BASH issue. USDA-WS personnel support activities that pertain to the WGR BASH Reduction Program. USDA-WS personnel are also responsible for coordinating their activities with the 177 FW EM and 177 FW SE.

- **New Jersey Pinelands Commission** – NJPC is an independent state agency that was created to preserve, protect, and enhance resources, both natural and cultural, within the Pinelands National Reserve. NJPC protects the Pinelands through implementation of the Comprehensive Management Plan which contains the rules that guide land use, development, and natural resource protection programs within the Pinelands National Reserve. Warren Grove Range is situated within the protection area boundaries found in the Comprehensive Management Plan (CMP) and is required to adhere to CMP standards. NJPC can provide technical assistance in development and review of the INRMP.

- **New Jersey Forest Fire Service (NJFFS)—**While Coyle Field is under management of the 177 FW, the NJFFS is responsible for operating and maintaining Coyle Field.

- **Other Organizations—**USFWS and NJDEP (and its various subdivisions) can provide technical assistance to WGR and are partners in the development and review of this INRMP. Specifically, these agencies will alert the WGR Natural Resource Manager and NGB A4/AM Natural Resources Manager whenever new species that have the potential for inhabiting WGR are added to the federal or state endangered species lists. In addition, these agencies should support WGR personnel during scheduled wildlife and vegetation surveys.

Offices in addition to the ones identified above can be solicited to aid in the 5-year evaluation and rewrite of this Plan as required by the Sikes Act, should additional personnel and expertise be required.

7.2 FISH AND WILDLIFE MANAGEMENT

The day-to-day management of fish and wildlife resources and enforcement of applicable laws and policies at WGR and Coyle Field are the responsibility of the Installation Commander. With more than 5,700 acres as a safety buffer surrounding the Impact Area, there is sufficient habitat at WGR to support a healthy diversity for wildlife. Fish and wildlife management focuses on maintaining and restoring natural habitat favorable for indigenous fish and wildlife in a manner consistent with the military mission and all applicable laws and regulations. The primary regulatory drivers for fish and wildlife management include the Sikes Act, Migratory Bird Treaty Act, AFI 32-7064, and New Jersey Pinelands Protection Act. A number of wildlife surveys and monitoring efforts have been completed over the last 5 years. Results of these studies have been incorporated into Sections 5.2 and 5.3 of this INRMP. WGR recently implemented a deer hunting program that is managed by WGR staff.

7.3 OUTDOOR RECREATION AND PUBLIC ACCESS TO NATURAL RESOURCES

Limited outdoor recreation opportunities exist at WGR due to the dangers associated with the air-to-ground mission; however, WGR does allow public access for outdoor recreation within a controlled manner. A number of groups such as Boy Scouts of America and local school groups are invited onto WGR at various times throughout the year for educational purposes. A nature pavilion is located just inside the entrance gate at WGR. This pavilion contains storyboards of research being conducted at WGR. The pavilion also offers bleachers for airplane viewing. In the

past, Open Houses have been held in the pavilion area that included an air show, historic WGR photographs, and samples of plants and animals found within WGR.

WGR also allows public access to natural resources onsite for universities and other groups for scientific studies and/or field trips when the WGR mission allows. In the past, professors and students have studied many aspects of the environment at WGR and make recommendations to military officials on how best to protect both rare and common species inhabiting WGR.

A Pinelands Short-Course is offered by the Pinelands Commission and Burlington County College, which provides a day of talks about many different aspects of Pine Barrens nature and culture. There are also field trips to different parts of the Pine Barrens, including WGR. Over the years, up to 50 people from the Philadelphia Botanical Club have also visited WGR. The club has identified rare plants in remote bogs, disturbed fields, and the pygmy pine forests.

Field visit from Police Explorers.

WGR implemented the Trespass Permit Program for active and retired military, in addition to their family members in 2012. The Trespass Permit Program is detailed in 177 FW Instruction 34-1004 (Appendix F). The objectives of the instruction are to establish criteria for participants to utilize WGR for recreational trespass and hunting purposes, to define procedures, and to manage wildlife populations. The 177 FW Range Operations Officer is responsible for the daily execution of the Trespass Permit Program. This program allows access to WGR for hunting, hiking, and mountain biking. Participants of the Trespass Permit Program must have a valid trespass permit, attend a training program, and have a valid New Jersey hunting permit. Trespass Permit holders must comply with state and federal firearms laws and NJDEP and New Jersey Division of Fish and Game regulations concerning hunting.

WGR personnel conduct safety briefings for all users of WGR, depending on their activity. Safety briefings range from short briefings for visitors to the Range Visitors Area to extensive briefings for users moving unescorted in the impact area. WGR personnel also provide handouts on the Natural Resources Program on WGR and from the NJFFS on prescribed fires and outdoor fire safety, when appropriate.

7.4 CONSERVATION LAW ENFORCEMENT

DoDI 5525.17, *Conservation Law Enforcement Program*, states that a Conservation Law Enforcement Program ensures that installations remain in compliance with appropriate environmental, natural, and cultural resource laws and regulations (Section 1(b)). Currently, there are no conservation law enforcement officers or a conservation law enforcement program at WGR or Coyle Field. In the past, WGR has had issues with illegal poaching of plants and wildlife, specifically snakes and orchids. Under the 177 FW Instruction 34-1004 (Trespass Permit Program), military personnel assigned to the 177 FW have the authority to act in a range commander's behalf concerning Trespass Program activity conducted on WGR. Military personnel may check Trespass Permits, hunting licenses, and season permits, and ask anyone abusing the instruction to leave the installation. In addition, the 177 FW has established a

Memorandum of Understanding (MOU) with the New Jersey State Police. The MOU enables prompt response by the New Jersey State Police to support the 177 FW in the event of a law enforcement or security emergency at WGR (Appendix G). The MOU for security with the New Jersey State Police is detailed in Appendix G.

7.5 MANAGEMENT OF THREATENED AND ENDANGERED SPECIES AND HABITATS

A total of one federally listed species (Knieskern's beaked rush) and 45 state listed species occur on WGR. No federal or state listed species are known to occur on Coyle Field. No critical habitat as designated by USFWS exists on WGR or Coyle Field. This INRMP removes the need for any critical habitat to be designated on the lands making up WGR. The 177 FW is required to manage federally listed threatened and endangered species. Failure to protect federally listed species could lead to an ESA violation, which could negatively impact training land availability. Federally listed threatened and endangered species management requires ESA Section 7 consultation with USFWS. State listed threatened and endangered species management and game species management requires consultation with NJDEP.

WGR specifically manages for seven priority special status species. These include the following:

- federally threatened and state endangered Knieskern's beaked rush
- state endangered bog asphodel
- state endangered broom crowberry
- pineland-listed endangered Pine Barren gentian
- state threatened pine barrens treefrog
- state endangered timber rattlesnake
- state threatened northern pine snake.

Research on the Knieskern's beaked rush, bog asphodel, broom crowberry, and pine barren gentian is limited to their life histories, reproductive biology, and ecology, while effects on population dynamics are for the most part unknown. To gain a better understanding on the populations of these four species at WGR, a rare plant monitoring survey was conducted to provide baseline data for managing rare plant populations at WGR, and evaluating changes in habitat, population size, and effects from management objectives implemented. Results of the rare plant survey and other research specific to the Knieskern's beaked rush and Pine Barren gentian have been incorporated into Section 5.4 of this INRMP.

Bog asphodel
Photo by Walter F. Bien

Current military operations do not appear to be impacting special status herpetofauna at WGR. The timber rattlesnake, northern pine snake, and Pine Barrens treefrog appear to have stable populations and are widely distributed at WGR (Smith and Bien 2005a). Nine 12-in.-diameter culverts were installed under the WGR military runway to mitigate road impacts to wildlife. Northern pine snakes were documented to use the culverts during a 2012 study. Research specific

to the population densities, spatial ecology, neonate ecology, and microhabitat use of the northern pine snake and timber rattlesnake have also been incorporated into Section 5.4 of this INRMP.

7.6 WATER RESOURCES PROTECTION

WGR includes streams, rivers, and ponds. In general, water resources are managed through conservation and impact avoidance. Prior to initiating projects with the potential to disturb water resources, the 177 FW EM should be consulted. Operations and maintenance programs that could potentially affect water resources are reviewed and procedures and guidelines are developed to avoid any impacts.

Oswego River
Photo by Walter F. Bien

Improper stormwater control can potentially lead to water resource impacts and CWA violations, thus potentially resulting in fines and other penalties, which may ultimately compromise the integrity of WGR as a viable training installation. Erosion and sediment control measures are tools that can be used for effective runoff/stormwater management to remain in compliance with the CWA. Under Section 438 of the Energy Independence and Security Act of 2007 (EISA), the 177 FW is required to reduce stormwater runoff from development and redevelopment projects to protect water resources. The New Jersey Soil and Erosion Control Act requires the submittal and approval of a plan to New Jersey Department of Agriculture for sediment erosion and sediment control prior to any construction. In addition, all controls should be in agreement with the New Jersey Department of Agriculture *Standards for Soil Erosion and Sediment Control in New Jersey*. The standards include a combination of science and engineering to aid in the development of successful control practices. To ensure proper stormwater management, the 177 FW implements the Erosion and Sediment Control and Road Maintenance Plan. This plan identifies specific erosion and sediment control measures and lays out a planning process to minimize erosion and sediment loss on WGR. This plan also identifies BMPs and permitting requirements for specific maintenance actions. The plan emphasizes road maintenance as that is the primary ground-disturbing activity at WGR, but it applies to all ground disturbance. The 177 FW assesses the potential erodibility of a site during planning of new development, training, and other land uses. The 177 FW will continue soil erosion management practices including institutional, structural, and vegetative practices. Institutional practices are procedures, policies, or regulations that ensure operations are conducted in a manner that minimizes their impact. Structural practices include permanent construction to install erosion-resistant surfaces, stabilize drainage, and modify slopes to reduce runoff velocity and trap sediments onsite. Vegetative practices consist of establishing live plants on erosive or exposed surfaces. Plants stabilize slopes by binding soils with their roots; shielding soils from rainfall impact; interrupting surface runoff by roughening the surface, allowing more water to infiltrate rather than run off over the surface; trapping sediments in runoff; and wicking moisture out of soils by evapotranspiration. In addition, vegetative practices are self-regenerating and relatively maintenance free.

7.7 WATERS OF THE U.S./WETLAND PROTECTION

Wetland area at WGR
Photo by Walter F. Bien

Wetlands and aquatic habitats are some of the most productive habitats, and often provide migration corridors for a variety of species. Wetland delineations have been conducted throughout WGR over the years. The latest wetland delineation from 2004 to 2006 identified nine wetland drainages comprising approximately 147.35 acres. In addition, a recent study in 2015 was conducted that identified 45 intermittent ponds on WGR. Wetlands at WGR are important for amphibian species, including the state listed pine barrens treefrog. In addition, many of the state and federally listed plant species occurring within WGR are found in wetland habitats.

Because WGR is located within the jurisdiction of the New Jersey Pinelands Commission and the Local Operating Procedure agreement with the USACE delegated authority under Section 404 and 401 for lands located within the New Jersey Pinelands Area to the NJPC, WGR is required to obtain permits from NJPC (Appendix G). The 177 FW EM is consulted anytime a project is proposed within a wetland area that has the potential to cause disturbance. If projects would potentially disturb wetlands, New Jersey Pinelands Commission is consulted to determine if jurisdictional wetlands will be impacted and mitigation procedures will be established. In general, to protect wetlands throughout WGR, vehicles are not allowed in known wetland areas and they are restricted from within 30 ft of water resources except where crossings have been established. Riparian zones and stream banks are protected through good forest, land, and wetland management.

7.8 GROUNDS MAINTENANCE

The 177 FW CEM is responsible for all grounds maintenance activities on WGR. Grounds maintenance helps to maintain and improve the aesthetic appearance of WGR lands and contributes to the overall biodiversity and ecosystem health. Common grounds maintenance activities include road grading, mowing, fire line/break maintenance, erosion control, and Target maintenance and development.

7.9 FOREST MANAGEMENT

There is no income-generating forestry program at WGR. Forest management includes maintaining pine plains and other habitats using cost effective and sustainable methods.

Military operations prior to 1989 had degraded significant portions of WGR, prompting restorative efforts. In the past, Drexel University has conducted studies to evaluate forest restoration projects in terms of plant growth and community structure. Detailed evaluations were completed of seven different restoration projects. Results showed that sites seeded with pitch pine had higher tree densities and shorter trees than sites planted with pine seedlings or natural reference sites. All restored sites lacked shrub-oak densities that were observed in reference sites. This study suggested that past restoration strategies did enhance vegetation cover but did not result in a restoring a natural community structure.

Drexel University also studied an alternative method for restoring abandoned gravel pits within WGR when prescribed burning cannot be used. The alternative restoration included using mulching, fertilizing, and seeding with little bluestem (*Schizachyrium scoparium*). The restored site was compared to a disturbed site undergoing natural succession. Results indicated that the restored site appeared to following the same succession to that of the reference site. Total cover, number of native species, and native pine densities were either similar or greater than the reference site. This study showed that this revegetation strategy is a useful approach in accelerating natural processes and restoring biodiversity with WGR.

Little bluestem restoration area
Photo by Walter F. Bien

7.10 WILDLAND FIRE MANAGEMENT

The Pine Barrens is one of the many fire-adapted areas in the United States. Every year portions of the Pine Barrens are swept up in wildfires. While these fires are important for the area's ecology, they also pose a significant threat to life and property. Management of wildland fires is important to the ecological integrity and to the priorities of the operational missions at WGR. The ecology of the Pine Barrens necessitates wildfires or prescribed fires to maintain vegetation diversity and to reduce the dangers associated with large-scale wildfires.

Different ecological communities require unique burn intervals to maintain the vegetative composition of the ecosystem. Table 7-1 lists the fire return intervals needed to maintain the various vegetation types present in the Pine Barrens. With complete suppression of the wildfires in the Pine Barrens, most of the area would transition to oak-dominated forests which are common throughout the eastern United States. Many unique Pine Barrens species and communities would be lost if the habitats were to change to this structure.

Table 7-1. Fire Return Intervals for Upland Vegetation within the Pine Barrens

Vegetation Type	Fire Return Interval (Average number of years between fires, over several centuries)
Oak-pine Forest	60–100 years
Pine-oak Forest	30–60 years
Pine-oak Woodlands	20–30 years
Pitch Pine-shrub Oak Barrens	15–25 years
Dwarf Pine Plains	5–15 years

Currently, NJFFS uses frequent (2–6 year interval) low-intensity surface fires to burn 10,000 to 15,000 acres of public land and 5,000 acres of private land in the winter in the Pine Barrens. Official prescribed fire management policy on state and private lands has focused on reducing wildfire hazard through repeated surface fuel reduction using backing fires along strategic firebreaks designed to impede the spread of wildfires. This focused management strategy leaves most state acreage unmanaged and experiencing increasing periods of fire exclusion. NJFFS has used higher intensity burning to achieve hazard reduction and ecological management objectives only at WGR in the East Plains core of the Pine Barrens. There is clearly a growing need for

ecological fire management planning in large parts of the Pine Barrens core (i.e., pitch pine barrens and plains) where fire exclusion has created wildfire hazard or overburning has degraded communities and rare species habitats.

