Department of the Air Force

Integrated Natural Resources Management Plan

MacDill

Installation Supplement

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the United States Air Force's (USAF) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which includes Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Where applicable, external resources, including Air Force Instructions (AFIs); Department of Defense Instructions (DoDIs); USAF Playbooks; federal, state, and local requirements; Biological Opinions; and permits are referenced.

Certain sections of this INRMP begin with standardized, USAF-wide "common text" language that address USAF and Department of Defense (DoD) policy and federal requirements. This common text language is restricted from editing to ensure that it remains standard throughout all plans. Immediately following the USAF-wide common text sections are installation sections. The installation sections contain installation-specific content to address local and/or installation-specific requirements. Installation sections are unrestricted and are maintained and updated by the approved plan owner.

NOTE: The terms "Natural Resources Manager," "NRM," and "NRM/POC" are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoDI 4715.03, Natural Resources Conservation Program.

DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule (BR) 08, *EMP Review, Update, and Maintenance*, the standard content in this INRMP template is reviewed periodically, updated as appropriate, and approved by the Natural Resources Subject Matter Expert (SME).

This version of the template is current as of 06/26/2020 and supersedes the 2018 version.

NOTE: Installations are not required to update their INRMPs every time this template is updated. When it is time for installations to update their INRMPs, they should adopt the most recent version of this template available in the Plan Tool.

Installation INRMP

Record of Review – The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act and AFMAN 32-7003, *Environmental Conservation*, the INRMP is required to be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation Natural Resources Manager (NRM), and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

INRMP APPROVAL/SIGNATURE PAGES

Installation Supplement

MacDill Air Force Base's 2021 Integrated Natural Resources Management Plan Annual Report can be found on the installation's eDASH page or by following the link below:

MACDILL AIR FORCE BASE

TAMPA, FLORIDA

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) - 2020
OPERATIONS AND EFFECT CONCURRENCE

The Sikes Act and Air Force instruction require that annual and 5-year reviews of INRMPs occur with federal and state partners. Representatives of the Air Force, U.S. Fish & Wildlife Service, Florida Fish and Wildlife Conservation Commission, and National Marine Fisheries Service are invited annually to participate in the yearly MacDill Air Force Base INRMP review. The last operation and effect review of this INRMP was completed in September 2019. We have updated the installation INRMP with input from the signatory partners as part of the required 5-year review process. By signing below, the partners concur that the management actions prescribed in the INRMP and implemented will contribute to the conservation and rehabilitation of installation natural resources.

KEVIN KISH, GS-13, DAF — DATE
Installation Management Flight Chief
6th Civil Engineer Squadron

ANNIE DZIERGOWSKI — DATE
Project Consultation Supervisor
U.S. Fish and Wildlife Service
North Florida Ecological Services Field Office

BERNHART.DAVID.M.1066125889
2020.08.14 16:47:22 -04'00'
8/14/2020

Nick Wiley — DATE
Executive Director
Florida Fish and Wildlife Conservation Commission

DAVID BERNHART
Assistant Regional Administrator
Protected Resources
Southeast Regional Office

ROBERT T. WYNN, GS-15, DAF — DATE
Director, 6th Civil Engineer Squadron

KISH.KEVIN.S.1186903486 Digitally signed by KISH.KEVIN.S.1186903486 Date: 2020.08.05 10:46:44 -04'00'

KEVIN KISH, GS-13, DAF DATE
Installation Management Flight Chief
6th Civil Engineer Squadron

Annie Dziergowski 7/1/2020

ANNIE DZIERGOWSKI DATE
Project Consultation Supervisor
U.S. Fish and Wildlife Service
North Florida Ecological Services Field Office

NICK WILEY DATE
Executive Director
Florida Fish and Wildlife
Conservation Commission

JOE HEUBLEIN DATE
Fish Biologist
NOAA - National Marine Fisheries Service
Southeast Regional Office*

WYNN.ROBERT.T.1103491670 Digitally signed by WYNN.ROBERT.T.1103491670 Date: 2020.08.05 17:03:45 -04'00'

ROBERT T. WYNN, GS-15, DAF DATE
Director, 6th Civil Engineer Squadron

* Signature by NOAA – National Marine Fisheries Service is not required IAW AFMAN 32-7003, paragraph 3.6

ANDREW RIDER DATE
Chief, Environmental Element
6 Civil Engineer Squadron
MacDill AFB

Jennifer L. Fitzwater
Digitally signed by Jennifer L. Fitzwater
Date: 2020.08.17 09:39:17 -04'00'

ERIC SUTTON DATE
Executive Director
Florida Fish and Wildlife
Conservation Commission

COL BENJAMIN R. JONSSON DATE
Commander
6th Air Refueling Wing
MacDill AFB

Annie Dziergowski 7/1/2020

ANNIE DZIERGOWSKI DATE
Project Consultation Supervisor
U.S. Fish and Wildlife Service
North Florida Ecological Services Field Office

JOE HEUBLEIN DATE
Fish Biologist
NOAA - National Marine Fisheries Service
Southeast Regional Office*

* Signature by NOAA – National Marine Fisheries Service is not required IAW AFMAN 32-7003, paragraph 3.6

[SIGNATURE]

EXECUTIVE SUMMARY
Installation Supplement

This Integrated Natural Resources Management Plan (INRMP) is a comprehensive guide for natural resources management for the 6th Air Refueling Wing (6 ARW) at MacDill Air Force Base (AFB) in Florida. This INRMP represents a commitment by the United States Air Force to protect the integrity and value of the natural resources at MacDill AFB. The INRMP integrates the Air Force (AF) mission with an interdisciplinary approach to ecosystem management to ensure that MacDill AFB continues to support present and future mission requirements while preserving, improving, and enhancing ecosystem integrity.

MacDill AFB is proud of its contribution toward the defense of the United States of America. Since its inception in 1939, the installation has trained and based aviators in aircraft ranging from B-17 Flying Fortresses to F-16 Fighting Falcons to KC-135 Stratotankers. Today, MacDill's global air refueling footprint, and hosting of the headquarters for the United States Central Command and United States Special Operations Command, makes it critical to worldwide defense operations.

MacDill was constructed on land with abundant wetlands, wildlife, forests, and other valuable natural resources. Land use and landscapes have changed considerably in the last 75 years as infrastructure and facilities were developed to support the varied missions. Nevertheless, as time and environmental awareness have evolved, so too has MacDill's commitment to the natural resources that support the military mission. Through habitat conservation and restoration, prescribed burning, comprehensive endangered species protection, invasive plant control, water quality initiatives and many other programs, MacDill proactively seeks balance between the well-being of its mission and the environment. MacDill is committed to this stewardship role. Our lands are critical to our military mission and important to the wellbeing of our community.

This INRMP is MacDill's plan of action for the care and wise use of the lands entrusted to us. MacDill AFB will manage its natural resources using this INRMP to pursue five overall themes:

- *Military Readiness* - Provide a natural resources management program that supports MacDill's vital military mission to the maximum extent.
- *Stewardship* - Manage natural resources to assure good stewardship of public lands entrusted to the care of MacDill AFB.
- *Quality of Life* - Provide outdoor recreational opportunities that promote the mental, physical, and social well-being of installation personnel.
- *Compliance* - Protect and improve the quality of water, land, and biological resources present on MacDill, thereby complying with pertinent regulations.
- *Integration* - Promote cooperative relationships with outside agencies, organizations, and interested parties and integrate elements of natural resources management into a single program.