WGR currently has a Wildland Fire Management Plan (Component Plan A). The wildland fire program requires consultation with NJFFS. WGR implements a series of pre-suppression programs, prevention programs, and suppression programs. Pre-suppression programs include creating access to control wildfires and implement prescribed burns, construction of firebreaks, and conducting controlled burns. Preventative programs include establishing proper operational procedures to limit wildfire and collection of data to compute National Fire Danger Rating System indices. Suppression programs include fire detection and reporting, fire behavior analysis, monitoring of ignitions to ensure that they burn out, initiating attacks on small fires with the potential to spread, and initiating interagency and inter-organizational suppression strategies.

A series of fire management units have been established on WGR, taking into account the location of roads, streams, and other firebreaks (e.g., open areas, tarmac, saturated wetlands). Figure 7-1 illustrates the location of the fire management units. Table 7-2 provides descriptions of the fire management units.

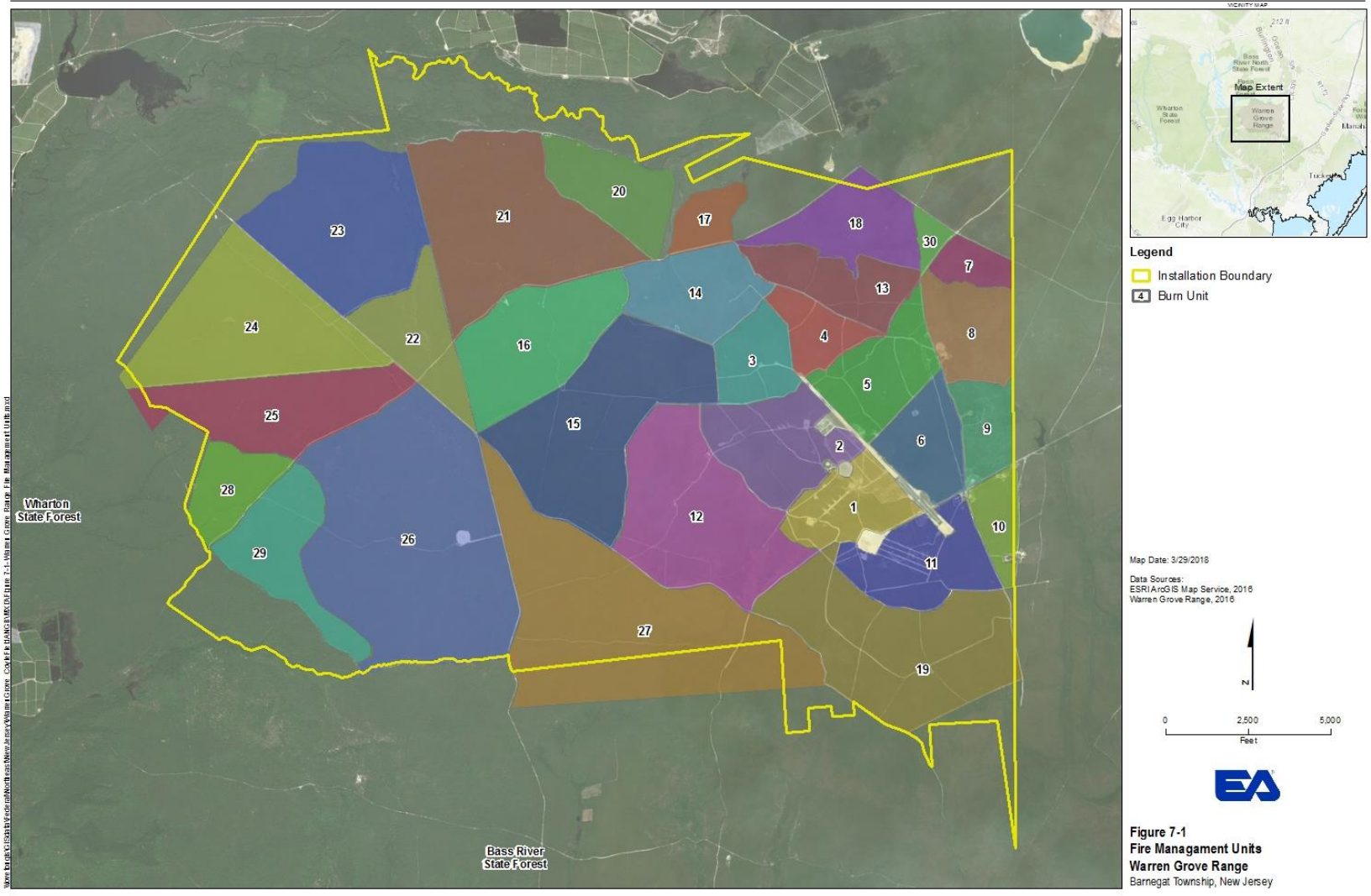

Figure 7-1
Fire Managament Units
Warren Grove Range
Barnegat Township, New Jersey

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Table 7-2. Description of Fire Management Units at WGR

Fire Unit	Unit Description	Fire Justification	Recommended Fire Prescription	Fire Interval
1–6	Pine plains burn units, repeatedly burned by intense fires since 1985 by the New Jersey Forest Fire Service. Only a few scattered roadside individuals of broom crowberry.	Hazard reduction Maintain ecological diversity of pine plains	Crown fire and scorching flank fire, 3:1 ratio Air temp 40–70 degrees Fahrenheit (ºF) Low-moderate relative humidity (RH)	5–7 years
7–10	Mostly pine plains last burned 13–25 years ago, with several large populations of broom crowberry in forest openings.	Strategic fuel break along east perimeter Fuel reduction around broom crowberry Testing effectiveness of back fires during warm air temperatures for maintaining pine plains	Burn with backfire and flank fire Air temp near or above 60ºF Low-moderate RH	5–7 years
11–17	Mostly pine plains and low transitional plains last burned 37–42 years ago. Some burned by recent wildfires ignited. Scattered broom crowberry in several openings.	Hazard reduction of pine plains fuels Maintenance of pine plains vegetation and characteristic species habitats	Crown fire and scorching flank fire 3:1 ratio Air temp 40–70ºF Low-moderate RH	5–10 years
18–27	Mostly serotinous pitch pine – shrub oak barrens and a few pockets of transitional plains, last burned 42– 66 years ago (except unit 27, last burned 15 years ago).	Hazard reduction of pine-shrub oak fuels Maintenance of pitch pine-shrub oak barrens vegetation	Scorching head and flank fires or survivable crown fires Moderate temperatures 25–45ºF Low-moderate RH	10–15 years (scorch fires) 15–25 years (crown fires)
28–30	Mostly pitch pine – post oak – shrub oak woodland or pitch pine – mixed oak forest. Last burned 60–66 years ago.	Hazard reduction of fuels Maintenance of oak woodland vegetation	Burn with back fires and non-scorching flank fires Air temps 25–45 ºF Low-moderate RH	10–15 years

A system of roads is maintained throughout WGR which connects to the West Plains area, and is integral to wildland fire management. Access roads are imperative in fire emergencies and provide necessary firebreaks to define blocks for the controlled burning program. To be reliable and serve as effective firebreaks, the integral access roads must provide traffic lanes that are safely passable for emergency equipment. These roads are periodically hand-cleared of brush to decrease the likelihood that fire will be able to breach the firebreak.

At WGR, each year one designated fire block is burned and the areas are rotated. Therefore, each burn block around the impact area is burned approximately every 5 to 7 years. The frequency for burns within the buffer areas is longer. Drexel University conducted a study to build an Ecosystem Fire Control Model. The data in the model assist natural resources managers to better protect threatened and endangered species, manage the rare dwarf pine plains forest type, reduce risks associated with hazardous fuel loads and wildfires, and meet compliance and regulatory standards. Additional studies conducted by Drexel University have shown that the current fire management plan is effective in maintaining a typical pine plains vegetative community that does not affect the distribution of listed plants and does not promote the presence of invasive and exotic species. Due to the remote location of WGR, a Smoke Management Plan is not needed. There is no developed land immediately adjacent to where prescribed burns occur.

Prescribed burn at WGR
Photo by Walter F. Bien

7.11 AGRICULTURAL OUTLEASING

The Agricultural Outleasing Program element does not apply to WGR or Coyle Field.

7.12 INTEGRATED PEST MANAGEMENT PROGRAM

The Integrated Pest Management Program at WGR are described in the Atlantic City Air National Guard Base IPM Plan (NJANG 2008b). However, this plan was prepared in 2008 and is in need of an update. IPM is the use of multiple techniques in a compatible manner to avoid damage and minimize adverse environmental affects while obtaining control of target pests. The IPM Plan includes pest identification and management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety, and environmental requirements of the program. This plan serves as a tool to reduce pesticide use, enhance environmental protection, and maximize the use of IPM techniques. It is the policy of the 177 FW to minimize the use of all pesticides, including herbicides, at the installation.

Invasive, non-native species and noxious weeds have the capability to significantly impact native vegetation, change fuel loads and flammability, and outcompete native species. Management of undesirable species is necessary to maintain military training areas in usable condition. In addition, uncontrolled animal pests can become health hazards, which could threaten the military mission.

The non-native plant survey (Bien et al. 2007) identified 25 non-native plants alien to the United States, 14 alien to New Jersey but native to the United States, and 9 species that typically did not occur in the Pine Barrens but did occur in other areas of New Jersey (Table 7-3). None of these species are on the United States Department of Agriculture (USDA) list for noxious weeds (USDA – Animal and Plant Health Inspection Service list dated July 2016) and none were considered priority invasive species in New Jersey by either Snyder and Kaufman (2004) and only two by the New Jersey Invasive Species Strike Team (list dated 2016).

The total area invaded by non-native species at WGR is relatively small (19 hectares) and constrained to areas where the soil chemistry has been altered. Non-native species favored disturbed sites where soil pH and soil SC were higher than background levels (Bien et al. 2007).

Sites only mechanically disturbed, disturbed by wildfire, or disturbed both mechanically and by fire had no occurrence of non-native plants. In contrast, 10 out of 11 disturbed sites that had been treated with soil amendments had an occurrence of non-native species, although the invasion intensity varied between sites.

Only one site which had been both mechanically disturbed and soil amended did not have an occurrence of non-native species. Differences between soil amended sites and non-amended sites was attributable to soil enrichment from non-indigenous rock and broken concrete used for fill. Except for one site, every invaded site supporting non-native plants had been amended with either non-indigenous rock or broken concrete.

Phragmites at WGR
Photo by Walter F. Bien

There was no evidence that non-native species were spreading from invaded sites into adjacent undisturbed areas. Of the 49 non-native species inventoried, 47 occurred within the headquarters and operations area (Bien et al. 2007). In comparison, 14 of 49 species inventoried occurred outside the headquarters and operation area. Cheat grass and hair-like sedge were the only non-native species not found in the operational areas. Field pussytoes and spreading dogbane had the highest frequency of occurrence across sites, followed by fireweed and black medic. Phragmites was also documented, and although it is not considered a nuisance species in New Jersey, it can spread quickly and be difficult to control.

Due to the unique soils and ecology of the Pine Barrens, the relative intact condition of WGR habitat and the lack of regionally significant priority species, managing for invasive species will focus on preventing soil amendments in disturbed areas and new sources for non-native seed, rather than on particular species. However, non-native species documented on WGR and their priorities are presented in Table 7-3.

Table 7-3. Non-Native Plant Species at WGR

Scientific Name	Common Name	Nativity	NJISST Priority	WGR Priority
Agrostis hyemalis	Ticklegrass	NNJ		
Antennaria neglecta	Field pussytoes	NNJ		
Apocynum androsaemifolium	Spreading dogbane	NNJ		
Apocynum floribundum	Indianhemp	NNJ		
Artemisia biennis	Biennial wormwood	NNJ		
Bromus japonicus	Japanese Chess	NUS		
Bromus tectorum	Cheatgrass	NUS		
Bulbostylis capillaris	Threadleaf beakseed	NPI		
Centaurea biebersteinii	Spotted knapweed	NUS		
Cirsium vulgare	Bull thistle	NUS		
Conyza canadensis	Horseweed	NNJ		
Coronilla varia	Crown vetch	NUS		
Digitaria sanguinalis	Large crabgrass	NUS		
Elytrigia repens	Quackgrass	NUS		
Eragrostis spectabolis	Petticoat climber	NNJ		
Erechtites hieracifolia	Fireweed	NPI		

Scientific Name	Common Name	Nativity	NJISST Priority	WGR Priority
Erodium cicutarium	Redstem filaree	NUS		
Euphorbia maculata	Spotted spurge	NNJ		
Euthamia graminifolia	Flat-topped goldenrod	NPI		
Gnaphalium uliginosum	Low cudweed	NUS		
Hypochaeris radicata	Cat's-ear	NUS		
Juniperus virginiana	Eastern red cedar	NPI		
Lepidium campestre	Cow cress	NUS		
Lespedeza virginica	Slender bush-clover	NNJ		
Linaria vulgaris	Butter and eggs	NUS		
Medicago lupulina	Black medic	NUS		
Melilotus officinalis	Yellow sweetclover	NUS		
Oxalis dillenii	Southern yellow wood sorrel	NNJ		
Parthenocissus quinquefolia	Virginia creeper	NPI		
Phragmites australis	Common reed	NPI	High	Low
Phytolacca americana	Poke weed	NNJ		
Plantago aristata	Bracted plantain	NNJ		
Plantago lanceolata	English plantain	NUS		
Plantago major	Broadleaf plantain	NUS		
Populus gradidentata	Bigtooth aspen	NPI		
Rhus copallina	Winged sumac	NNJ		
Rosa rugosa	Beach rose	NUS	High	Low
Rubus occidentalis	Black raspberry	NPI		
Rumex acetosella	Sheep sorrel	NUS		
Setaria viridis var. *viridis*	Green foxtail	NUS		
Solanum ptychanthum	Eastern black nightshade	NPI		
Stellaria media	Common chickweed	NUS		
Taraxacum officinale	Dandelion	NUS		
Trichostema dichotomum	Blue curls	NPI		
Trifolium arvense	Rabbitfoot clover	NUS		
Trifolium repens	White clover	NUS		
Triodanis perfoliata	Venus looking glass	NNJ		
Verbascum blattaria	Moth mullein	NUS		
Verbascum thapsus	Common mullein	NUS		

Notes: NJISST = New Jersey Invasive Species Strike Team.
NNJ = Non-native to New Jersey.
NPI = Non-native to the Pine Barrens.
NUS = Non-native to the United States.
Source: Bien et al. (2007).

The southern pine beetle (*Dendroctonus frontalis*) has the potential to impact pine trees at WGR. The southern pine beetle has been expanding its range north and has now been documented in Burlington County. An infestation of southern pine beetles can also increase wildfire risk due to increased fuel loads. There is currently no management of the southern pine beetle population on WGR.

There are few nuisance wildlife species at WGR. If any large-scale fish and wildlife deaths and unnatural behavior occur on the installation, it will be reported, recorded, and investigated, in conjunction with USFWS and NJDEP staff, as appropriate.

7.13 BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD

The 177 FW actively implements a BASH Plan to reduce the potential for a bird strike to occur at WGR. The 177 FW BASH Plan (NJANG 2017) made several recommendations to reduce BASH risk. The BASH Plan is provided in Component Plan B.

Birds can be encountered up to altitudes of 30,000 ft and higher. However, most birds fly close to ground level, and more than 95 percent of all reported incidents in which USAF aircraft have struck a bird have been below 3,000 ft above ground level. Approximately half of these bird strikes occur in an airfield environment, and approximately one-quarter occur during low-altitude training. Strike rates rise significantly as altitude decreases, which is partly due to the greater number of low-altitude missions, but mostly because birds are commonly active close to the ground. Any gain in altitude represents a substantially reduced threat of a bird-aircraft strike. The potential exists for future bird strikes unless current BASH Plan and USDA-WS management strategies and protocols continue to be implemented.