MacDill's natural resource goals and objectives for our INRMP were formulated based on mission needs, assessment of past natural resources-related projects, assessment of current environmental conditions, and changes (if any) in guidance or requirements of various federal/state agencies. The goals, objectives and projects identified for this INRMP are intended to enable MacDill to meet the five overall natural resource goals: military readiness, stewardship, quality of life, compliance, and integration.

1 OVERVIEW AND SCOPE

This INRMP was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of the USAF. They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USAF adaptability in all environments. The USAF has stewardship responsibility for the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the USAF natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

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This INRMP guides the implementation of the natural resources program at MacDill AFB and represents the principal tool and guidance for managing the natural resources at MacDill AFB under the Sikes Act, U.S.C. §670 et.seq. These resources include plants and wildlife, hydrologic and topographic features, upland and coastal environments, and certain aspects of pest management. This plan applies to internal and external organizations that are involved with, or interested in, the management or use of MacDill AFB's natural resources. It helps to ensure the conservation of MacDill AFB's natural resources, as well as, compliance with related environmental laws and regulations. The INRMP encompasses all land at MacDill AFB, whether leased to others or not, including privatized housing areas.

This INRMP serves as the umbrella and guiding document for other various management plans implemented at MacDill AFB with respect to natural resources management, including the base Wildland Fire Management Plan, Ecosystem Restoration Masterplan, and others. This INRMP encompasses specific features of such plans and/or references them where applicable

1.2 Management Philosophy

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MacDill AFB personnel, including military, civilian, and contractor, will act responsibly and in the public interest when managing natural resources that are an integral part of the installation. There shall be a conscious and active concern for the inherent value of these resources in installation plans, decisions, actions, and programs. The conservation of natural resources and the military mission is not mutually exclusive. Current and planned installation activities (e.g., master planning, construction requests, site approval requests, training exercise plans) are conducted to ensure effective and timely coordination with installation natural resources personnel. The 6 CES/CEIE (Civil Engineer Squadron/Environmental Element) shall review all necessary work orders for impacts of such activities on natural resources, with the following specific management goals and processes in mind.

Overall Management Goals

MacDill AFB will manage its natural resources to meet five overall goals:

- *Military Readiness* - Provide a natural resources management program that supports MacDill's military mission with no net-loss of military mission activity.
- *Stewardship* - Manage natural resources to assure good environmental stewardship of public lands entrusted to the care of MacDill AFB.
- *Compliance* - Maintain and improve the quality of water, land, and biological resources present on MacDill by complying with pertinent regulations.
- *Integration* - Promote cooperative relationships with regional and state agencies, conservation organizations, and other interested parties. Integrate elements of natural resources management into the planning and implementation processes of the 6 ARW.
- *Quality of Life* - Provide outdoor recreational opportunities to military personnel that promote the mental, physical and social well-being of installation personnel.

Ecosystem Management

Ecosystem management is not articulated formally in law, but its basic concepts have strong legal compliance aspects, especially within the Endangered Species Act (ESA), the Sikes Act, and other laws such as the Clean Water Act (CWA) and the National Environmental Protection Act (NEPA). The Implementation of Ecosystem Management in the DoD (DoD, 1994) states an overall goal as: "The goal of ecosystem management is to preserve, improve, and enhance ecosystem integrity. Over the long term, this approach will maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies and communities." Ecosystem management is a management philosophy that will help achieve biodiversity protection and maintain fully functional natural resources.

The ESA and Sikes Act clearly mandate biodiversity protection, and many other environmental laws are aimed at protecting natural processes and landscapes. Ecosystem management is a way to package a natural resources program so that it encompasses legal compliance, land stewardship, and the production of renewable products of the land. Ecosystem management is the best way to provide quality lands and natural resources to support MacDill AFB's military mission.

The DoD and USAF endorses ecosystem management within the Department of Defense Instruction (DoDI) 4715.03 (Integrated Natural Resources Management Plan Implementation Manual) and Air Force Manual (AFMAN) 32-7003 (Environmental Conservation). This endorsement states that ecosystem management is the basis for management of DoD lands and waters.

Principles and guidelines to achieve this goal are:

- Maintain and improve the sustainability and native diversity of ecosystems.
- Administer with consideration of ecological units and time frames.
- Support sustainable human activities.
- Develop a vision of ecosystem health.
- Develop priorities and reconcile conflicts.
- Develop coordinated approaches to work toward ecosystem health.
- Rely on the best scientific information available.
- Use benchmarks to monitor and evaluate outcomes.
- Incorporate adaptive management techniques.
- Implement through installation plans and programs.

MacDill AFB intends to use these ecosystem management principles and guidelines to guide its program into the future. This management philosophy allows MacDill AFB to proactively manage and protect its natural resources and conduct its military mission. Concurrently, ecosystem management will ensure both compliance with environmental laws and the maintenance and improvement of natural resources values.

Adaptive Management

Ecosystem management is best implemented through adaptive management, a process by which implementing actions occur simultaneously with the collection of data before, during, and after completion of the action. This helps identify changes that need to be developed and implemented to reduce uncertainty and help achieve desired goals.

MacDill AFB will use current status information to choose the best management options to implement this INRMP. With every management practice implemented, MacDill AFB will monitor the systems response to these actions and adjust management options as needed, in order to continually improve the management of the natural resources and the restoration of the ecosystems found at MacDill AFB.

This INRMP is a living document that changes as necessary. It reports the current status of the natural resources program and is updated annually. Any changes to this INRMP are captured in the annual INRMP review. This includes a summary of changes to the INRMP since the previous year's update, an INRMP summary report, and a work plan implementation table. It identifies actions and projects currently planned for implementation to meet the needs of natural resources management at MacDill AFB and serves as the implementing document to meet those needs. However, this INRMP will be reviewed annually and adjusted as needed to compensate for changes in the status, or to document and implement new management options.

Integration with Base Comprehensive Planning Process

This INRMP is an integral part of the base comprehensive planning process. It is consistent with other plans for the development and/or use of the lands associated with MacDill AFB. This INRMP has been coordinated with all appropriate personnel and organizations at MacDill AFB. The INRMP has been reviewed and approved by the installation Environmental Safety and Occupational Health Council (ESOHC) and the Patrick Air Force Base Installation Support Section. It is consistent with the overall MacDill AFB environmental program.

Relationship of INRMP to Military Mission

This INRMP is designed to support the AF military mission at MacDill AFB by protecting and enhancing the lands entrusted to the DoD. This INRMP is not designed to evaluate the installation's military mission, nor is it intended to replace any needs for environmental documentation of the military mission at MacDill AFB.

1.3 Authority

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Preparation and implementation of this INRMP are required by the Department of Defense (DoD), Department of Air Force, and the Sikes Act (16 USC 670 et. seq.). In addition, this INRMP helps ensure that MacDill AFB complies with other federal and state laws, most notably laws associated with environmental documentation, wetlands, endangered species, water quality, and management of wildlife in general.

This INRMP describes how MacDill AFB will implement provisions of DoD Instruction (DoDI) 4715.3 (Environmental Conservation Program) and Air Force Manual (AFMAN) 32-7003 (Environmental Conservation). This INRMP is prepared within the scope of Air Force Policy Directive 32-70 (Environmental Quality).

Installation-Specific Policies (including State and/or Local Laws and Regulations)	
Hillsborough County, Chapter 84-446	"Environmental Protection Act"
Hillsborough County, Chapter 1-11	"Rules of the Environmental Protection Commission - Wetlands"
Florida Administrative Code (FAC) Chapter 62-312	"Dredge and Fill Activities"
FAC Chapter 62C-20	"Aquatic Plant Management"
FAC Chapter 62-4	"Water Quality Standards"
Sections 403.9321-403.9333, Florida Statutes	"1996 Mangrove Trimming and Preservation Act"

1.4 Integration with Other Plans

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INRMP revisions, updates and concurrence with the final INRMP must be coordinated through the 6 ARW chain of command at MacDill AFB with the guidance and cooperation of the U.S. Fish & Wildlife Service (USFWS), National Oceanic & Atmospheric Administration National Marine Fisheries (NOAA Fisheries), and Florida Fish & Wildlife Conservation Commission (FWC). The MacDill AFB Natural Resource Manager (NRM) must ensure that the INRMP, Integrated Cultural Resources Management Plan (ICRMP), Comprehensive Environmental Response, Compensation, and Liability Act of 1980/Resource Conservation and Recovery Act of 1976 (CERCLA/RCRA) cleanup plans, Integrated Pest Management Plan (IPMP), Invasive Species Management Plan (ISMP), Installation Development Plan (IDP), Wildland Fire Management Plan (WFMP), Grounds Maintenance contract, Air Installation Compatible Ground Use Zone (AICUZ) studies, and any additional plans that may affect natural resources, are mutually supportive and not in conflict. The INRMP identifies natural resource features that are considered and incorporated into the IDP including, but not limited to, federal and state-listed wildlife species, vulnerable ecosystems, wetland, and other hydrologic features. The INRMP also addresses natural resource concerns associated with wildlife hazards around the installation airfield and has been reviewed by the MacDill AFB BASH team. Due to the outsized proportion of the airfield compared with the size of MacDill AFB, wildlife hazards are considered within all habitat management techniques.

2 INSTALLATION PROFILE

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Office of Primary Responsibility (OPR)	6 ARW Commander has overall responsibility for implementing the natural resources management program and is the lead organization for monitoring compliance with applicable federal, state, and local regulations.
Natural Resources Manager/Point of Contact (POC)	Name: Andrew Rider (Environmental Element Chief – government oversight of contracted NRM) Phone: 813-828-2718 Email: andrew.rider.2@us.af.mil
State and/or local regulatory POCs (Include agency name for Sikes Act cooperating agencies)	US Fish & Wildlife Service Florida Fish & Wildlife Conservation Commission National Marine Fisheries Service
Total acreage managed by installation	5,695
Total acreage of wetlands	1,101.5
Total acreage of forested land	934.7
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
Natural Resources Program Applicability (Place an X in the brackets "[X]" next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	[X] Fish and Wildlife Management [X] Outdoor Recreation and Access to Natural Resources [X] Conservation Law Enforcement [X] Management of Threatened, Endangered, and Host Nation-Protected Species [X] Water Resource Protection [X] Wetland Protection [X] Grounds Maintenance [X] Forest Management [X] Wildland Fire Management [ ] Agricultural Outleasing [X] Integrated Pest Management Program [X] Bird/Wildlife Aircraft Strike Hazard (BASH) [X] Coastal Zone and Marine Resources Management [X] Cultural Resources Protection [X] Public Outreach [X] Geographic Information Systems (GIS)

2.1 Installation Overview

2.1.1 Location and Area

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MacDill AFB is located in west central Florida at the southern tip of the Interbay Peninsula in Hillsborough County. The base covers an approximate area of 5,695 acres, and is surrounded by Tampa Bay to the south (Middle Tampa Bay), west (Old Tampa Bay) and east (Hillsborough Bay), and the City of Tampa to the north and west. All or parts of the counties of Pinellas, Pasco, Hernando, Polk, Hardee, DeSoto, Manatee, and Sarasota are within a 50-mile radius (USAF, 1994a). MacDill AFB does not have any Geographically Separated Units (GSU) under the command of the 6 ARW. The closest military installation of interest to MacDill AFB is the 106,000-acre Avon Park Air Force Range (APAFR) located ~65 miles to the East. MacDill AFB, and other visiting units, utilize APAFR for flight and munitions training. Figure 1 shows the location of MacDill AFB within the city of Tampa and in relation to the surrounding Tampa Bay region.

Figure 1: Location of MacDill Air Force Base in Tampa Bay region

Installation/GSU Location and Area Descriptions

Installation/ Geographically Separated Unit (GSU)	Main Use/ Mission	Acreage	Addressed in INRMP?	Describe Natural Resource Implications
N/A	N/A	N/A	N/A	N/A

2.1.2 Installation History

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The history of MacDill AFB is rooted in its location. The base comprises 5,695 acres on the southern tip of the Interbay Peninsula. Originally known as Catfish Point, this peninsula sits between Hillsborough Bay on the east and Middle Tampa Bay to the south and Old Tampa Bay to the west. Tampa's location historically was desirable to the military as it provided access to the Gulf of Mexico and the Caribbean, and during such conflicts as the Spanish-American War in 1898, it served as a strategic military post (Earth Tech, Inc. 2003).

The establishment of MacDill AFB occurred in part because of the same reasons previous military leaders used the site during the Spanish-American War: its location provided access to the strategic Gulf of Mexico and Caribbean. By the 1930s, this area was considered to be inadequately defended. In 1935, the Wilcox Defense Act was passed, which called for the creation of seven air fields in the US, Puerto Rico, and Panama to form what was called a "triangular defense system" (Earth Tech, Inc. 2003). The Wilcox Site Board, which was created out of the defense act and comprised of US Army Air Corps and War Department officers, assessed potential locations and chose Tampa for four specific reasons as a site that could protect U.S. interests and shipping routes in the Caribbean:

- Tampa had favorable weather year round.
- Land access was restricted to just the north.
- The water surrounding three sides of the peninsula provided a safe place to jettison aircraft during training.
- Tampa had a well-developed infrastructure, including an established railroad (Earth Tech, Inc. 2003).

Tampa residents lobbied hard, and on 6 September 1939, construction began on Southeast Air Base, now known as MacDill AFB. The Hillsborough County Commission purchased the property for $97,000 and donated it to the Federal government (Florida Aviation Historical Society 2006). The base officially opened on 15 April 1941 just months prior to the attack on Pearl Harbor. It was this attack on 7 December 1941 that brought the U.S. into World War II, and MacDill AFB would play a strong role in the training of pilots during the war.