Barred owl
Photo by Bob Birdsell

At WGR, there are several common birds that might be present and pose a hazard: gulls, hawks, owls, falcons, blackbirds, starlings, rufous-sided towhee, pigeons, doves, ducks, geese, woodpeckers, crows, wild turkey, sparrows/house sparrows, chickadee, meadowlark, killdeer, tufted titmice, and common grackle. Migratory waterfowl (ducks, geese, and swans) pose a threat to low-flying aircraft. Waterfowl vary considerably in size, from 1 to 2 pounds for ducks, 5 to 8 pounds for geese, and up to 20 pounds for most swans. There are two normal migratory seasons, spring and fall. Waterfowl are usually only a hazard during the migratory season. Waterfowl typically migrate at night and generally fly between 1,500 and 3,000 ft above ground level during the fall migration and 1,000 to 3,000 ft above ground level during spring migration. In addition, other large avian species, such as turkey vultures and gulls, pose a threat to military aircraft.

To minimize the BASH-related risk, wildlife management on WGR attempt to deter animals from foraging or roosting in areas near or adjacent to the low-level flying routes and attract wildlife to areas away from those routes. This approach has been chosen due to the relative abundance and diversity of wildlife species present on WGR, and the low likelihood of excluding all wildlife species that pose a significant threat to the safety of the flying mission.

BASH is not a significant issue at WGR because planes do not land and take off at WGR and generally perform few low approaches. More than one-half of all USAF bird-aircraft strikes occur at or below 600 ft above ground level during low-level flights. As part of BASH procedures, aircraft are provided with a report from the Avian Hazard Advisory System, conditions and recent bird observations when they check in with the tower. If risk is considered high, WGR occasionally imposes altitude limits. Planes descend occasionally to 500 ft for some training and down to 75 ft for the strafing pit. Helicopters do occasionally land at WGR.

7.14 COASTAL ZONE AND MARINE RESOURCES MANAGEMENT

The Coastal Zone and Marine Resources Program element does not apply to WGR or Coyle Field.

7.15 CULTURAL RESOURCES PROTECTION

The 177 FW Atlantic City Air National Guard Base ICRMP includes WGR and Coyle Field. The ICRMP outlines installation policies and procedures for the protection, management, and preservation of all cultural resources including historic properties, and for integrating cultural resources management into the overall base planning process.

Recent surveys at WGR have identified archaeological sites that may be eligible for the National Register of Historic Places (NRHPAll buildings and structures have been evaluated and determined not eligible through consultation with the New Jersey SHPO. There are no Traditional Cultural Properties, cemeteries, or graves located at WGR.

No formal cultural resources surveys have been conducted at Coyle Field. However, based on property records and continual adherence to inadvertent discovery procedures, no historical (50+ years) or Cold War architecture have been identified at the location, and no archaeological sites are known to exist or have been recorded as a result of inadvertent discovery. There are no Traditional Cultural Properties, cemeteries, or graves located at Coyle Field.

7.16 PUBLIC OUTREACH

Opportunities for public outreach are limited at WGR due to the high security of the installation. WGR and 177 FW personnel participate in at least two public outreach events every year. One is a community meeting with other agencies to discuss WGR and any community concerns. The meetings typically focus on safety, but current Range activities are also discussed at the meetings. Meeting participants are encouraged to ask questions. The other is an onsite event to which the public and various groups are invited to view a training exercise.

The 177 FW in support of WGR is participating in the Readiness and Environmental Protection Initiative (REPI) Program within the DoD. The REPI program allows DoD to partner with non-profit organizations and state and local governments to put in place long-term protection of land that preserves high-value habitat and limits incompatible development around military installations. The primary purpose of the REPI program at WGR is to support fireshed management, primarily fuel management, which minimizes wildfire risk from WGR during training.

7.17 GEOGRAPHIC INFORMATION SYSTEM

The DoD/USAF standardized requirement for GIS follows the guidance provided in these links:

https://www.sdsfieonline.org/Components/USAF
http://www.sdsfieonline.org/Downloads/geospatial_guidancememo041409.pdf

8. MANAGEMENT GOALS AND OBJECTIVES

Specific management objectives and strategies have been identified in a number of subject areas that affect the natural resources present on and immediately adjacent to WGR and Coyle Field. This chapter lists the goals and objectives for future natural resources management on the installation. The goals are the primary focal point for implementation of the INRMP. A goal should reflect the values of the installation by expressing a vision of the desired condition for the installation's natural resources in the foreseeable future. Each goal is supported by one or more objectives. An objective indicates a management initiative or strategy that will be used to achieve the stated goal. Projects or tasks are the individual component actions required to achieve an objective. Project statements describe the specific methods and procedures that will be used to achieve the objective supported.

Management objectives established in this INRMP were initially developed during a thorough evaluation of the natural resources present on WGR and Coyle Field. In accordance with AFI 32-7064 and the principles of adaptive ecosystem management, subject areas were identified and management alternatives developed by an interdisciplinary team of ecologists, biologists, geologists, planners, and environmental scientists. The revision of this INRMP involved a complete review of the original subject areas and management alternatives accomplished during the 5 years since the 2011 INRMP revision. This revised section presents the preferred management alternatives based on the professional opinions of the WGR Natural Resources Manager, USFWS, NJDEP, and the WGR Task Force. Through these evaluations, the original natural resources planning and management goals have been reevaluated to ensure they represent the most current theories on adaptive ecosystem-based planning. Selection of these management goals has been tempered with the fact that the operational mission at WGR and Coyle Field takes primacy over natural resources management. However, through the multiple-use adaptive paradigms used, sound ecological management on the installation should supplement the operational effectiveness and safety of the military missions. Ecosystem management provides a means for the USAF to conserve biodiversity and to provide high-quality military readiness. The INRMP is a mechanism through which WGR and Coyle Field can maintain sustainable land use through ecosystem management.

The specific "management issues" identified in the 2011 INRMP have been reviewed and updated in this revision. These management issues related to a number of subject areas that affect the natural resources present on and immediately adjacent to WGR and Coyle Field. The purpose of this section is to identify actions and objectives for WGR and Coyle Field to obtain workable and useful solutions for each management issue identified. This chapter is divided into 17 sections, one for each of the natural resource subject areas. For simplicity and clarity within this INRMP, each natural resource subject area is assigned an individual "issue number." Each subject area has been abbreviated, as shown in Table 8-1. For example, the first management objective in Section 8.1, Natural Resources Program Management, is identified as NRP-1. In addition, a series of projects/tasks are presented following the goal and objective for each subject area. The projects/tasks are consecutively numbered for each management objective. A summary of the management objectives is provided in Chapter 10, Annual Work Plans.

Some of the projects described in this section will be accomplished through interactive partnerships with federal, state, and local organizations. WGR/Coyle Field natural resources

management staff will initiate partnerships based on the benefits to the regional ecosystem and the local environment. Required projects, which are part of the continued management of WGR and Coyle Field, will be internally funded through the ANG.

Table 8-1. Integrated Natural Resources Management Plan Subject Area Abbreviations

Section	INRMP Subject Area	Abbreviation
8.1	Natural Resources Program Management	NRP
8.2	Fish and Wildlife Management	FWM
8.3	Outdoor Recreation and Public Access to Natural Resources	OR
8.4	Conservation Law Enforcement	CLE
8.5	Threatened and Endangered Species and Habitats	TE
8.6	Water Resources Protection	WRP
8.7	Wetland Protection	WP
8.8	Grounds Maintenance	GM
8.9	Forest Management	FM
8.10	Wildland Fire Management	WFM
8.11	Agricultural Outleasing	AG
8.12	Integrated Pest Management Program	IPM
8.13	Bird/Wildlife Aircraft Strike Hazard	BH
8.14	Coastal Zone and Marine Resources Management	CZ
8.15	Cultural Resources Protection	CRP
8.16	Public Outreach	PO
8.17	Geographic Information System	GIS

8.1 NATURAL RESOURCES PROGRAM MANAGEMENT

The guiding philosophy of this INRMP is to take an ecosystems approach to managing the natural resources present on WGR. Ecosystem management provides a framework to link the military mission to local, regional, and global ecological integrity. Sustaining ecosystem integrity is the best way to protect and enhance biodiversity, ensure sustainable use, and minimize the effort and cost of management. Natural resources should be managed in a manner that is compatible with and supports the military mission while complying with federal, state, and USAF laws and regulations.

NRP GOAL 1: HIRE A WGR NATURAL RESOURCES MANAGER

- **NRP OBJECTIVE 1.1:** WGR does not have an appointed Natural Resources Manager. Create a management position that requires thorough knowledge of federal and state environmental regulations, DoD environmental instructions and rules, local ecosystems, and the natural resources present at WGR. To be fully compliant with AFI 32-7064, installations must use professionally trained natural resources management personnel to develop, implement, and enforce their INRMPs. Natural resources issues at WGR are equally handled by 177 FW Environmental Manager and the NGB A4/AM Natural Resources Manager, in addition to installation personnel and government contractors. Responsibilities for the position would include the management of all natural resources at WGR and coordination with neighboring landowners and state and federal agencies.

— **PROJECT 1.1.1:** Per available funding and coordination with the State, hire a qualified candidate to serve as the WGR Natural Resources Manager.

- **NRP OBJECTIVE 1.2:** Promote discussion with Base Command, personnel, and pertinent stakeholders about incorporating ecosystem-management philosophy into command decisions and natural resources planning. This should include training and education of installation personnel in applying an ecosystem-management approach to natural resources management decisions and actions on WGR and Coyle Field. Discussion and training is needed if WGR and Coyle Field personnel are unaware of the appropriate guidance on applying an ecosystem-management approach to natural resource management.

  — **PROJECT 1.2.1:** Appropriate WGR and Coyle Field personnel need to be informed of the ecosystem management objectives established by the environmental management office. Utilize, as appropriate and available, local universities, cooperative extension programs, local NRCS offices and the like. Develop a brochure showing the ecosystem management objectives and make it available to the personnel in the Public Relations and Environmental offices.

  — **PROJECT 1.2.2:** Develop educational materials that describe ecosystem management, natural resources, and operational policies for use in training visiting units. The educational materials will be made available in their information packet upon arrival to the installation.

  — **PROJECT 1.2.3:** Develop a handbook that contains descriptions and results of all surveys and studies completed at WGR. The handbook should be made available to WGR staff and visiting units so they are aware of the important Pine Barrens habitat and species it supports.

NRP GOAL 2: UPDATE THE INRMP WHEN ENVIRONMENTAL OR MISSION CONDITIONS CHANGE AS REQUIRED BY THE SIKES ACT (16 USC 670A) AND DoDI 4715.03.

- **NRP OBJECTIVE 2.1:** Coordinate with installation organizations to ensure there is an understanding of management goals and actions developed in the INRMP and to ensure that management actions developed in the INRMP are consistent with current management instructions and plans. Coordination with installation operational and management organizations and stakeholders is necessary to ensure that the goals and objectives of management actions developed in this INRMP are understood and consistent with current ongoing management on the installation. INRMP tasks need to be compatible with management and actions prescribed in other installation plans and documents.

  — **PROJECT 2.1.1:** Conduct an internal review with installation operational and management organizations on an annual basis to ensure effectiveness of the INRMP and an understanding among all installation stakeholders of the goals, objectives, and projects presented in this INRMP.

- **NRP OBJECTIVE 2.2:** Conduct external stakeholder annual review and update the INRMP as needed based on pertinent review findings. The installation will coordinate with USFWS and NJDEP to review and assess conservation goals and objectives and to determine if updates to the INRMP need to be made. In addition, the plan should be updated whenever there is a modification to an installation's mission, or when there is a substantial change to the installation's resources.

  — **PROJECT 2.2.1:** Conduct annual review with USFWS and NJDEP.

  — **PROJECT 2.2.2:** Utilize internal and external stakeholder comments to update the INRMP.

- **NRP OBJECTIVE 2.3:** During annual reviews, determine if an update or revision of the INRMP is necessary based on changes in environmental conditions or the mission as required by the Sikes Act (16 USC 670a) and DoDI 4715.03. The Sikes Act requires INRMPs to be reviewed for operation and effect no less than once every 5 years.

  — **PROJECT 2.3.1:** Conduct an internal and external evaluation of the INRMP annually to determine if an update or revision is necessary based on changes in environmental conditions or the mission. If determined necessary, make changes to the INRMP to address changes in environmental conditions or the mission as required by the Sikes Act (16 USC 670a) and AFI 32-7064.

  — **PROJECT 2.3.2:** If aforementioned evaluation identifies changes in environmental conditions or the mission, the modifications to the INRMP will be coordinated with USFWS and NJDEP (tripartite coordination), as appropriate.

8.2 FISH AND WILDLIFE MANAGEMENT

Fish and wildlife management at WGR and Coyle Field will focus on maintaining and restoring natural habitat favorable for indigenous fish and wildlife in a manner consistent with the military mission and all applicable laws and regulations. Information pertaining to fish and wildlife species known to occur at the WGR are included in Appendix E**.**

With more than 5,700 acres as safety buffer and not readily accessible to the public, there is sufficient habitat to support a healthy diversity of wildlife. WGR supports numerous native species and habitats, as well as several federal and state listed endangered and threatened species. In fact, mission-related disturbances have been shown to benefit federal and state threatened, endangered, and species of concern.

Some limited non-consumptive fish and wildlife management opportunities exist outside of the impact area. Management for the consumptive use of game species is also limited due to the operational mission. In addition, safety and security issues are present as a result of illegal trespassing during hunting season. Observations and discussions with WGR, federal, and state agency personnel identified a number of important wildlife species. The variety of habitats present (e.g., swamps, pine forests, riparian corridors) contributes to the diversity of species found on WGR. Game species that have been documented or likely occur on WGR include the raccoon,

river otter, gray squirrel, eastern cottontail rabbit, eastern coyote, red fox, gray fox, white-tailed deer, beaver, wild turkey, waterfowl (Canada geese and various species of ducks), and ruffed grouse. Populations of these species are limited due to ecological associations that game species have with the unique habitats of the Pine Barrens. The limited amount of browse in these habitats limits the abundance of prey species and, ultimately, the densities of predatory species. In addition, WGR does not encourage the high densities of prey species because of their incompatibility with flying operations.

FWM GOAL 1: CONDUCT PERIODIC INSPECTIONS/SURVEYS TO DETERMINE STATUS OF EXISTING WILDLIFE POPULATIONS

- **FWM OBJECTIVE 1.1:** Determine how existing wildlife populations at WGR and Coyle Field are doing by conducting periodic inspections/surveys. Periodic inspections will ensure that viable populations of native species found in the ecosystem (including rare, threatened, and endangered species and species of concern) are protected, restored, and maintained in accordance with state and federal laws and regulations. This will also help WGR and Coyle Field adhere to the principles of ecosystem management.

  — **PROJECT 1.1.1:** WGR Natural Resources Manager to develop an inspection/monitoring plan or program to determine the status of wildlife populations at WGR and Coyle Field. The monitoring plan should include periodic surveys of known wildlife populations.

  — **PROJECT 1.1.2:** Incorporate biological survey data into the INRMP as they are collected. Survey data can be incorporated into the applicable section of Chapter 5, Ecosystems and the Biotic Environment.

- **FWM OBJECTIVE 1.2:** Maintain populations of wildlife by minimizing impacts and providing healthy, diverse habitat types and corridors for movement between those habitats. Wildlife management involves manipulating various aspects of an ecosystem to benefit chosen wildlife species. Management of these habitats generally is focused to benefit indigenous species. The 177 FW will continue to manage wildlife and its habitat by continuing to implement the projects listed below.