When the U.S. entered the war, MacDill AFB became the staging area for 15 LB-30s and 63 Boeing B-17s that were to be sent to Australia and the Pacific under Project X. Operations such as Project X proved to the War Department that the training of pilots was not keeping pace with the aircraft and weapons being developed and utilized. As a result, MacDill AFB would become the leader in a new method of training pilots, an assembly-line system called Operational Training Units (OTU). Approximately 2,200 new personnel arrived every seven weeks at MacDill AFB to train in the OTU program, and by the end of World War II, approximately 200,000 troops had been stationed at the base. Three units were residents of the base during the war: the 21st Bombardment Group (BG), the 29th BG, and the 44th BG. The base would also house a unit of the Women's Army Corps and a German Prisoner of War (POW) camp. At its height, this camp held approximately 448 POWs (Earth Tech, Inc. 2003).

Initially, MacDill AFB served as training station for the B-17 "Flying Fortress". In 1942, the base transitioned to a training site for the B-26 "Marauder," although its cumbersome handling resulted in a return to the B-17 by 1943. In 1945, MacDill AFB became the training location for the Boeing B-29 "Superfortress". On 12 July 1948, the Southeast Air Base was officially named MacDill AFB after Colonel Leslie MacDill, an aviation pioneer in the 1st Aero Squadron, who died in 1938.

By 1951, MacDill AFB again changed aircraft. The training transitioned to the B-47 and KC-97 tankers. Within two years, the base housed the B-12s and became an operational base for the Strategic Air Command (SAC). Several SAC units stationed at MacDill AFB, including the 305, 306, and 307 BGs and the 311 Reconnaissance Wing of the 6th Air Division, trained on the B-47s. As a result, MacDill was the location where the operational procedures for the aircraft were developed. Major construction activity occurred on base to accommodate the increasing demand for training facilities and housing.

The Cold War evolved, changing the focus of the USAF from aircraft to ICBMs and radar stations. MacDill AFB was listed for partial closure and reduced activity by the DoD on 28 November 1960. This plan changed within one year as the tumultuous relationship between the U.S. and Cuba escalated. Rumors abounded that Soviet MiG-17s were in Cuba, and defense weapons were supposedly aimed at the US. MacDill AFB was viewed as a location to launch an invasion on Cuba (Hawes 1992). The base changed from being "mothballed" to having a fighter force and being part of the U.S. Strike Command (USSTRIKCOM), which had a mission of being prepared as a strike force worldwide. MacDill AFB became extremely active, and Tampa residents witnessed an increase in air traffic; anti-aircraft rockets on beaches; caravans of trucks with "explosives" signs arriving on base with a police escort; numerous F-101 Voodoo jets, all-weather fighter-interceptors, and four-engine cargo planes; and hotels booked to capacity with soldiers (Hawes 1992). No invasion occurred, although MacDill AFB remained on alert. Afterwards, records indicated that 42 Soviet medium-range missiles were installed on Cuban bases, and the Soviet soldiers stationed on the island were equipped with short-range, tactical nuclear weapons.

That same year, 1962, the mission of the base changed from the SAC to the Tactical Air Command (TAC). The aircraft would again evolve, and MacDill AFB housed two fully operational wings of F-4 Phantoms. Two Tactical Fighter Wings (TFW), the 12 TFW and 15 TFW, deployed to Vietnam, where the 4 Tactical Fighter Squadron of the 15 TFW would be "the first F-4 unit in Vietnam and the first unit to account for an air victory in the region" (USAF 2018). MacDill AFB would continue to serve as a training location during the Vietnam War, and retained its USSTRIKCOM mission.

Several changes occurred at the base during the 1970s and 1980s. By 1972, the USSTRIKCOM would be changed to the U.S. Readiness Command (USREDCOM), although it maintained its mission as a quick response strike force. Seven years later, under the same command, the aircraft at MacDill AFB would transition from the F-4 to the F-16. MacDill would ultimately train the largest number of F-16 pilots in the world (USAF 2018). The major change at the base, though, included transition of the USREDCOM. A taskforce was organized under USREDCOM by President Jimmy Carter in response to the Iranian Revolution and the Soviet invasion of Afghanistan. This task force, the Rapid Deployment Joint Task Force (RDJTF), was headquartered at MacDill AFB and had several units under it, including one at Fort Bragg in North Carolina and one at Fort Campbell in Kentucky. The RDJTF would evolve in time and become the US Central Command (USCENTCOM). While the RDJTF was intended to be temporary, President Ronald Reagan officially activated this permanent command on 1 January 1983. All four Armed Services provide component of the command, which would attain national significance in 1991. In 1991, under the command of General H. Norman Schwarzkopf, Operation Desert Shield and Operation Desert Storm were initiated in response to the invasion of Kuwait, and showed the effectiveness of this command in its rapid deployment and short duration of conflict.

In 1996, MacDill AFB transitioned to become an Air Mobility Command installation. The 6th Air Refueling Wing (6 ARW) was activated October 26, 1996, with the arrival of 12 KC-135 Stratotankers from Malmstrom AFB. In 2001, the 310th Airlift Squadron moved to MacDill AFB and the 6 ARW was re-designated at the 6th Air Mobility Wing. In 2008, the 6th ARW was augmented by the Air Force Reserve Command's 927th Air Refueling Wing and the 63d Air Refueling Squadron also flying KC-135s. In 2019, the 6th Air Mobility Wing deactivated the 310th Airlift Squadron and the wing was redesignated as the 6th Air Refueling Wing.

2.1.3 Military Missions

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The 6th Air Refueling Wing is the host unit at MacDill AFB. The wing is a subordinate unit of the 18th Air Force, Air Mobility Command, headquartered at Scott AFB, Illinois. The mission of the 6 ARW is to deliver unmatched air refueling and installation and mission support. The Wing provides world-class, worldwide air refueling and installation and airbase support to Headquarters U.S. Central Command, Headquarters U.S. Special Operations Command, and 31 other Joint mission partners. In addition, the Wing and MacDill AFB provide support to the MacDill community, including more than 19,000 base personnel and employees, 250,000 retirees, and their families (MacDill 2020).

Listing of Major Mission Partners and Natural Resources Responsibility

Tenant Organization	Natural Resources Responsibility
Air Force Reserve Command's 927th Air Refueling Wing	Host Base is responsible for NR management

Headquarters, United States Special Operations Command (USSOCOM)	Host Base is responsible for NR management
Headquarters, United States Marine Corps Forces Central Command (USMARCENT)	Host Base is responsible for NR management
U.S. Special Operations Command Central (SOCCENT)	Host Base is responsible for NR management
Joint Communication Support Element (JCSE)	Host Base is responsible for NR management
U.S. Naval Reserve	Host Base is responsible for NR management
Joint Communication Support Squadron (JCSS)	Host Base is responsible for NR management
United States Army Reserve (USAR) Aviation Support Facility (ASF)	Host Base is responsible for NR management

2.1.4 Natural Resources Needed to Support the Military Mission

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The natural resources which support the military mission at MacDill AFB include:

- *Coastal areas* – provides unoccupied space which serves as noise buffer and accident protection, occasionally used for special operations training, provides recreational opportunities, and provides habitat for protected species. These areas are critical in providing a protective buffer around the installation. Mangrove forests provide wind and tidal buffers to prevent potential flooding during large storms. The 6th Security Forces Squadron (6 SFS) patrols the open water coastal areas to ensure compliance from the general public and protection of military operations on installation.
- *Open space* – provides flexibility for future missions/land use, required for security and training exercises, ensures adequate space for noise buffers and accident protection (CZ/APZs), necessary for providing habitat for protected species,
- *Water quality* – the City of Tampa provides clean potable water for human consumption at the base, and management plans are in place to ensure that base operations necessary to support the mission do not adversely affect groundwater and surface water quality. Such plans also ensure permit compliance, wetlands and habitat protection, and flood control – which if compromised, could affect the military mission.
- *Forested land* – provides noise and visual buffers for military activities and areas for land training activities including troop movements.
- *Marina channels* – allow for 6 SFS to monitor and patrol marine security zone around the installation.

Although not mission critical, the natural resources provide outdoor recreational opportunities that boost morale and provide daily enjoyment for base tenants, personnel, and residents. These resources provide people with opportunities for hiking, fishing, nature study, camping, boating, and countless other forms of outdoor recreation.

2.1.5 Surrounding Communities

Installation Supplement

The City of Tampa population is estimated at over 390,000 individuals as of 2019 with over 20,000 veterans as of 2017 (City of Tampa, 2020). The Tampa-St. Petersburg-Clearwater Metropolitan Statistical Area (MSA) is defined as Hillsborough, Pinellas, Hernando and Pasco County with an estimated population, as of 2019, of 3,194,831 (U.S. Census Bureau). Manatee County, with an estimated population in 2019 of 403,253, is located on the Southern edge of the Tampa Bay MSA and plays a large role in both natural resource management of Tampa Bay ecosystems and utilization by military personnel for residence and flight operations. Due to this, it is included within the surrounding communities of the installation.

These counties range from highly developed and urban (Pinellas and Western Hillsborough) to suburban and largely undeveloped (Eastern Hillsborough, Pasco, Hernando, and Manatee) which provides for a diverse and metropolitan demographic and economic picture. Tourism, construction, health care, agriculture, finance, and military defense are some of the largest economic industries within the region.

The City of Tampa has retained planning and zoning jurisdiction over land directly adjacent to MacDill AFB's Northern and Western boundary. Surrounding land use is primarily residential, commercial, and industrial. Recent zoning has been aimed toward industrial use, with this zoning designed to prohibit noise-sensitive uses, such as residential, within the airfield flight path. In recent years considerable development has occurred directly to the north of the base. The continued development of this land North and West of the installation will continue to provide encroachment issues and future planning for installation growth.

2.1.6 Local and Regional Natural Areas

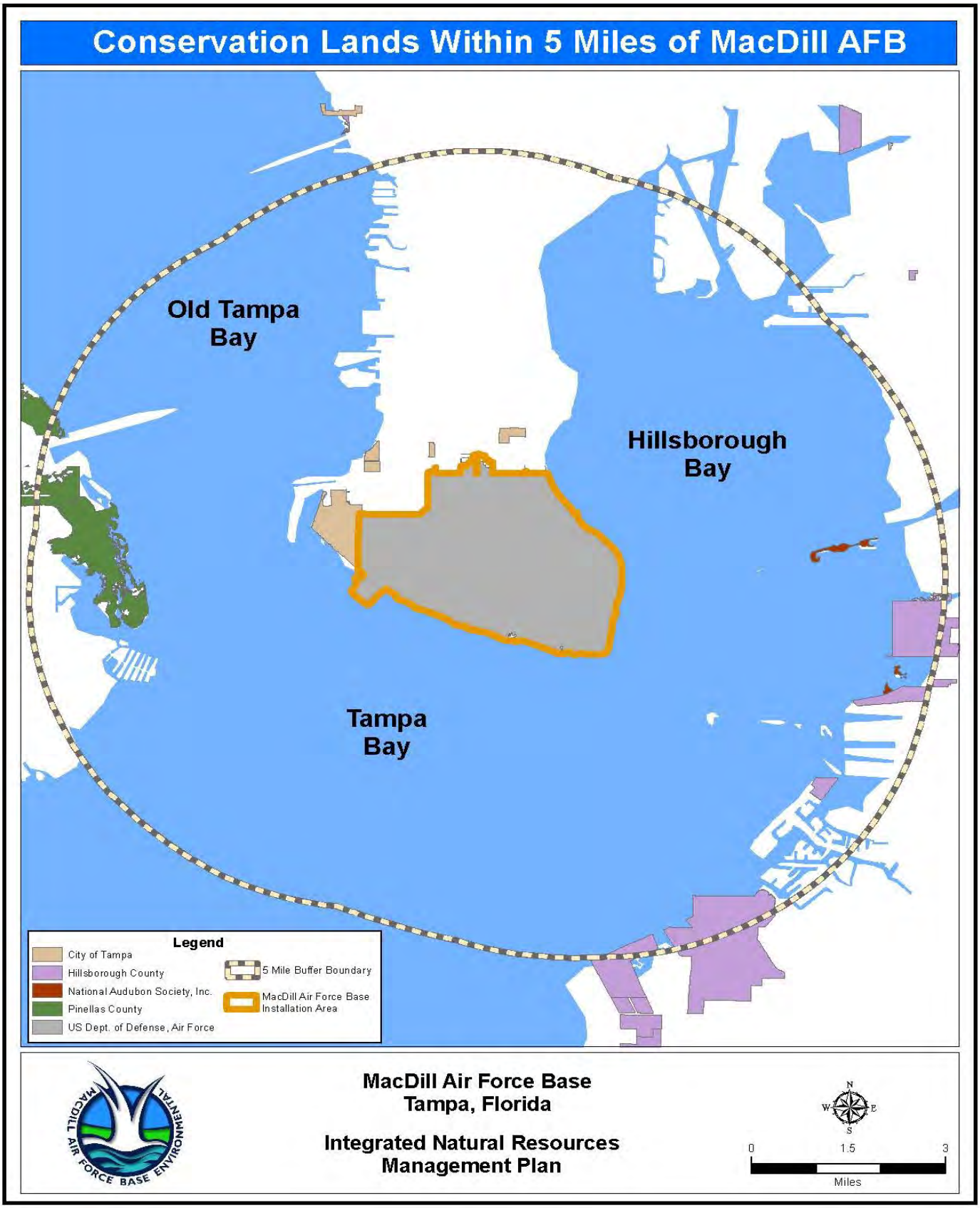
Installation Supplement

MacDill AFB is surrounded on the west, south, and east by portions of Tampa Bay and has a limited number of neighbors directly adjacent to the installation's boundaries. To the northwest is a residential community referred to as Port Tampa City. The Western boundary is bordered by the City of Tampa property and managed by the City of Tampa Parks and Recreation department. Along the northern border of the base between the Manhattan Gate and Bayshore Gate is a mixture of developed and undeveloped land owned by various parties including the City of Tampa, several residential developers, two industrial facilities, and the Bayshore Trails Townhomes Association, Inc. This includes Gadsden Park (City of Tampa) that abuts the installation's Northern boundary. None of these properties have significant impacts with regard to the management of ecosystems on MacDill AFB. The natural areas of appreciable size adjacent, or within close proximity, to the base are Picnic Island Park, Middle Tampa Bay, Old Tampa Bay and Hillsborough Bay. Figure 2 shows public conservation lands within 5 miles of the installation's boundaries.