  — **PROJECT 1.2.1:** Preserve snags and large trees for cavity-nesting species like woodpeckers and bluebirds in the safety buffer unless required for safety or mission considerations. Trees with hollows in the trunk or upper limbs provide homes for several species.

  — **PROJECT 1.2.2:** Protect riparian forests and forested wetlands.

  — **PROJECT 1.2.3:** Coordinate pest management needs with the 177 FW's Pest Management Coordinator andthe NGB A4/AM Pest Management Consultant to develop a pest management plan of action for WGR that involves mechanical, cultural, and biological methods and that limits the use of pesticides to the greatest extent practicable.

— **PROJECT 1.2.4:** Mow and burn open fields between November and February to avoid impacting nesting and migratory birds.

— **PROJECT 1.2.5:** Maintain corridors between wetlands to provide for wildlife movement between areas.

— **PROJECT 1.2.6:** Minimize habitat fragmentation by minimizing land clearing, new road construction, and expansion of firebreaks and plowlines.

— **PROJECT 1.2.7:** Minimize clearing of shrubs along roads.

8.3 OUTDOOR RECREATION AND PUBLIC ACCESS TO NATURAL RESOURCES

The 177 FW is a trustee of public land and has a responsibility to protect and enhance environmental quality, conserve natural resources, and provide opportunities for outdoor recreation. Outdoor recreation is defined as a recreational program, activity, or opportunity that is dependent on the natural environment. Limited outdoor recreation opportunities exist at WGR due to the dangers associated with the air-to-ground mission. It must be recognized that land under 177 FW control was acquired solely for national defense purposes. Other uses are secondary to mission needs, and offered at the discretion of the installation commander. Public access for any reason will be within manageable quotas, subject to safety, military security, threatened or endangered species restrictions, and the capability of the natural resources to support such use.

OR GOAL 1: PROVIDE QUALITY OUTDOOR RECREATION EXPERIENCES WHILE SUSTAINING ECOSYSTEM INTEGRITY. ENSURE THAT OUTDOOR RECREATION ACTIVITIES ARE NOT IN CONFLICT WITH MISSION PRIORITIES.

- **OR OBJECTIVE 1.1:** Continue to provide outdoor recreation and educational opportunities. In the past, WGR has hosted multiple community events and educational outreach opportunities. These opportunities should continue as the military mission allows.

  — **PROJECT 1.1.1:** Continue to host community events such as open houses, botanical club visits, and pinelands short course field trips.

  — **PROJECT 1.1.2:** Maintain and update storyboards located in the nature pavilion as needed. Allow use of nature pavilion for the public, school groups, and other groups such as the Boy Scouts.

  — **PROJECT 1.1.3:** Continue to implement the Trespass Permit Program which allows active military, retired military, and their family access to WGR for hunting, hiking, and mountain biking.

8.4 CONSERVATION LAW ENFORCEMENT

DoDI 5525.17, *Conservation Law Enforcement Program*, ensures that installations remain in compliance with appropriate environmental, natural, and cultural resource laws and regulations. Conservation law enforcement also includes regulating hunting and fishing programs on the installation. Hunting is allowed at WGR through the Trespass Permit Program (Appendix F). DoDI 5525.17 states that with an INRMP, the Conservation Law Enforcement section will provide specific goals and objectives to ensure compliance with laws and regulations to support the overarching goals of the INRMP (DoDI 5525.17 2(b)). There are a number of federal statutes and directives addressing specific requirements pertaining to natural resources. A comprehensive list of these regulations can be found in Appendix D.

Typically, trained Conservation Law Enforcement Officers (CLEOs) are responsible for conservation law enforcement. However, no CLEOs have been designated at WGR or Coyle Field. Currently, the environmental manager at 177 FW is responsible to help maintain environmental compliance for the base with federal, state, and local regulations. Education and training of natural resources personnel allow for more effective identification of ecosystem elements and actions for successful natural resources management.

An MOU was established in January 2016 between the 177 FW and the New Jersey State Police (NJSP) for WGR support. The MOU enables prompt response by the NJSP to support the 177 FW in the event of a law enforcement or security emergency at WGR.

CLE GOAL 1: ENSURE THAT THE ENFORCEMENT OF NATURAL RESOURCES LAWS AND REGULATIONS IS IMPLEMENTED.

- **CLE OBJECTIVE 1.1:** Continue to implement the MOU with NJSP for enforcement support including natural resources related issues on the installation. AFI 32-7064 7.3.1*Cooperative Law Enforcement* states that Commanders will provide reasonable access to federal and state conservation officers for the purpose of fish and wildlife enforcement. Commanders are authorized to enter into law enforcement support agreements (MOU) on a reimbursable basis with federal and state agencies having responsibility and jurisdiction for conservation law enforcement.

  — **PROJECT 1.1.1:** Continue to implement the MOU with NJSP to assist in law enforcement including natural resources including deer hunting and illegal poaching.

8.5 MANAGEMENT OF THREATENED AND ENDANGERED SPECIES AND HABITATS

This section presents information about the management of sensitive species that are located or may be located at WGR, and requirements and strategies for management. There are federally and state listed species present on WGR; however, no critical habitat as designated by USFWS exists on WGR. This INRMP removes the need for any critical habitat to be designated on the lands making up WGR. For a complete summary of federal and state listed species, as well as other rare species, see Section 5.4. A total of 1 federally listed species and 45 state listed species have been documented on WGR. It is possible other species may be documented in the

future as additional surveys and natural resources management are conducted. In addition to those species described below, recent research has indicated that a rare tiger beetle (*Cicindela patruela consentanea*) occurs on WGR and at only three other locations in the state of New Jersey. This species merits regular observation, as it may be nominated for listing as more information becomes available.

TE GOAL 1: PROTECT AND MAINTAIN LISTED SPECIES AND THEIR HABITATS AT WGR AND COYLE FIELD.

- **TE OBJECTIVE 1.1:** Conduct a rare, threatened, and endangered species survey at WGR. Although studies for specific species have been conducted at WGR, a comprehensive rare, threatened, and endangered species survey has not been completed at WGR. It is important to update biological inventories as the occurrence of threatened and endangered species is subject to change over time as a result of recruitment, identification of additional protected species, or the change in status of species currently present at WGR.

  — **PROJECT 1.1.1:** As part of the reconnaissance level flora and fauna survey, a rare, threatened, and endangered species survey should be complete to identify and locate listed species occurring at WGR.

  — **PROJECT 1.1.2:** Conduct mist netting and acoustical survey detection protocols to determine the presence of, populations and distribution of bat species, specifically the northern long-eared bat. The method for conducting the mist netting and acoustical surveys and equipment/units required shall be in conformance with USFWS and NJDEP survey policy and procedures.

- **TE OBJECTIVE 1.2:** Maintain populations of Knieskern's beaked rush. The populations of Knieskern's beaked rush are located within the impact zone and require some form of disturbance. The population has declined over the past 10 years. The following projects are recommended to manage the population.

  — **PROJECT 1.2.1:** Continue to conduct prescribed burns to open canopy and cycle nutrients into soil.

  — **PROJECT 1.2.2:** Continue to monitor fire related effects on the population.

  — **PROJECT 1.2.3:** If such action does not affect the WGR mission, avoid changing land use patterns in the vicinity of Knieskern's beak rush populations.

- **TE OBJECTIVE 1.3:** Maintain populations of bog asphodel, broom crowberry, pine barren gentian, and other state or Pine Barrens -listed rare species. Populations of these species appear to be stable, but vulnerable if the habitat is not maintained.

  — **PROJECT 1.3.1:** While bog asphodel populations appear to be secure, long-term monitoring should be conducted to detect effects from anthropogenic activities, canopy closure and hydrology. Efforts should be made to maintain the hydrology of the area

where this species occurs, specifically when implementing military activities, such as road maintenance, when there is a potential to impact the hydrology of the area.

— **PROJECT 1.3.2:** Avoid road maintenance activities that could directly impact broom crowberry. The wildland fire management plan should account for the vulnerability of young populations. Prescribed burns should be conducted in areas of senescing plant populations. Clear buffers around broom crowberry populations prior to prescribed burning.

— **PROJECT 1.3.3:** Monitor regeneration of broom crowberry populations killed or damaged by wildfires.

— **PROJECT 1.3.4:** Remove scrub oaks and utilize prescribed fire on grasslands to enhance pine barren gentian populations and avoid habitat fragmentation.

— **PROJECT 1.3.5:** Maintain diversity of habitat patches to provide a variety of disturbance regimes and habitat types to support a variety of rare species.

— **PROJECT 1.3.6:** Monitor for new populations of swamp pink and maintain populations if found on WGR.

- **TE OBJECTIVE 1.4:** Maintain populations of pine snake, timber rattlesnake, and other rare herpetofana and invertebrates. Populations of these species appear to be stable, but vulnerable if the habitat is not maintained. Gaining additional information on habitat and life history requirements would benefit efforts to maintain populations at WGR

  — **PROJECT 1.4.1:** Consider potential effects to amphibian and reptile populations when implementing training projects and activities, such as road improvements or pesticide/herbicide application. Certain chemicals and road gravel can alter water quality and in turn indirectly effect these populations.

  — **PROJECT 1.4.2:** Monitor anuran populations and water quality to provide data of trends over time.

  — **PROJECT 1.4.3:** Conduct mowing, gravel removal, road maintenance, target material removal, and other habitat alterations when herpetofaunal activity is at its lowest. Peak activity occurs between late spring and early summer.

  — **PROJECT 1.4.4:** Focus future survey efforts on listed species, such as the corn snake, that have not been inventoried to date.

  — **PROJECT 1.4.5:** Monitor populations of abundant species such as Fowler's toad, Pine Barrens treefrog, and northern fence lizard to enable long-term assessment of habitat requirements at WGR and the effects of military activities on these species. The most recent inventory for reptiles and amphibians at WGR was conducted by Drexel University from 2002 to 2006.

— **PROJECT 1.4.6:** Monitor populations and habitats of rare invertebrates, particularly the arogos skipper. The most recent study for rare invertebrates on WGR was conducted by Drexel University, a 3-year Lepidoptera survey from 2008 to 2010.

— **PROJECT 1.4.7:** Monitor populations and habitats of northern pine snake and timber rattlesnake populations regularly (every 3 years). Drexel University has conducted numerous studies on the ecology of northern pine snakes and timber rattlesnakes.

— **PROJECT 1.4.8:** Conduct studies to determine hibernacula requirements, nesting sites, and migration corridors for listed snake species and determine effects of military activities on these species.

- **TE OBJECTIVE 1.5:** Determine through discussion with USFWS if assisting USFWS in its recovery efforts for the American chaffseed will negatively impact the WGR mission. The federally endangered American chaffseed has the potential to occur at WGR, but has not been documented. The only documented population along the northeast coast is in New Jersey.

  — **PROJECT 1.5.1:** Meet with the USFWS to discuss specific details and needs associated with recovery efforts for the American chaffseed. Discussions to include the USFWS specifically identifying any restrictions associated with use of WGR lands including any time of year restrictions that would be required if the ANG were to assist in recovery efforts of this species.

- **TE OBJECTIVE 1.6:** Continue to minimize overall impact to listed species when such action does not affect the military mission. It is important to assess impacts to listed species for any new activities and be in compliance with Section 7 of the ESA.

  — **PROJECT 1.6.1:** When new activities are undertaken at WGR, potential impacts to listed species and their habitat will have to be identified and if there is potential for impact, the WGR Natural Resources Manager will have to initiate contact with the USFWS and NJDEP for further evaluation.

  — **PROJECT 1.6.2:** Monitor populations of state and federally listed plant species identified in previous studies to enable long-term assessment of habitat requirements at WGR and the effects of military activities on these species.

8.6 WATER RESOURCES PROTECTION

Water resources protection is important to natural resources management because it directly affects surface water quality and the value of aquatic habitats. Stormwater runoff can be a significant source of pollutants and sediment into surface waters, especially in areas where groundcover has been disturbed or with impervious surface cover. Water quality also may be negatively impacted by disturbances causing increased sedimentation to wetlands and stream channels. This section presents goals for protecting the water resources on WGR through education and management strategies.

WRP GOAL 1: REMAIN IN COMPLIANCE WITH FEDERAL, STATE, LOCAL, AND USAF ENVIRONMENTAL REGULATIONS AND POLICIES. CONTINUE TO IMPLEMENT STORMWATER POLLUTION PREVENTION BMPS AND IMPROVE WATER QUALITY BY REDUCING EROSION AND IMPERVIOUS SERVICES.

- **WRP OBJECTIVE 1.1:** Ensure erosion and sediment control measures are installed and maintained when required for project construction and maintenance activities in accordance with New Jersey's Erosion and Sediment Control laws and regulations. The Erosion and Sediment Control and Road Maintenance Plan (NJANG 2003b) identifies specific erosion and sediment control measures and lays out a planning process to minimize erosion and sediment loss on WGR. This plan also identifies BMPs and permitting requirements for specific maintenance actions. The plan emphasizes road maintenance as that is the primary ground disturbing activity at WGR, but it applies to all ground disturbance.

  — **PROJECT 1.1.1:** Ensure all required erosion and sediment control documents for construction projects and maintenance activities are current for the specific project.

  — **PROJECT 1.1.2:** Monitor and evaluate the effectiveness of the erosion and sediment control measures, specifically road maintenance and at-risk sites by determining if impacts to water quality are occurring.

- **WRP OBJECTIVE 1.2:** Ensure personnel involved in land disturbance activities are knowledgeable about erosion and sediment control measures. It is important that range personnel and visiting units are aware of erosion and sediment control and BMPs.

  — **PROJECT 1.2.1:** Maintain awareness of erosion and sediment control courses and manuals offered by the NJDEP and attend if needed.

- **WRP OBJECTIVE 1.3:** When required ensure stormwater requirements set forth by NJDEP and Section 438 of the EISA are adhered to when required. Limiting the use of substances that contain pollutants to avoid contact with stormwater and subsequent transport to surrounding waterbodies will protect overall water quality. Pollutants, such as metals, organic contaminants, and chlorides, originating on or flowing onto WGR have the potential to adversely affect the health of waterbodies adjacent to the installation. Although water quality monitoring is not required, it is a good way to measure ecosystem health. Land-based environmental degradation eventually affects water quality and aquatic ecosystems.

  — **PROJECT 1.3.1:** Maintain awareness of federal and state stormwater management requirements to ensure compliance when required.

  — **PROJECT 1.3.2:** When required, obtain all necessary permits and plans including but not limited to NPDES Point Source Permits, Stormwater Pollution Prevention Plans and Spill Prevention Plans, and ensure all permit/plan conditions are met.

- — **PROJECT 1.3.3:** Prevent surface water pollution by ensuring environmental plans are followed. Minimize nonpoint source pollution through implementation of BMPs and following the existing Spill Prevention and Hazardous Materials Management protocols. Minimize nutrient and sediment inputs by following the IPM Plan.

- — **PROJECT 1.3.4:** Monitor surface water quality at WGR near known areas of sensitive herpetofauna. The NJPC water quality criteria for pH and conductivity should be used during monitoring efforts.

- — **PROJECT 1.3.5:** Minimize the amount of impervious surfaces in newly developed areas.