MacDill AFB is part of the larger Tampa Bay watershed that includes the drainage of Hillsborough, Alafia, Little Manatee, and Manatee Rivers. Much of this region's hydrology derives from the drainage of the Lake Wales Ridge ecosystem in central Florida, the Green Swamp, and the Pinellas peninsula. Ecosystems within this region range from coastal (tidal flats, salt marshes, coastal and mangrove forests) to upland (sandhill, scrub, and pine flatwoods). A large portion of this region has been developed or converted to rangeland or agriculture. Major public conservation lands within the Tampa Bay watershed include Alafia River State Park, Hillsborough River State Park, Fort Desoto Park, Crystal River National Wildlife Refuge Complex, Duette Preserve, and several other city/county/state/federal properties, state Wildlife Management Areas (WMA), and private lands.

Tampa and Hillsborough Bays are rated as Class III with some Class II waters. Both classes include recreation and well-balanced populations of fish and wildlife while Class II includes shellfish propagation or harvesting. Currently, portions of Tampa Bay are listed as impaired by the FDEP for various factors including high levels of dissolved oxygen, bacteria, and other nutrients (DEP 2018).

Figure 2: Conservation Lands Within 5 Miles of MacDill Air Force Base



2.2 Physical Environment

2.2.1 Climate

Installation Supplement

The general climate at MacDill AFB is humid subtropical, with hot summers and mild winters. MacDill AFB has about a 10-month growing season. Killing frosts do not normally occur in the area, but have been recorded as early as October 31st and as late as March 17th. About 46% of the annual rainfall occurs during the wet season (i.e., June through August). Most rainfall events are heavy thunderstorms of short duration in summer months (USAF, 1994a). Tropical storms and/or hurricanes could affect the area during June through November each year.

The climate projections for MacDill Air Force Base (AFB) represent a moderate emission scenario (RCP 4.5) and a high emission scenario (RCP 8.5) (Moss et al., 2008, 2010) based on National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) prepared for the IPCC-AR5 (Gent, P. R., 2011; Hurrell et al., 2013; Moss et al., 2008, 2010). Climate information for historical data are downscaled to approximately 1 km grid resolution and provide daily climate information from 1900 to 2100. Climate model simulations were downscaled to 6 km grid resolution and data from 2026 to 2035 were extracted to represent the decadal average for 2030 and extracted data from 2046 to 2055 for the decadal average for 2050.

Summary of climate projections (Table 1) indicate that minimum and maximum temperatures will increase over time under both emissions scenarios. For the decade centered around 2030, both of the scenarios project a similar increase in average annual temperature (TAVE) of between 1.9 °F (1.0 °C) and 2.0 °F (1.1°C) over the historic average. For the decade centered around 2050, the RCP 4.5 scenario projects an increase of 2.3 °F (1.5 °C). The RCP 8.5 projections estimate TAVE will increase by 3.3 °F (1.8 °C) for this period.

Average annual precipitation (PRECIP) varies between emission scenarios and over time due to larger interconnected ocean-atmosphere dynamics associated with the NCAR-CCSM. For 2030, RCP 4.5 scenario projects an increase in PRECIP of approximately 20% while RCP 8.5 shows an increase of 8%. For 2050 RCP 4.5 projects an increase in PRECIP of 13% while RCP 8.5 shows a smaller increase of approximately 7%.

Table 1. Summary data for the 30-year historical base period and the decadal average data for 2030 and 2050 for RP4.5 and RCP 8.5 scenarios.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	52.6	63.1	59.6	56.9	56.1
TMIN (°F)	63.8	65.8	66.2	65.8	67.2
TMAX (°F)	82.6	84.4	84.9	84.7	85.9
TAVE (°F)	73.2	75.1	75.5	75.2	76.5
GDD (°F)	8513	9125	9202	9124°F	9473
HOTDAYS	86.5	115.3	132.9	128.6	148.4
WETDAYS	1.7	2	1.5	1.2	1.1

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of hot days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding 2 inches in a day.

Understanding changes in daily intensity and total precipitation for multi-day precipitation events is helpful to evaluate precipitation patterns in addition to assessment of annual averages. Three-day storm events were generated from projected precipitation data based on RCP 4.5 and 8.5 emission scenarios for target years 2030 and 2050 (Table 2). Historical precipitation data were used to calculate a baseline storm event for the year 2000 for comparison (Table 2). Projected storms were generated from ten years of data surrounding the targeted year and are therefore likely to occur between once per year to once per ten years during the 10-year projection period.

Table 2. Projected precipitation from projected three-day storm events.

	Baseline	RCP 4.5		RCP 8.5	
	2000	**2030**	**2050**	**2030**	**2050**
Day 1	1.4 in	2.1 in	1.1 in	1.5 in	1.9 in
Day 2	2.4 in	2.2 in	1.8 in	2.5 in	1.9 in
Day 3	1.9 in	1.7 in	1.9 in	1.4 in	1.0 in
Total	5.7 in	6.1 in	4.8 in	5.4 in	4.8 in
Change from baseline		8.0%	-14.5%	-4.1%	-15.5%

2.2.2 Landforms

Installation Supplement

MacDill AFB covers 5,695 total acres. For purposes of this INRMP, the land use at MacDill AFB is defined by the following subcategories: improved, semi-improved, and unimproved/vacant lands. This INRMP deals primarily with the land classified as unimproved/vacant, especially those lands not paved or occupied by buildings which generally includes wildlands/wetlands, designated Bird Aircraft Strike Hazard areas, and golf courses.

Generally, no routine grounds maintenance occurs in natural areas. Those areas are addressed in this INRMP with respect to management of species, natural habitats, and other resources.

In general, topography at MacDill AFB is flat. MacDill AFB is located in the Pamlico Terrace which rises gently from the coast to about 25 feet above sea level. Ground elevations on the base range from sea level at the southern boundary and gradually rise to about 15 feet above sea level along the northern boundary. The mean elevation of the installation is only 4.7 feet above mean sea level (SERDP). There are no natural large topographic features on the base

2.2.3 Geology and Soils

Installation Supplement

The geologic features of MacDill AFB are consistent with the surrounding area of southwest Florida, with generally flat, sandy terrain.

Geology

MacDill AFB is situated in the Gulf Coastal Lowlands physiographic region. There are three principal lithologic sequences in the area. The top unit is unconsolidated sand, clay, and marl. This unit may include remnants of the Hawthorn Formation composed of sand, clay, and thin lenses of limestone. Sands in this unit range from 5-20 feet thick with clay layers up to 40 feet thick. This surficial layer is very thin to absent on the eastern side of the base, and underlying limestone formations may outcrop in this area.