- **WRP OBJECTIVE 1.4:** Revegetate bare ground and otherwise disturbed land with native plant species. Areas on the installation with exposed soils could potentially impact on-base and off-base water quality. Success in revegetating disturbed sites depends on the chemical and physical properties of the soil. Correct pH, phosphorus levels, and nitrogen fertilization are necessary for degraded lands to be re-vegetated. Application procedures should include soil analysis to determine proper nutrient application levels. Other factors to consider are soil moisture, weather patterns, and potential contamination of streams, ponds, and lakes.

  - — **PROJECT 1.4.1:** Following land-disturbing activities when revegetation is required use native grasses, shrubs, and tree species to replant the disturbed areas. Use of native plant species will reduce the amount of water needed to establish the plants and will reduce maintenance costs in ensuring plant growth is successful. A list of native plants suitable for landscaping is provided in Table 8-2.

Table 8-2. Native Plants for Use in Landscaping at WGR

Common Name (Scientific Name)	Height (ft)	Description
Amelanchier *(Amelanchier arborea)*	15–25	In the fall the leaves range from yellow to bronze- red. The showy flowers appear in April and last only seven days, followed by reddish-purple fruit.
American holly *(Ilex opaca)*	40–70	American holly is a beautifully shaped tree, with a symmetrical, dense, wide pyramidal form. The spiny green leaves are accented with clusters of red berries which persist throughout the fall and winter. These red berries attract a wide variety of birds. American holly can tolerate both shade and sunlight and many soil types.
Bearberry *(Arcostaphylos uva-ursi)*	1–2	Bearberry is a creeping, alpine shrub that is suitable for planting in rock gardens or along banks or sandy slopes. The green foliage of this attractive plant turns bronze in autumn. In summer, clusters of nodding, white flowers tinged with pink are produced. The flowers are followed by red, berry-like fruits.
Bayberry *(Morella pensylvanica)*	30	Bayberry has inconspicuous early spring flowers which give rise to a beautiful, fragrant fruit. The leaves are dark green, deciduous and aromatic when crushed.
Broom sedge (*Andropogon virginicus*)	4	Broom sedge has green leaves and stems that turn purple and bright orange in the fall.
Little bluestem (*Schizachyrium scoparium*)	2–4	Little bluestem has bright green to light blue leaves that turn copper or orange in the fall.
Red maple *(Acer rubrum)*	40-60	Red maple naturally occurs in low wet sites. Red flowers are small and form in dense clusters in early spring. It is one of the first trees to show fall color with variability from tree to tree - yellow, yellow-green, orange to red.
Switch Panic Grass (*Panicum virgatum*)	4–6	Switch panic grass has a bluish cast in summer that turns to a reddish color in the fall.
White oak *(Quercus alba)*	80–100	White oak grows best in uplands and slopes. The tree has grayish-white bark, which gives its name, and greenish brown acorns. The white oak is an excellent shade tree. In the fall, the leaves will turn a variety of colors including red, gold, yellow, or purple.
Winterberry holly *(Ilex verticillata)*	6–20	Winterberry is a shrub with grayish bark and smooth twigs. The leaves are from 2 to 3 inches long and about an inch wide. They are usually rather thick and sharply toothed. In autumn, the leaves turn black. The flowers, which appear from May to July, are small and white. The bright- red, shining fruits about the size of a pea are clustered around the stem.
Note: Additional plant information may be found at http://www.plantnative.org, http://www.npsnj.org/index.html, and http://www.state.nj.us/pinelands/infor/fact/.		

8.7 WATERS OF THE U.S./WETLAND PROTECTION

Rivers and streams and some wetlands, ponds, and lakes are protected as a subset of the Waters of the United States under Section 404 of the CWA. The New Jersey Freshwater Wetlands Protection Act protects freshwater wetlands and transition areas or buffers around freshwater wetlands, including vernal pools. Part of the management strategy for natural resources on WGR is to identify and maintain the wetland and floodplain habitat in order to avoid activities that may impact the beneficial values of these resources.

WP GOAL 1: MAINTAIN HEALTHY, FUNCTIONAL WETLANDS THAT CAN SUSTAIN MINOR OPERATIONAL INFLUENCES OUTSIDE INDIRECT INFRINGEMENT OF WETLANDS, AND MANAGE FOR NO NET LOSS OF WETLAND ACREAGE, FUNCTIONS, AND VALUES.

- **WP OBJECTIVE 1.1:** Identify and delineate the boundaries of waters of the U.S. including wetlands and obtain written approval for the delineated boundaries from the Pinelands Commission. A wetland delineation was last completed in 2006, but the installation does not have a Jurisdictional Determination. Jurisdictional determinations should be received and maintained every 5 years.

  — **PROJECT 1.1.1:** Conduct delineations of the boundaries of waters of the U.S. including wetlands on WGR in accordance with New Jersey's laws and regulations governing Sections 404 and 401 of the Clean Water Act.

  — **PROJECT 1.1.2:** Submit the delineation report to the Pinelands Commission for their evaluation and to obtain written confirmation they agree with the boundaries as delineated.

  — **PROJECT 1.1.3:** Incorporate delineated boundaries into the NGB GeoBase and incorporate into land use development plans to minimize impacts to these areas to the greatest extent practicable.

  — **PROJECT 1.1.4:** Ensure the approved delineations are kept up to date in accordance with the Pinelands Commission's requirements.

  — **PROJECT 1.1.5:** Minimize impacts to wetlands and vernal pools and comply with all laws pertaining to wetlands and vernal pools. Prior to initiating projects within the vicinity of wetlands or Waters of the United States, consult with the Natural Resources Manager. If projects have the potential to impact wetlands/Waters of the United States, NJDEP should be contacted to identify mitigation procedures. Acquire support to implement mitigation requirements if needed.

- **PROJECT 1.1.6:** Maintain or enhance Atlantic white cedar wetlands.

WP GOAL 2: OBTAIN THE APPLICABLE FEMA FEDERAL INSURANCE RATE MAPS ON WHICH WGR IS SHOWN AND TRANSLATE THAT INFORMATION ONTO INSTALLATION MAPPING AND PLANNING DOCUMENTS

- **WP OBJECTIVE 2.1:** Obtain the applicable FEMA Federal Insurance Rate Maps on which WGR is shown and translate that information onto installation mapping and planning documents. It is important to remain in compliance with EO 11988, *Floodplain Management,* and protect the naturally functioning floodplain.

  — **PROJECT 2.1.1:** Provide floodplain information to WGR leadership when land condition changes are proposed to avoid when feasible directly impacting 100-year and 500-year floodplain boundaries.

8.8 GROUNDS MAINTENANCE

Base grounds maintenance personnel perform most grounds maintenance activities at WGR. Common grounds maintenance activities include road grading, mowing, fire line/break maintenance and erosion and sediment control.

GM GOAL 1 MAKE MAXIMUM USE OF REGIONALLY NATIVE PLANT SPECIES AND AVOID INTRODUCTION OF INVASIVE, EXOTIC SPECIES IN RE-VEGETATION ACTIVITIES

- **GM OBJECTIVE 1.1:** Use native grass and native landscape plant species that are well adapted to the growing conditions in the New Jersey Pine Barrens. If native plants are not used, non-native and invasive species could be introduced to the installation during revegetation efforts and landscaping activities.

  — **PROJECT 1.1.1:** Future landscaping projects should include planting native grasses as opposed to planting non-native ornamentals. A list of native plants for landscaping can be found in Table 8-2.

GM GOAL 2: ENSURE COMPLIANCE WITH ENVIRONMENTAL LEGISLATION, REGULATIONS, AND GUIDELINES. LESSEN OR AVOID ADVERSE EFFECTS FROM GROUNDS MAINTENANCE ACTIVITIES TO THE OVERALL ECOSYSTEM AND ITS SENSITIVE RESOURCES.

- **GM OBJECTIVE 2.1:** Manage soil to minimize sediment loss and erosion. Soil erosion can lead to impacts to water quality and rare plants found throughout WGR.

  — **PROJECT 2.1.1:** Continue to manage the maintenance of roads and firebreaks to minimize the potential for erosion and sedimentation and to minimize the establishment of invasive species.

  — **PROJECT 2.1.2:** Maintain vegetative buffers and monitor roads adjacent to wetlands to ensure erosion and sedimentation are not occurring.

- **GM OBJECTIVE 2.2:** Alter mowing schedule and vegetation management techniques at WGR. Mowing and drum chopping in areas containing rare plants prior to seed dispersal can have adverse impacts to the populations at WGR.

  — **PROJECT 2.2.1:** Develop/update guidance regarding seasonal restrictions on maintenance activities and vegetation management. Include avoidance of basking herpetofauna along roads.

  — **PROJECT 2.2.2:** Mow fields containing rare plant populations at the end of the growing season (October or November) to ensure that plants have completed seed dispersals and life cycles. This is important to the rare plant populations in open fields within the Target Zone, along road shoulders, and adjacent to the runway.

— **PROJECT 2.2.3:** Reduce or limit the use of drum chopping along roads to protect seed banks, prevent erosion, and improve habitat for shrubs and herbaceous species. Alternative methods to drum chopping include mowing, or use a brush hog or rotary ax on trees and shrubs. Slash and wood chips should also be removed.

8.9 FOREST MANAGEMENT

WGR is located within the boundaries of the New Jersey Pine Barrens. The Pine Barrens are a globally rare habitat. Forest or vegetation management plays an important role in the overall ecosystem and natural resources management at WGR. Research has been conducted at WGR concerning vegetation restoration over the past years. Research has demonstrated that seeding with warm season grasses and using soil amendments, such as mulching and fertilizing, is more effective than just planting pine seedlings. Past planting practices at the WGR that did not follow this method resulted in monocultures of pine trees with little diversity.

In areas where shrub oaks have not been established it is important to maintain the duff layer. Oaks require a duff layer for acorn germination as opposed to pines that require a bare mineral soil for seed germination. Oaks are more shade tolerant than pines and take more time to establish.

FM GOAL 1: MANAGE FOREST RESOURCES AT WGR

- **FM OBJECTIVE 1.1:** Continue vegetation restoration efforts throughout WGR. Enhancement of vegetative cover on degraded sites is needed to support wildlife and rare plant species.

  — **PROJECT 1.1.1:** Identify areas where forested areas may need to be restored.

  — **PROJECT 1.1.2:** Evaluate the recommendation in Zolkewitz and Bien (2005 and determine which ones are feasible for implementation at WGR. Develop a plan of action to implement those recommendations that will not impact the military mission.

  — **PROJECT 1.1.3:** Conduct a study on the regrowth of pines in the helicopter barren area. Studying the success of regrowth will help in restoring other areas on the range when required or needed.

  — **PROJECT 1.1.4:** Consider long-term monitoring of restored sites, as part of adaptive management to identify future restoration strategies.

  — **PROJECT 1.1.5:** Conduct a long-term monitoring study at the South Landing Zone to determine how long it takes for native vegetation to return and to recover site dominance following stoppage of fertilizer and lime usage.

  — **PROJECT 1.1.6:** Conduct a 3-year study at known disturbed sites to assess changes in non-native population densities.

- **FM OBJECTIVE 1.2:** Enhance riparian areas throughout WGR. Protecting and enhancing undisturbed riparian areas benefits habitat quality for wildlife and listed species and protects water resources.

  — **PROJECT 1.2.1:** Allow undisturbed riparian forests to flourish naturally. Intermittent troop and flooding disturbances will naturally enhance these areas.

  — **PROJECT 1.2.2:** Monitor disturbances closely and restrict training activities and riparian forest entry point during training missions as needed on an event-by event basis.

  — **PROJECT 1.2.3:** Avoid unnecessary removal of trees along the riparian corridor.

8.10 WILDLAND FIRE MANAGEMENT

WGR currently has a Wildland Fire Management Plan. Wildfire management and control is a matter of concern for military training and natural resources management at WGR. Wildfires have several undesirable aspects including the following: they interfere with ongoing training activities, they make training areas unsuitable for training over the short- and long-term, they produce smoke that contributes to the air pollution and brings complaints from neighbors, and they lead to soil erosion when vegetative cover is sufficiently destroyed. Given that the habitat on WGR is fire-adapted, ecological effects of wildfire on habitat and species are generally positive in the long term. They can promote natural succession and help maintain the globally rare pygmy pine habitat. Wildfires generally burn hotter than prescribed fires and occur more frequently in the summer, so their affects can be different ecologically than prescribed fires. Prescribed fires, however, are an efficient and effective means of minimizing wildfire risk and are vital components of natural resources management within the pine barrens. Prescribed fire can be used to accomplish the following:

- *Reduce hazardous fuels*—Periodically burning the underbrush can significantly decrease the chance of a catastrophic forest fire.

- *Prepare sites for seeding or planting*—Prescribed fires often expose adequate mineral soil and can control competing vegetation.

- *Improve wildlife habitat*—Prescribed fires can improve wildlife habitat and increase forage by keeping hardwood sprouts short, tender, palatable, and abundant. Deer, dove, quail, and turkey generally benefit from prescribed burns. In addition, grassland habitat is improved by the removal of undesirable grassland species.

- *Manage competing vegetation*—Prescribed fires can be used to control invasive vegetation.

- *Control insects and disease*—Prescribed fires may be used to control some insects and diseases.

- *Enhance appearance*—Prescribed fires often enhance recreation and aesthetic values of a forest and native grasslands by removing understory brush.

- *Perpetuate fire-dependent species*—Prescribed fires can be used to perpetuate many fire-adapted species. However, it is imperative to understand the ecology of the species to know which months will be ideal for a fire.

In addition to conducting prescribed fires, there are specific measures taken to minimize the effects of wildfires and to provide a safe environment for conducting prescribed fires and military training. These measures include monitoring fire danger conditions, implementing fire reporting procedures, fire-related training restrictions, firebreak maintenance, establishing a prescribed fire plan, and establishing wildland fire management strategies for the entire region by coordinating with adjacent state properties. WGR currently has an MOU with NJFFS to conduct prescribed burning at the range (Appendix G).

NJFFS was pursuing a regional fireshed management initiative through the East Plains Fireshed Management Plan. The goal of the Plan was to incorporate East Plains landowners' fire ecology requirements into one comprehensive system. The initiative would transition fireshed management from a local scale burning paradigm to one that addressed ecological issues at a regional scale. This initiative was underway for a number of years and was anticipated for completion in 2012; however, the project stopped and a plan was never written.

WFM GOAL 1: IMPLEMENT FIRE MANAGEMENT TO REDUCE WILDLAND FIRES AND TO MANAGE PINE BARRENS HABITAT

- **WFM OBJECTIVE 1.1:** Continue to implement the Wildland Fire Management Plan to minimize risk and maximize ecological benefits. Conducting prescribed burns maintains vegetative diversity within the Pine Barrens habitat while reducing the dangers associated with large-scale wildfires.

  — **PROJECT 1.1.1:** Develop a grounds fuel model to target areas for prescribed burns and update the descriptions of the fire management units within the Wildland Fire Management Plan.

  — **PROJECT 1.1.2:** Revise/Update the Wildland Fire Management Plan utilizing the existing MOU with NJFFS.

  — **PROJECT 1.1.3:** Continue to implement prescribed burns within one designated fire block per year to maintain Pine Barrens habitat. Overall, prescribed fires within a given fire management unit should occur between 5- and 15-year intervals. Maintain the diversity of spatial and temporal fire regimes to create a habitat mosaic that maximizes habitat diversity. Too frequent low intensity prescribed fires can increase the growth of oak trees and begin to exclude pine trees. Too infrequent prescribed fires create dangerous fuel loads and change the understory composition. Prescribed fires should occur in both the summer and winter to maximize habitat diversity. Consider sensitive populations and time periods for priority listed species when selecting area and timing of prescribed burns. Buffer areas or protected habitats should also be incorporated into the prescribed fire planning.

— **PROJECT 1.1.4:** Maintain an accurate fire log of all wildfires and prescribed burns. The fire log should include maps.

— **PROJECT 1.1.5:** Minimize risk of escaped wildfires and prescribed fires by maintaining firebreaks, managing vegetation, planning adequately, and coordinating with NJFFS. Maintaining boundary roads and firebreaks annually should be emphasized and should be in compliance with the Erosion and Sedimentation Control and Roads Maintenance Plan. If additional firebreaks are needed, they should be designed to with minimal ecological damage and risk. Brush hog or rotary axe trees and shrubs along roads and firebreaks. Follow with mowing twice a year during the growing season for 3 years to reduce carbohydrate stores in woody rootstocks. Thereafter, mow at the end of the growing season. This will create larger firebreaks along roads, help control wildfires, and protect sections of the landscape from uncontrolled fire damage, while minimizing erosion. Remove tree slash along roads and firebreaks and chip into mulch. Mulch can be used for restoration projects. Store mulch in safe locations and away from active flight zones as not to create fire hazards or attract prey species for birds that may pose potential danger to aircraft.

— **PROJECT 1.1.6:** Brush hog or rotary axe trees and shrubs along roads and firebreaks. Follow with mowing twice a year during the growing season for 3 years to reduce carbohydrate stores in woody rootstocks. Thereafter, mow at the end of the growing season. This will create larger firebreaks along roads, help control wildfires, and protect sections of the landscape from uncontrolled fire damage, while minimizing erosion. Remove tree slash along roads and firebreaks and chip into mulch. Mulch can be used for restoration projects. Store mulch in safe locations and away from active flight zones as not to create fire hazards or attract prey species for birds that may pose potential danger to aircraft.

- **WFM OBJECTIVE 1.2:** Conduct research studies that will benefit Wildland Fire Management at WGR. Gaining additional knowledge concerning vegetation dynamics at WGR would benefit Wildland Fire Management.

— **PROJECT 1.2.1:** Clearcut to remove all pine except pitch pine in Widgeon Helicopter Landing Zone,

— **PROJECT 1.2.2:** Conduct survey of non-vascular cryptogams (mosses and lichens) which are good bioindicators for changes in environmental conditions.

— **PROJECT 1.2.3:** Conduct survey of seed banks to determine potential availability of plant species in different habitats and soil types.

— **PROJECT 1.2.4:** Continue to monitor the 2004 burn area for long-term impacts to pine growth and species composition.

— **PROJECT 1.2.5:** Evaluate vegetation impacts of wildland fire management program every 5 years, using study plots already established.

— **PROJECT 1.2.6:** Determine if prescribed burns have an effect on wetlands or associated hydrology and vegetation.

— **PROJECT 1.2.7:** Examine effects of fire plowline and roads on habitat fragmentation in reference to herpetofauna and vegetation.

— **PROJECT 1.2.8:** Test the effects of prescribed fire on controlling non-native invaders especially in areas where soil has been enriched.

8.11 AGRICULTURAL OUTLEASING

The Agricultural Outleasing program element does not apply to WGR or Coyle Field.

8.12 INTEGRATED PEST MANAGEMENT PROGRAM

Native plant and animal communities have been adversely impacted by development and the introduction of non-native species. Non-native species are those plants or animal species that were not present during European settlement. Due to aggressive growth habits of many non-native species, the species have become invasive and out-compete the native plants and animals. "An invasive species is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (EO 13112). Invasive species put native plants and animals at risk. Invasive plants, which can be both native and non-native, result in the loss of diversity within a local plant community. Table 7-3 includes a list of non-native species occurring at WGR.

AFI 32-1053, *Integrated Pest Management Program* and DoDI 4150.7, *DoD Pest Management Program*, is a DoD policy to establish and maintain safe, effective, and environmentally sound IPM programs to prevent or control pests and disease vectors that could adversely impact readiness or military operations by affecting the health of personnel or damaging structures, material, or property.

The goal of IPM is to utilize non-chemical procedures to control pests, including both invasive and exotic plant and animal species. Typically a combination of the following IPM techniques is required to resolve a problem on a sustained basis:

- Mechanical control—alters environments in which pests live, traps or removes pests from where they are not wanted, or excludes pests from where they are not wanted
- Cultural control—manipulates environmental conditions to suppress or eliminate pests
- Biological control—uses predators, parasites, or disease organisms to control pests
- Chemical control—relies on pesticides and/or herbicides to kill pest and/or undesirable species of plants.

IPM GOAL 1: MINIMIZE IMPACTS OF INVASIVE AND PEST SPECIES, WHILE MINIMIZING USE OF CHEMICALS TO MANAGE THOSE SPECIES, UTILIZING AN INTEGRATED PEST MANAGEMENT APPROACH

- **IPM OBJECTIVE 1.1:** Following completion of the IPM Plan template, the IPM Plan for the 177FW for both WGR and Atlantic City ANGB will be updated accordingly. Pest management for Coyle Field does not fall to the 177 FW as they are a tenant of the property.

  — **PROJECT 1.1.1:** The WGR Natural Resources Manager and the Installation Pest Management Coordinator will work together to ensure pest management needs at WGR are consistent with the goals and objectives of this INRMP.

  — **PROJECT 1.1.2:** Implement the revised IPM Plan for WGR and Atlantic City ANGB.

8.13 BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD

The BASH Plan for the 177 FW was revised in February 2017 (Component Plan B). BASH is not a significant issue at WGR because planes do not land and take off at WGR and generally perform few low approaches; however, it is important to still deter wildlife that may cause BASH risk from the installation.

BH GOAL 1: IMPLEMENT PROCEDURES OF THE BASH REDUCTION PLAN TO LESSEN OCCURRENCES OF BIRD/WILDLIFE AIRCRAFT STRIKES.

- **BH OBJECTIVE 1.1:** Implement BASH procedures for WGR. Without the continuation of the BASH reduction plan for the installation, bird/wildlife aircraft strike incidents would not be prevented, resulting in a greater BASH threat at the installation.

  — **PROJECT 1.1.1:** Continue implementation of measures outlined in the 177 FW BASH reduction plan. All BASH related activities should be coordinated through the 177 FW Flight Safety Office. The Flight Safety Office is responsible for funding all BASH related projects.

  — **PROJECT 1.1.2:** WGR staff should continue to participate in Bird Hazard Working Group semi-annual meetings.

  — **PROJECT 1.1.3:** Modify management strategies if BASH risk increase or if high BASH risk species increase.

- **BH OBJECTIVE 1.2:** Update species identification chart. It is important for WGR and Coyle Field staff and pilots to have knowledge of birds that cause BASH threats.

  — **PROJECT 1.2.1:** Update the WGR species identification chart and disseminate it to staff and pilots for educational purposes.

8.14 COASTAL ZONE AND MARINE RESOURCES MANAGEMENT

The Coastal Zone and Marine Resources program element does not apply to WGR.

8.15 CULTURAL RESOURCES PROTECTION

Cultural resource protection will be addressed through the NGB A4/AM Cultural Resources Program Manager.

8.16 PUBLIC OUTREACH

Opportunities for public outreach are limited at WGR due to the high security of the installation. It is important for WGR to continue to develop a positive relationship with the public and surrounding communities.

PO GOAL 1: PROVIDE OUTREACH OPPORTUNITIES WHILE SUSTAINING ECOSYSTEM INTEGRITY AND ENSURING THERE IS NO CONFLICT WITH THE MILITARY MISSION

- **PO OBJECTIVE 1.1:** Continue regular WGR Community Council meetings. Successful community relations are vital to the continued positive image that WGR has with the public. The achievements of the natural resource management program should be shared with the community.

  — **PROJECT 1.1.1:** Attend WGR Community Council meetings with other agencies and the public to discuss WGR, safety, activities, and other community concerns.

- **PO OBJECTIVE 1.2:** Continue to host onsite public events.

  — **PROJECT 1.2.1:** Continue to host onsite events where the public and various groups are invited to view training exercises and learn about the unique natural resources within WGR.

- **PO OBJECTIVE 1.3:** Update the existing WGR natural resource pamphlet.

  — **PROJECT 1.3.1:** The existing natural resource pamphlet should be reviewed and updated to include all recent natural resource studies and surveys.

- **PO OBJECTIVE 1.4:** Develop a website to host information on natural resources at WGR. In the past, Drexel University housed the WGR Natural Resources website; however, this website is no longer operational.

  — **PROJECT 1.4.1:** Contact 177 FW Public Affairs and determine the appropriate location to house a WGR Natural Resources website.

  — **PROJECT 1.4.2:** Once the location is identified, rebuild the WGR natural resources website with similar information that was previously made available on the Drexel University website.

8.17 GEOGRAPHIC INFORMATION SYSTEM

The use of GIS is to manage and catalogue information acquired in natural resources research. GIS assists in planning by charting areas of environmental concern and providing a baseline for analyzing the potential impacts of any proposed natural resources management action.

GIS GOAL 1: MAP THE LOCATIONS AND POPULATIONS OF SPECIES FOUND ON WGR.

- **GIS OBJECTIVE 1.1:** Ensure data obtained from studies, including but not limited to, plant, mammal, reptile, amphibian, bird, and insect species is translated into the GIS program. WGR has natural resources data from various surveys in GIS data but it is not all standardized and readily available for use. Due to the relatively large size of the WGR and the diversity of habitat and land use features, complete and usable GIS data and access to GIS software is essential for efficient natural resources management at WGR. In addition, it would facilitate accurate analysis of potential effects of all future projects and activities.

  — **PROJECT 1.1.1:** Ensure all contract documents direct contractors to provide GIS data for all fieldwork conducted and to provide that data to the NGB A4/AM GeoBase office.

  — **PROJECT 1.1.2:** Provide GIS obtained from studies conducted on the WGR to the 177 FW GIS office and the NGB A4/AM GeoBase office for uploading into the GIS database for WGR.

  — **PROJECT 1.1.3:** As missing GIS data becomes available, incorporate data into GeoBase.

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9. INTEGRATED NATURAL RESOURCES MANAGE PLAN IMPLEMENTATION

9.1 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN IMPLEMENTATION

9.1.1 Implementation

The INRMP Program has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of the installation. The various organizations on the installation that are responsible for implementation of the INRMP are described below.

9.1.2 Natural Resources Management Staffing

The Natural Resources Program at WGR is administered by the 177 FW and the NGB/A4AM. Responsibilities of the 177 FW in regard to implementation of this INRMP include:

- Providing oversight and coordination with other agencies
- Developing and implementing programs to ensure the inventory, delineation, classification, and management of all applicable natural resources to include: forests, wetlands, endangered and threatened species, sensitive or unique habitats, and other natural resource areas of special interest
- Providing for the training of natural resources personnel
- Maintaining natural resources management records
- Reviewing environmental documents (e.g., environmental impact assessments and remedial action plans) and construction designs and proposals to ensure adequate consideration of natural resources, while ensuring that technical guidance as presented in this INRMP is adequately considered
- Evaluating impacts of training missions and providing guidance to trainers
- Coordinating with the cultural resources program and Section 106 compliance
- Coordinating with local, state, and federal governmental and civilian conservation organizations relative to the WGR natural resources management program
- Implementing and executing AFI 32-7064.

The acting WGR Natural Resources Manager also receives support from the NGB/A4AM Natural Resources Manager and WGR staff, each of whom has significant duties in addition to natural resources support. Additional labor resources may include:

- Federal agencies (for example, USFWS, NRCS)

- State agencies
- Local and regional Universities (e.g., Drexel University, Rutgers University, Stockton)
- Scouting groups
- Conservation groups (e.g., Audubon Society, and sportsmen's clubs).

Currently, the primary responsibilities of WGR personnel are for implementing programs other than the natural resources management necessary to implement this INRMP. Additional sources of temporary labor, hired with term limitations, could be utilized to augment current staff, such as seasonal employees (e.g., grounds maintenance summer hires). Outside agency reimbursable hires and Guardsman, Reservists, or Active Duty USAF personnel assigned to WGR on temporary duty are another source of supplemental labor. Implementation of a number of projects discussed in this INRMP will require active outside assistance. The outside assistance could come from state and federal agencies, private consortiums and organizations, universities, and contractors. Using these resources is the most efficient and cost-effective method for acquiring expertise on a temporary basis. Some parties will be reimbursed for their assistance, as agreed based on the MOU and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements. The INRMP Working Group (including NGB/A4AM when funding is being determined) should assess the level of additional resources necessary to fully implement this Plan during the INRMP annual review process, and determine the extent to which outside assistance will be required.

Lack of a WGR Natural Resources Manager and GIS support both hinder implementation of this INRMP and efficient natural resources management.

9.1.3 Monitoring Integrated Natural Resources Management Plan Implementation

WGR INRMP Implementation Monitoring

Monitoring of INRMP implementation is necessary to facilitate the legal requirements of the Sikes Act Improvement Act (SAIA) for review for operation and effect. These SAIA implementation criteria do not necessarily measure the effectiveness of an INRMP in facilitating mission accomplishment while conserving natural resources. The WGR INRMP implementation will be monitored for meeting the legal requirements of the SAIA as well as for other mission and biological measures of effectiveness.

The ultimate successful implementation of this INRMP is realized in no net loss in the capability of the WGR training lands to support the military mission while at the same time providing effective natural resources management. Initiation of projects is one measure that is used to monitor INRMP implementation, but it does not give the total picture of the effectiveness of the natural resources management program. Natural resources management is not the sum total of projects, interagency coordination, or program funding and staffing. Natural resources management at WGR is a program and a philosophy that guides the 177 FW's approach to land use. A significant portion of INRMP implementation is done through internal coordination in regard to training site operations and land use decision making. This type of implementation cannot be measured by project implementation or funding levels. It is evidenced by such things as the ability to continually train, sustainable land use, ongoing regulatory compliance, retention of species diversity, retention of surface water quality, and the acknowledgement of sustainable

natural resources management by partnering conservation agencies and other interested organizations and individuals.

In order to monitor and evaluate the effectiveness of the INRMP implementation the following will be reviewed as applicable and discussed within the context of the annual review and/or a formal review of operation and effect:

- Impacts to/from the military mission
- Conservation program budget
- Staff requirements
- Program and project implementation
- Trends in species and habitat diversity as evidenced by recurring biological surveys, land use changes, and opinions of natural resource experts
- Compliance with regulatory requirements
- Feedback from military trainers, USFWS, NJDEP, and others.

Some of these areas may not be looked at every year due to lack of data or pertinent information. The effectiveness of the INRMP as a mission enabling conservation tool will be decided by mutual agreement of USFWS, NJDEP, and the 177 FW during annual reviews and/or reviews for operation and effect.

USAF and DoD INRMP Implementation Monitoring

USAF uses the Defense Environmental Programs Annual Report to Congress (DEPARC) to monitor SAIA compliance. DEPARC is the automated system used to collect installation environmental information for reporting to DoD and Congress.

Established to fulfill an annual requirement to report the status of DoD's Environmental Quality program to Congress, DEPARC collects information on enforcement actions, inspections, and other performance measures for high-level reports and quarterly reviews. DEPARC also helps USAF track fulfillment of DoD Measures of Merit requirements.

The DUSD *Updated Guidance for Implementation of the SAIA* updated Conservation Metrics for Preparing and Implementing INRMPs. Progress toward meeting these measures of merit is reported in the annual report to Congress. DEPARC reporting requirements currently include:

- The installation plans, programs, and budgets for actions that support INRMP goals and objectives?
- Was the INRMP "fully-implemented" during previous execution year?