The next deepest layer is composed of Tampa and Suwannee limestones which range from 250-500 feet thick. Below this layer are the Ocala Group; Avon Park, Lake City, and Oldsmar limestones; and Cedar Keys Limestone. These formations are about 2,300 feet deep.

Sinkholes are common to this type of geology. These form from dissolution of limestone due to percolation of groundwater followed by subsidence of overlying materials. However, due to overlying layers of clay, limited groundwater recharge, and the presence of a slow discharge zone for the Floridan aquifer, sinkhole activity at MacDill AFB is minimal with only one identified during a 1985 study (Beck et al., 1985; USAF, 1994a).

Soils

There are no prime or unique farmland soils at MacDill AFB (USAF, 1994a), and the primary soil types at MacDill AFB are Myakka Fine Sand, Malabar Fine Sand, Pomello Fine Sand and Wabasso Fine Sand based on characteristics as listed in the U.S. Department of Agriculture (USDA) Soil Survey of Hillsborough County, Florida (USDA, 1989).

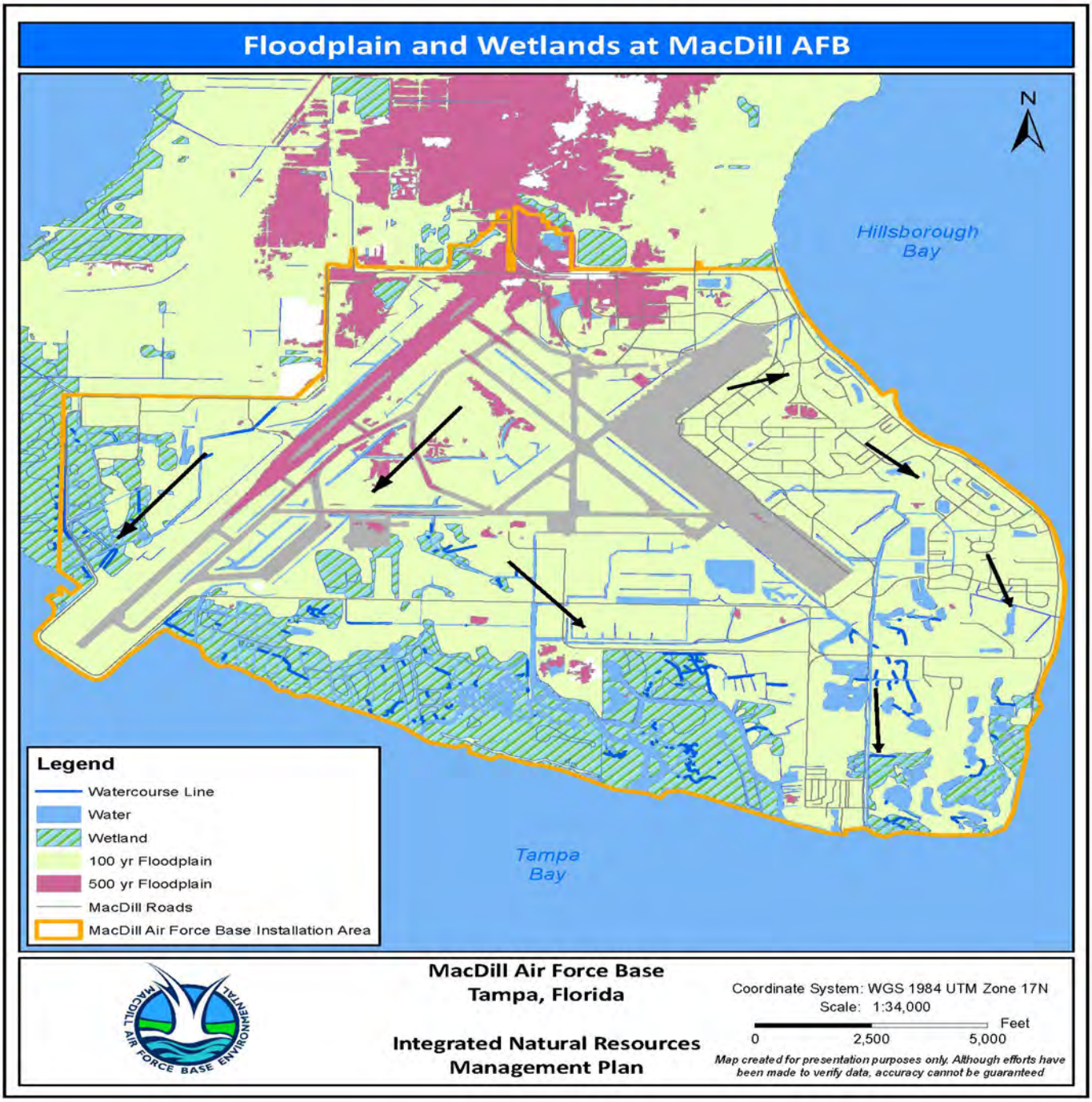
Two MacDill AFB soils are hydric and thus have jurisdictional wetland implications. Myakka Fine Sand (frequently flooded) is in tidal areas and occurs mainly on mangrove areas. These soils are subject to tidal flooding, are very level, and are poorly drained. Malabar Fine Sand is generally adjacent to the Myakka Fine Sand. This includes flatwood areas, portions of the golf course, and some development. They are nearly level and poorly drained, often occurring in low-lying sloughs and shallow flatwoods depressions (Dames & Moore, 1994).

2.2.4 Hydrology

Installation Supplement

The hydrologic features of MacDill AFB include: ponds, drainage ditches, wet weather irrigation fields, and wetlands. Flooding is a concern at MacDill AFB due to tidal surges and rainfall associated with periodic tropical storms and hurricanes, as well as frequent torrential rainfall during the summer rainy season. The figure below illustrates the 100-year floodplain, 500-year floodplain, and wetlands at MacDill. Due to space constraints and mission requirements, development within the floodplain is inevitable. The risk of developing in these areas is mitigated by meeting the requirement to raise the finished floor elevation above the floodplain.

Figure 3: Floodplain and Wetlands at MacDill



Drainage

MacDill AFB is an independent drainage area with no surface waters entering or leaving the base prior to discharge into Tampa Bay. The road on the northern boundary acts as a drainage divide between the base and the community to the north (USAF, 1994a). The above figure "100-Year Floodplain and Wetlands at MacDill" illustrates the surface drainage pattern at the base. The drainage system at the base is greatly affected by ditches and pipes, primarily constructed to drain the developed portions of the base. There are approximately 24.4 miles of culverts (ranging 6 to 48 inches in diameter), and 56.3 miles of open ditches and canals. There are five drainage basins on MacDill AFB, largely created by ditches. Drainage routes occur in all directions with the exception of north.

Actions aimed at improving the water quality and habitat of the ponds are addressed in Section 8.0 Management Goals and Objectives of this INRMP, and mainly consist of invasive species removal. In FY 2012, MacDill implemented a large project to improve storm water quality by diverting storm water from a major drainage canal through a series of ponds. Slowing storm water movement and increasing the contact time with vegetation resulted in improved storm water quality. The project, known as Surface Water Improvement and Management (SWIM) Phase III, restored over 100 acres of wetland habitat and created approximately 22 acres of new wetlands. The $1.6M project was a partnering effort between the Southwest Florida Water Management District (SWFWMD) and the USAF. The large restoration project included the removal of aquatic and upland invasive and exotic plant species, including cattails, from the most of the freshwater bodies in the southeastern portion of the base.