- Were all funds allocated for INRMP implementation (e.g., reimbursable and other) executed for the intended purpose?

- Is there adequate participation/collaboration from USFWS during Annual INRMP Review and major revisions?

- Is there adequate participation/collaboration from the state fish and wildlife agency during Annual INRMP Review and major revisions?

- Is the INRMP consistent with the goals of the State Wildlife Action Plan, Candidate Conservation Agreements, and other regional ecosystem management agreements for which DoD/USAF is signatory?

- Are communications with USFWS and state fish and wildlife agency documented?

- Does the installation have onsite USAF natural resources management staff employed in the GS-0400 Biological Sciences Job Series?

- Is there a sufficient number of natural resources staff to adequately implement INRMP goals and objectives?

- Are the capabilities of the USAF natural resources team enhanced through use of volunteers, cooperative agreements with non-governmental organizations, onsite contractor support, or Interagency Agreements with other federal or state agencies?

- Does the installation have adequate conservation law enforcement capability through employment of a credentialed conservation law enforcement officer, or through interagency agreement with another agency?

- Is there adequate participation/collaboration from the Operations Group, Range and Airspace managers, Community Planners, Tenant Organizations, and other organizations in INRMP update and revision to ensure mission needs are addressed?

- Does the INRMP support unrestricted use of the installation?

- Has there been a net loss of operations area, airspace, or training lands? Is there a deficiency in capacity, size, or arrangement of the installation natural infrastructure to support the current mission and foreseeable future needs?

- Name the Federally listed threatened and endangered (T&E) species present on the installation.

- List the state protected species present on the installation.

- Have surveys for the presence of potentially occurring, federally listed T&E species, or suitable habitat within the historic range of a listed species, been conducted on the installation?

- Does the INRMP adequately address potentially occurring T&E species and/or potentially suitable habitat within the historic range of a listed species?

- Have T&E species locations, or potentially suitable habitats within the historic range of a listed species, been mapped and included as part of the Environmental Functional Data Set and Geodatabase?

- Does the INRMP provide adequate conservation measures for identified T&E species and their habitat, as mutually agreed by USFWS and state fish and wildlife agency during the INRMP Annual Review or major revision coordination?

- Has Critical Habitat for T&E species been designated on the installation?

- Have all major ecosystems (i.e., vegetative communities/habitats) been surveyed and mapped for the installation?

- Does the INRMP address the desired future condition for ecosystems, habitats, and communities to sustain current and future mission activities and achieve natural resources management goals and objectives?

- Are native habitat restoration projects to support INRMP goals and objectives being planned, programmed, budgeted, and executed?

- Does the INRMP provide for adequate control of invasive and exotic species?

- Does the INRMP address the availability of outdoor recreational opportunities (e.g., hunting, fishing, and other dispersed outdoor recreation) on the installation?

- Does the INRMP address the availability of outdoor recreation opportunities for the public, and establish access and usage categories for installation areas in accordance with mission and security requirements (i.e., Open, Restricted, Off-Limits)?

- For each outdoor recreation access category (Open, Restricted, Off- Limits), does the INRMP address and justify allowable access to those areas by category of participant (e.g., Active Duty Military, Military Dependents, DoD Civilians, Military Retirees, Defense Contractors, General Public)?

- Does the INRMP address program management for hunting, fishing and other outdoor recreation, and the role of the installation natural resources manager?

9.2 ANNUAL INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN REVIEW AND COORDINATION REQUIREMENTS

To ensure that this INRMP properly addresses all aspects of the natural resources present on the installation and proposes actions that are in accordance with USAF goals and objectives, this plan and all its components are subject to review by the installation's Environmental Management

Office and the NGB/A4AM Natural Resources Program Manager. Similarly, all changes to be incorporated into this plan must be approved by the installation, USFWS, and NJDEP.

9.3 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN UPDATE AND REVISION PROCESS

This INRMP is in effect from the date that all required signatures have been received.

This INRMP is to be reviewed internally on an annual basis to assess the recommended management practices in terms of their appropriateness for current conditions at the installation. The INRMP should also be coordinated annually with the USFWS and NJDEP. In addition, the INRMP should be updated whenever there is a modification to the mission or when there is a substantial change to the installation's natural or cultural resources.

10. ANNUAL WORK PLANS

The purpose of this chapter is to present a road map for the execution of specific actions to achieve management goals and objectives identified in this INRMP.

Under the authority and direction of the Commanding Officer, the WGR Natural Resources Manager provides staff for implementing the INRMP management actions, and the NGB/A4AM Natural Resources Program Manager provides technical assistance when necessary.

Tables 10-1 through 10-5 summarize the management actions identified in Chapter 8 for WGR and Coyle Field and propose priorities for their implementation from 2018 to 2022. The actions proposed for this INRMP are aggressive, and might not be accomplished within the established timelines due to a number of factors (e.g., budget and manpower constraints, wartime tasks). However, their importance to the proper management of the installation's natural resources cannot be understated. Therefore, the management actions presented in these tables should be modified as part of the annual review of this INRMP by the INRMP Working Group to ensure that these goals are continually emphasized, and accomplished when practicable.

This INRMP reflects the commitment set forth by WGR to conserve, protect, and enhance the natural resources present on the installation. This INRMP is the final plan that will direct the natural resources management at the installation from Fiscal Years 2018 to 2022. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, conserve, and enhance the ecological integrity of the installation and the biological communities occurring on the installation. In addition, the natural resources management measures described in this plan will protect the installation's ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Natural resources and land use management issues are not the only factors contributing to the development and implementation of the INRMP. Installation management and other seemingly unrelated issues affect the implementation of this Plan. It is of utmost importance to the implementation of this INRMP that installation personnel take "ownership" of the Plan (i.e., individual or organizational primary responsibility to implement the INRMP), provide the necessary resources (i.e., personnel and equipment), and allocate the appropriate funding to enact the Plan. It is extremely important that an INRMP Working Group be established to aid in the continued development of and commitment to the implementation of this INRMP. The INRMP Working Group should be comprised of key installation personnel, and will assume an oversight role to ensure the effective implementation of this plan. Top- and middle-level management representation, as well as representation from several individuals with day-to-day on-installation field experience, will provide the INRMP Working Group with the leadership and structure necessary for the successful implementation of this INRMP.

Any requirement for the obligation of funds for projects in this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law. Implementation of the actions and projects described in this INRMP are guided by how budget priorities are assessed for environmental work on DoD installations. This is described in

DoDI 4715.03, Natural Resources Conservation Program, which implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control.

The Office of Management and Budget considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, to be a high priority; however, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding. As such, these programs and projects have been placed into four priority-based categories:

- Priority 0 – Day-to-day recurring projects
- Priority 1 – High priority projects
- Priority 2 – Medium importance projects
- Priority 3 – Low importance projects.

The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer toward successfully achieving its goal. DoDI 4715.03 defines recurring and non-recurring conservation requirements as follows:

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

Priority 0: Recurring Natural Resources Conservation Management Requirements
a. Administrative, personnel, and other costs associated with managing the DoD Natural Resources Conservation Program that are necessary to meet applicable compliance requirements in federal and state laws, regulations, EOs, and DoD policies, or in direct support of the military mission. b. DoD components shall give priority to recurring natural resources conservation management requirements associated with the operation of facilities, installations, and deployed weapons systems. These activities include day-to-day costs of sustaining an effective natural resources management program, and annual requirements, including manpower, training, supplies, permits, fees, testing and monitoring, sampling and analysis, reporting and recordkeeping, maintenance of natural resources conservation equipment, and compliance self-assessments.
Priority 1 (High): Non-Recurring Natural Resources Management Requirements. Current Compliance.
Includes installation projects and activities to support: a. Installations currently out of compliance (e.g., received an enforcement action from an authorized federal or state agency or local authority). b. Signed compliance agreement or consent order. c. Meeting requirements with applicable federal and state regulations, standards, EOs, or DoD policies. d. Immediate and essential maintenance of operational integrity or military mission sustainment. e. Projects or activities that will be out of compliance if not implemented in the current program year including the following:

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

Priority 1 (High): Non-Recurring Natural Resources Management Requirements. Current Compliance (continued)

i. Environmental analyses for natural resources conservation projects, and monitoring and studies required to assess and mitigate potential impacts of the military mission on conservation resources.

ii. Planning documentation, master plans, compatible development planning, and INRMPs.

iii. Natural resources planning-level surveys.

iv. Reasonable and prudent measures included in incidental take statements of Biological Opinions; biological assessments; surveys; monitoring; reporting of assessment results; or habitat protection for listed, at-risk, and candidate species so that proposed or continuing actions can be modified in consultation with USFWS or the National Marine Fisheries Service.

v. Mitigation to meet existing regulatory permit conditions or written agreements.

vi. Non-point source pollution or watershed management studies or actions needed to meet compliance dates cited in approved state coastal non-point source pollution control plans, as required to meet consistency determinations consistent with Coastal Zone Management.

vii. Wetlands delineations critical for the prevention of adverse impacts on wetlands, so that continuing actions can be modified to ensure mission continuity.

Compliance with missed deadlines established in DoD-executed agreements.

Priority 2 (Medium): Non-Recurring Natural Resources Management Requirements. Maintenance Requirements.

Includes those projects and activities needed to meet an established deadline beyond the current program year and maintain compliance. Examples include the following:

a. Compliance with future deadlines.

b. Conservation, GIS mapping, and data management to comply with federal, state, and local regulations; EOs; and DoD policy.

c. Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives.

d. Wetlands enhancement to minimize wetlands loss and enhance existing degraded wetlands.

e. Conservation recommendations in biological opinions issued pursuant to the ESA.

RECURRING AND NON-RECURRING CONSERVATION REQUIREMENTS

Priority 3 (Low): Non-Recurring Natural Resources Management Requirements. Enhancement Actions Beyond Compliance.
Includes those projects and activities that enhance conservation resources or the integrity of the installation's mission, or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation, or EO, and are not of an immediate nature. Examples include: a. Community outreach activities, such as International Migratory Bird Day, Earth Day, National Public Lands Day, Pollinator Week, and Arbor Day activities. b. Educational and public awareness projects, such as interpretive displays, oral histories, Watchable Wildlife areas, nature trails, wildlife checklists, and conservation teaching materials. c. Restoration or enhancement of natural resources when no specific compliance requirement dictates a course, or timing of action. d. Management and execution of volunteer and partnership programs.

Table 10-1. Summary of WGR Management Actions 2018

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Natural Resources Program Management				
NRP – 1.1	**Create and Appoint a WGR Natural Resources Manager**	1		
NRP – 1.2	**Train Personnel in Ecosystem Management and Promote Ecosystem Management Approach**	1		
NRP – 2.1	**Ensure INRMP Goals Are Consistent with Current Management**	1		
NRP – 2.2	**Conduct Stakeholder Review and Update INRMP**	0		
NRP – 2.3	**Determine if an Update to the INRMP is Needed**	0		
Fish and Wildlife Management				
FWM – 1.1	**Conduct Reconnaissance-Level Flora and Fauna Surveys**	1		
FWM – 1.2	**Maintain Wildlife Populations by Providing Habitat and Corridors**	2		
Outdoor Recreation and Public Access to Natural Resources				
OR – 1.1	**Continue to Provide Outdoor Recreation and Educational Opportunities**	3		
Conservation Law Enforcement				
CLE – 1.1	**Establish a Memorandum of Understanding with NJDEP for Enforcement of Installation Natural Resource Issues**	1		
Management of Threatened and Endangered Species and Habitats				
TE – 1.1	**Conduct a Rare, Threatened, and Endangered Species Survey at WGR and Coyle Field**	1		
TE – 1.1.2	**Conduct Mist Netting and Acoustical Surveys to Determine Bat Presence**	1		
TE – 1.2	**Maintain Populations of Knieskern's Beaked Rush**	3		
TE – 1.2.1	**Continue Prescribed Burns to Promote an Open Canopy and Nutrient Cycling**	2		
TE – 1.3	**Maintain Bog Asphodel, Broom Crowberry, Pine Barren Gentian, and Other Rare Plants Populations**	3		
TE – 1.4	**Maintain Pine Snake, Timber Rattlesnake, and Rare Herpetofauna and Invertebrate Populations**	3		
TE – 1.4.3	**Conduct Road Maintenance/Habitat Alterations During Periods of Low Herpetofauna Activity**	2		
TE – 1.4.6	**Monitor Populations of Rare Invertebrates**	3		
TE – 1.5	**Consider Assisting USFWS in Recovery Efforts for American Chaffseed**	3		
TE – 1.6.1	**WGR Natural Resources Manager Should Review Impacts of New Activities at WGR for Impacts on Listed Species**	1		
Water Resources Protection				

Table 10-1. Summary of WGR Management Actions 2018

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
WRP – 1.1	**Continue to Implement Soil Erosion Management Practices**	1		
WRP – 1.2	**Educate Staff on Erosion and Sediment Control**	1		
WRP – 1.2.1	**Develop Erosion and Sediment Best Management Practices Training**	2		
WRP – 1.3	**Continue to Protect Water Quality throughout WGR**	2		
WRP – 1.4	**Revegetate Areas of Exposed Soils with Native Flora**	2		
Wetland Protection				
WP – 1.1	**Conduct a Wetland Delineation and Obtain a Corps of Engineers Jurisdictional Determination**	1		
WP – 2.1	**Protect the Floodplain at WGR by Avoiding Development and Training within This Area**	2		
Grounds Maintenance				
GM – 1.1.1	**Include Native Grasses and Landscape Plants for Future Landscaping Projects**	2		
GM – 2.1	**Manage Soil to Minimize Sediment Loss and Erosion**	2		
GM – 2.2	**Alter Mowing Schedule and Vegetation Management Techniques**	2		
Forest Management				
FM – 1.1.1	**Identify Forest Areas Requiring Restoration and Develop a Scope of Work**	3		
Wildland Fire Management				
WFM – 1.1.3	**Continue to Implement Prescribed Burns**	2		
WFM – 1.1.4	**Maintain an Accurate Fire Log of All Wildfires and Prescribed Burns**	2		
WFM – 1.1.5	**Minimize Risks of Escaped Fire**	2		
WFM – 1.2.4	**Continue to Monitor the 2004 Burn Area**	3		
WFM – 1.2.5	**Evaluate Vegetation Impacts of Wildland Fire Management Program Every 5 Years**	3		
WFM – 1.2.6	**Determine Effect of Prescribed Burns on Wetlands**	3		
WFM – 1.2.7	**Examine Effects of Fire Plowline and Roads on Habitat Fragmentation**	3		
Integrated Pest Management Program				
IPM – 1.1	**Revise and Update the 2008 IPM Plan**	1		
Bird/Wildlife Aircraft Strike Hazard				
BH – 1.1	**Implement BASH Procedures**	1		

Table 10-1. Summary of WGR Management Actions 2018

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Public Outreach				
PO – 1.1	**Continue Regular WGR Community Council Meetings**	3		
PO – 1.2	**Continue to Host Onsite Events**	3		
PO – 1.4	**Update Existing WGR Natural Resource Website**	3		

Table 10-2. Summary of WGR Management Actions 2019

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Natural Resources Program Management				
NRP – 1.2	**Train Personnel in Ecosystem Management and Promote Ecosystem Management Approach**	1		
NRP – 2.1	**Ensure INRMP Goals Are Consistent with Current Management**	1		
NRP – 2.2	**Conduct Stakeholder Review and Update INRMP**	0		
NPR – 2.3	**Determine if an Update to the INRMP is Needed**	0		
Fish and Wildlife Management				
FWM – 1.2	**Maintain Wildlife Populations by Providing Habitat and Corridors**	2		
Outdoor Recreation and Public Access to Natural Resources				
OR – 1.1	**Continue to Provide Outdoor Recreation and Educational Opportunities**	3		
Management of Threatened and Endangered Species and Habitats				
TE – 1.2	**Maintain Populations of Knieskern's Beaked Rush**	3		
TE – 1.2.1	**Continue Prescribed Burns to Promote an Open Canopy and Nutrient Cycling**	3		
TE – 1.3	**Maintain Bog Asphodel, Broom Crowberry, Pine Barren Gentian, and Other Rare Plant Populations**	3		
TE – 1.4	**Maintain Pine Snake, Timber Rattlesnake, and Rare Herpetofauna and Invertebrate Populations**	3		
TE – 1.4.2	**Monitor Anuran Populations and Water Quality**	3		
TE – 1.4.3	**Conduct Road Maintenance/Habitat Alterations During Periods of Low Herpetofauna Activity**	2		
TE – 1.4.6	**Monitor Populations of Rare Invertebrates**	3		
TE – 1.4.7	**Monitor Northern Pine Snake and Timber Rattlesnake Populations Regularly**	3		
TE – 1.4.8	**Conduct studies to determine hibernacula requirements, nesting sites, and migration corridors for listed snake species**	3		
TE – 1.6.1	**WGR Natural Resources Manager Should Review Impacts of New Activities at WGR for Impacts on Listed Species**	1		
Water Resources Protection				
WRP – 1.1	**Continue to Implement Soil Erosion Management Practices**	1		
WRP – 1.2	**Educate Staff on Erosion and Sediment Control**	1		
WRP – 1.3	**Continue to Protect Water Quality throughout WGR**	2		
WRP – 1.4	**Revegetate Areas of Exposed Soils with Native Flora**	2		

Table 10-2. Summary of WGR Management Actions 2019

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Wetland Protection				
WP – 1.2	**Continue to Manage and Maintain Wetland Areas through Conservation and Impact Avoidance**	2		
WP – 2.1	**Protect the Floodplain at WGR by Avoiding Development and Training within This Area**	2		
Grounds Maintenance				
GM – 1.1.1	**Include Native Grasses and Landscape Plants for Future Landscaping Projects**	2		
GM – 2.1	**Manage Soil to Minimize Sediment Loss and Erosion**	2		
GM – 2.2	**Alter Mowing Schedule and Vegetation Management Techniques**	2		
Forest Management				
FM – 1.1.2	**Restore Degraded Sites According to Recommendations**	2		
Wildland Fire Management				
WFM – 1.1.1	**Develop a Grounds Fuel Model**	3		
WFM – 1.1.3	**Continue to Implement Prescribed Burns**	2		
WFM – 1.1.4	**Maintain an Accurate Fire Log of All Wildfires and Prescribed Burns**	2		
WFM – 1.1.5	**Minimize Risks of Escaped Fire**	2		
WFM – 1.2.1	**Clearcut to Remove all Pine Except Pitch Pine in Widgeon Helicopter Landing Zone**	3		
Integrated Pest Management Program				
IPM – 1.1.2	**Implement the Revised IPM Plan for WGR and Coyle Field**	1		
Bird/Wildlife Aircraft Strike Hazard				
BH – 1.1	**Implement BASH Procedures**	1		
BH – 1.2	**Update Species Identification Chart**	2		
Public Outreach				
PO – 1.1	**Continue Regular WGR Community Council Meetings**	3		
PO – 1.2	**Continue to Host Onsite Events**	3		
Geographic Information Systems				
GIS – 1.1	**Develop a Useable GIS GeoDatabase Product for Staff Access**	2		

Table 10-3. Summary of WGR Management Actions 2020

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Natural Resources Program Management				
NRP – 1.2	**Train Personnel in Ecosystem Management and Promote Ecosystem Management Approach**	1		
NRP – 2.1	**Ensure INRMP Goals Are Consistent with Current Management**	1		
NRP – 2.2	**Conduct Stakeholder Review and Update INRMP**	0		
NPR – 2.3	**Determine if an Update to the INRMP is Needed**	0		
Fish and Wildlife Management				
FWM – 1.2	**Maintain Wildlife Populations by Providing Habitat and Corridors**	2		
Outdoor Recreation and Public Access to Natural Resources				
OR – 1.1	**Continue to Provide Outdoor Recreation and Educational Opportunities**	3		
Management of Threatened and Endangered Species and Habitats				
TE – 1.2	**Maintain Populations of Knieskern's Beaked Rush**	3		
TE – 1.2.1	**Continue Prescribed Burns to Promote an Open Canopy and Nutrient Cycling**	3		
TE – 1.2.2	**Continue Study of Seed Banking, Dispersal and Fire Effects on Knieskern's Beaked Rush**	3		
TE – 1.3	**Maintain Bog Asphodel, Broom Crowberry, Pine Barren Gentian, and Other Rare Plant Populations**	3		
TE – 1.3.6	**Monitor for New Populations of Swamp Pink, and Maintain if Found**	3		
TE – 1.4	**Maintain Pine Snake, Timber Rattlesnake, and Rare Herpetofauna and Invertebrate Populations**	3		
TE – 1.4.3	**Conduct Road Maintenance/Habitat Alterations During Periods of Low Herpetofauna Activity**	2		
TE – 1.4.6	**Monitor Populations of Rare Invertebrates**	3		
TE – 1.4.8	**Conduct studies to determine hibernacula requirements, nesting sites, and migration corridors for listed snake species and determine effects of military activities on these species**	3		
TE – 1.6.1	**WGR Natural Resources Manager Should Review Impacts of New Activities at WGR for Impacts on Listed Species**	1		
Water Resources Protection				
WRP – 1.1	**Continue to Implement Soil Erosion Management Practices**	1		
WRP – 1.2	**Educate Staff on Erosion and Sediment Control**	1		
WRP – 1.3	**Continue to Protect Water Quality throughout WGR**	1		
WRP – 1.4	**Revegetate Areas of Exposed Soils with Native Flora**	2		

Table 10-3. Summary of WGR Management Actions 2020

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Wetland Protection				
WP – 2.1	**Protect the Floodplain at WGR by Avoiding Development and Training within This Area**	2		
Grounds Maintenance				
GM – 1.1.1	**Include Native Grasses and Landscape Plants for Future Landscaping Projects**	2		
GM – 2.1	**Manage Soil to Minimize Sediment Loss and Erosion**	2		
GM – 2.2	**Alter Mowing Schedule and Vegetation Management Techniques**	2		
Forest Management				
FM – 1.1.5	**Conduct Long-Term Vegetation Monitoring at South Landing Zone**	3		
FM – 1.1.6	**Conduct a 3-Year Study of Non-Native Species at Disturbed Sites**	3		
FM – 1.2	**Enhance Riparian Areas throughout WGR**	3		
Wildland Fire Management				
WFM – 1.1.2	**Revise/Update the Wildland Fire Management Plan**	1		
WFM – 1.1.3	**Continue to Implement Prescribed Burns**	2		
WFM – 1.1.4	**Maintain an Accurate Fire Log of All Wildfires and Prescribed Burns**	2		
WFM – 1.1.5	**Minimize Risks of Escaped Fire**	2		
WFM – 1.2.2	**Conduct Surveys of Non-Vascular Cryptogams (Mosses and Lichens)**	3		
Integrated Pest Management Program				
IPM – 1.1.2	**Implement the Revised IPM Plan for WGR and Coyle Field**	1		
Bird/Wildlife Aircraft Strike Hazard				
BH – 1.1	**Implement BASH Procedures**	1		
Public Outreach				
PO – 1.1	**Continue Regular WGR Community Council Meetings**	3		
PO – 1.2	**Continue to Host Onsite Events**	3		
PO – 1.3	**Update Existing WGR Natural Resource Pamphlet**	3		

Table 10-4. Summary of WGR Management Actions 2021

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Natural Resources Program Management				
NRP – 1.2	**Train Personnel in Ecosystem Management and Promote Ecosystem Management Approach**	1		
NRP – 2.1	**Ensure INRMP Goals Are Consistent with Current Management**	1		
NRP – 2.2	**Conduct Stakeholder Review and Update INRMP**	0		
NPR – 2.3	**Determine if an Update to the INRMP is Needed**	0		
Fish and Wildlife Management				
FWM – 1.2	**Maintain Wildlife Populations by Providing Habitat and Corridors**	2		
Outdoor Recreation and Public Access to Natural Resources				
OR – 1.1	**Continue to Provide Outdoor Recreation and Educational Opportunities**	3		
Management of Threatened and Endangered Species and Habitats				
TE – 1.2	**Maintain Populations of Knieskern's Beaked Rush**	3		
TE – 1.2.1	**Continue Prescribed Burns to Promote an Open Canopy and Nutrient Cycling**	3		
TE – 1.3	**Maintain Bog Asphodel, Broom Crowberry, Pine Barren Gentian, and Other Rare Plant Populations**	3		
TE – 1.4	**Maintain Pine Snake, Timber Rattlesnake, and Rare Herpetofauna and Invertebrate Populations**	3		
TE – 1.4.3	**Conduct Road Maintenance/Habitat Alterations During Periods of Low Herpetofauna Activity**	2		
TE – 1.4.5	**Monitor Populations of Abundant Herpetofauna Species to Learn Habitat Requirements**	3		
TE – 1.4.6	**Monitor Populations of Rare Invertebrates**	3		
TE – 1.4.8	**Conduct studies to determine hibernacula requirements, nesting sites, and migration corridors for listed snake species and determine effects of military activities on these species**	3		
TE – 1.6.1	**WGR Natural Resources Manager Should Review Impacts of New Activities at WGR for Impacts on Listed Species**	1		
Water Resources Protection				
WRP – 1.1	**Continue to Implement Soil Erosion Management Practices**	1		
WRP – 1.2	**Educate Staff on Erosion and Sediment Control**	1		
WRP – 1.3	**Continue to Protect Water Quality throughout WGR**	2		
WRP – 1.4	**Revegetate Areas of Exposed Soils with Native Flora**	2		
Wetland Protection				
WP – 1.2	**Continue to Manage and Maintain Wetland Areas through Conservation and Impact Avoidance**	2		

Table 10-4. Summary of WGR Management Actions 2021

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
WP – 2.1	**Protect the Floodplain at WGR by Avoiding Development and Training within This Area**	2		
Grounds Maintenance				
GM – 1.1.1	**Include Native Grasses and Landscape Plants for Future Landscaping Projects**	2		
GM – 2.1	**Manage Soil to Minimize Sediment Loss and Erosion**	2		
GM – 2.2	**Alter Mowing Schedule and Vegetation Management Techniques**	2		
Forest Management				
FM – 1.1.3	**Conduct a Study on Pine Regrowth in the Helicopter Barren**	3		
Wildland Fire Management				
WFM – 1.1.3	**Continue to Implement Prescribed Burns**	2		
WFM – 1.1.4	**Maintain an Accurate Fire Log of All Wildfires and Prescribed Burns**	2		
WFM – 1.1.5	**Minimize Risks of Escaped Fire**	2		
WFM – 1.2.8	**Test the Effect of Prescribed Burns for Non-Native Species Control**	3		
Integrated Pest Management Program				
IPM – 1.1.2	**Implement the Revised IPM Plan for WGR and Coyle Field**	1		
Bird/Wildlife Aircraft Strike Hazard				
BH – 1.1	**Implement BASH Procedures**	1		
Public Outreach				
PO – 1.1	**Continue Regular WGR Community Council Meetings**	3		
PO – 1.2	**Continue to Host Onsite Events**	3		

Table 10-5. Summary of WGR Management Actions 2022

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Natural Resources Program Management				
NRP – 1.2	**Train Personnel in Ecosystem Management and Promote Ecosystem Management Approach**	1		
NRP – 2.1	**Ensure INRMP Goals Are Consistent with Current Management**	1		
NRP – 2.2	**Conduct Stakeholder Review and Update INRMP**	0		
NPR – 2.3	**Determine if an Update to the INRMP is Needed**	0		
Fish and Wildlife Management				
FWM – 1.2	**Maintain Wildlife Populations by Providing Habitat and Corridors**	2		
Outdoor Recreation and Public Access to Natural Resources				
OR – 1.1	**Continue to Provide Outdoor Recreation and Educational Opportunities**	3		
Management of Threatened and Endangered Species and Habitats				
TE – 1.2	**Maintain Populations of Knieskern's Beaked Rush**	3		
TE – 1.2.1	**Continue Prescribed Burns to Promote an Open Canopy and Nutrient Cycling**	3		
TE – 1.3	**Maintain Bog Asphodel, Broom Crowberry, Pine Barren Gentian, and Other Rare Plant Populations**	3		
TE – 1.4	**Maintain Pine Snake, Timber Rattlesnake, and Rare Herpetofauna and Invertebrate Populations**	3		
TE – 1.4.2	**Monitor Anuran Populations and Water Quality**	3		
TE – 1.4.3	**Conduct Road Maintenance/Habitat Alterations During Periods of Low Herpetofauna Activity**	2		
TE – 1.4.4	**Focus Future Survey Efforts on Listed Species Not Yet Inventoried**	3		
TE – 1.4.6	**Monitor Populations of Rare Invertebrates**	3		
TE – 1.4.7	**Monitor Northern Pine Snake and Timber Rattlesnake Populations Regularly**	3		
TE – 1.6.1	**WGR Natural Resources Manager Should Review Impacts of New Activities at WGR for Impacts on Listed Species**	1		
Water Resources Protection				
WRP – 1.1	**Continue to Implement Soil Erosion Management Practices**	1		
WRP – 1.2	**Educate Staff on Erosion and Sediment Control**	1		
WRP – 1.3	**Continue to Protect Water Quality throughout WGR**	2		
WRP – 1.4	**Revegetate Areas of Exposed Soils with Native Flora**	2		

Table 10-5. Summary of WGR Management Actions 2022

Objective/ Project No.	Projects	Priority Level	Completed (Date)	Notes (include actions and dates)
Wetland Protection				
WP – 1.1.4	**Maintain Jurisdictional Determination Every 5 Years**	1		
WP – 2.1	**Protect the Floodplain at WGR by Avoiding Development and Training within This Area**	2		
Grounds Maintenance				
GM – 1.1.1	**Include Native Grasses and Landscape Plants for Future Landscaping Projects**	2		
GM – 2.1	**Manage Soil to Minimize Sediment Loss and Erosion**	2		
GM – 2.2	**Alter Mowing Schedule and Vegetation Management Techniques**	2		
Wildland Fire Management				
WFM – 1.1.3	**Continue to Implement Prescribed Burns**	2		
WFM – 1.1.4	**Maintain an Accurate Fire Log of All Wildfires and Prescribed Burns**	2		
WFM – 1.1.5	**Minimize Risks of Escaped Fire**	2		
WFM – 1.2.3	**Conduct Survey of Seed Banks to Determine Plant Availability**	3		
WFM – 1.2.4	**Continue to Monitor the 2004 Burn Area**	3		
WFM – 1.2.5	**Evaluate Vegetation Impacts of Wildland Fire Management Program Every 5 Years**	3		
Integrated Pest Management Program				
IPM – 1.1.2	**Implement the Revised IPM Plan for WGR and Coyle Field**	1		
Bird/Wildlife Aircraft Strike Hazard				
BH – 1.1	**Implement BASH Procedures**	1		
Public Outreach				
PO – 1.1	**Continue Regular WGR Community Council Meetings**	3		
PO – 1.2	**Continue to Host Onsite Events**	3		

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