In addition to occasional larger scale restoration projects such as (Surface Water Improvement and Management (SWIM) Phase III, annual operations and maintenance (O&M) funding is used to ensure the maintenance of wetlands and storm water drainage features. Currently three different entities are being utilized for the control of nuisance and invasive vegetation in the storm water conveyances, storm water treatment ponds and other surface water bodies throughout the base.

- The base Habitat Restoration contractor (Petroleum Resources & Development) is working to control nuisance and invasive plant species in upland and aquatic sites throughout MacDill AFB.
- The U.S. Fish & Wildlife Service is operating under an agreement between the USAF and USFWS to treat nuisance and invasive aquatic plant species in water bodies throughout the base associated with the SWIM Phase III restoration project.
- The 6 Civil Engineer Squadron (6 CES) Heavy Equipment Shop accomplishes routine in-house drainage ditch mechanical maintenance work to keep the storm water conveyances free of vegetation and sediment build-up.

The principle storm water management areas and other aquatic sites around MacDill AFB which are being maintained through the current Habitat Restoration contract, USFWS, or 6 CES Heavy Equipment Shop include: wetland mitigation areas associated with the Bayshore Shoreline Stabilization project, thirteen freshwater and oligohaline ponds associated with the SWIM Phase III project, two storm water treatment ponds at the USCENTCOM facility as well as a storm water drainage canal known as Turtle Creek, the network of upland man-made drainage ditches throughout the base including ditches in the family housing area, munitions storage area, airfield, and administrative areas of the base.

Surface Water

Surface water flows at MacDill AFB primarily result from storm water runoff. Approximately 17% of the base is either pavement, concrete or buildings, and such impervious surfaces increase surface runoff.

There are two larger man-made ponds, Lake McClelland and Lewis Lake, in the eastern portion of the base. These lakes comprise approximately 20 acres combined. There are also approximately 35 acres of small, unnamed impoundments, 14 of which are located on the north and south golf course. The main natural drainage features on the base are Raccoon Hammock and Broad Creek to the south. These natural features discharge through dense mangrove swamps, which flood during high tides.

Approximately 93% of MacDill AFB is within the 100-year floodplain (CSU-CEMML, 2022). Tropical storms typically flood much of the southern and northwestern portions of MacDill, and all of the base proper would be flooded by a Category 3 or greater hurricane (USAF, 1994a).

For several years, MacDill's eastern shoreline was rapidly eroding due to wave action resulting from wind, fetch, and freighter traffic through Tampa Bay. Consequently, shoreline stabilization has been ongoing activity at MacDill AFB for the past decade. In 2007, the developed portions of the base from the Bayshore Gate south to just north of the WWTP were stabilized with installation of a revetment constructed on limestone boulders. In the undeveloped portions of the base between the WWTP around to the Family Campground, the shoreline is being stabilized using an alternative shoreline stabilization method. The stabilization method includes construction of oyster reefs offshore to break-up wave energy before it hits the shoreline and allow the accumulation of sediment, which in time permits establishment of marsh grasses that in turn aid the shoreline stabilization process by binding up sediment. Through natural succession, mangroves (i.e., natural native shoreline stabilizers) will colonize the marsh grass area and further stabilize the shoreline. The shoreline restoration and enhancement processes include planting near shore and dune areas with vegetation and augmenting the existing oyster structures.

A large-scale oyster reef shoreline stabilization project, completed in phases, has been underway during the last 17 years along the southern and eastern shorelines of the installation. Phase V was completed in 2016, and Phase VI is currently underway. Additional phases of oyster reef shoreline stabilization are currently planned and being permitted.

Since 2012, the southeastern corner of MacDill AFB, known as Gadsden Point, has shown clear signs of being stabilized following installation of oyster reef and the establishment of marsh habitat landward of the oyster reef. Currently, Gadsden Point appears to be protected from day to day wave energy and even moderate storms, but may still see erosion events during severe storms. The installation of offshore Wave Attenuation Devices is still being considered, but not actively pursued due to the current stabilization of the shoreline.

One significant hurdle for the Marine Habitat Wave Barrier project is the extensive seagrass coverage in the area proposed for construction of the marine habitat wave barriers. The adverse impacts to seagrass beds resulting from the installation of the large concrete wave attenuation devices may outweigh the shoreline stabilization and marine habitat benefits served by installation of the Marine Habitat Wave Barriers.

Groundwater

The base is within the southern west-central Florida groundwater basin. The surficial aquifer system (consisting of sand, clayey sand, and shell) is about 20 feet thick and is used to supply small irrigation systems beyond base boundaries. This shallow aquifer ranges from the surface to about five feet beneath the surface at inland locations. The surficial aquifer is not used at MacDill AFB. Recharge of this aquifer is primarily through precipitation.

The surficial aquifer is highly susceptible to groundwater contamination (FDEP, Chapter 62-777 F.A.C.), primarily due to shallow water table depth and permeable sediments. MacDill AFB operations have affected this aquifer. Underground storage tanks, landfills, and the golf courses are sources of known contamination.

The surficial aquifer is generally underlain by heterogeneous calcareous clays and limestone with varying permeability, including Tampa and Suwannee limestones, the Ocala Group, and the Avon Park Limestone, all of which are highly permeable. This formation varies in thickness across the base with the clay and limestone virtually nonexistent in some of the northeastern portions of MacDill AFB, and thickness as high as 40-feet along the southern portion of the base.

A deeper drinking water aquifer, the Floridian aquifer, underlies the clay and limestone barrier, and is not significantly recharged from the surface of MacDill AFB or surficial aquifer. The base is primarily a discharge zone for the Floridian aquifer, and the flow of water is upward. MacDill obtains potable water from the City of Tampa; no drinking water wells are located on the base.

Groundwater quality of the Floridian aquifer has not been fully defined due to a lack of monitoring wells. This aquifer is rated as moderately susceptible to contamination. There is slight contamination of this aquifer, apparently from base operations, but not at levels requiring mitigation/cleanup. Impacts in this aquifer could affect areas outside the base that use this aquifer for potable water (USAF, 1994a).

Coastal Zone Flood Modeling

Exposure to Sea Level Rise (SLR) and Storm Surges (SS) was assessed using projection data from the 2016 DoD (Department of Defense) report "Regional Sea Level Scenario for Coastal Risk Management." Extreme water level scenarios were based on regional frequency analysis estimates of 20-year and 100-year storm surges. Coastal flooding projections were modeled for the years 2035 and 2065 due to available data. Projected SLR inundation estimates the new permanent coastline for each scenario and timeframe. Projected SS inundation represents short term flooding associated with extreme water level event that is expected to recede after the storm.

Table 3 (Projected SLR and SS Inundation for Each of the Climate Scenarios) summarizes projected coastal inundation in acres for each scenario. SLR is projected to reduce installation area by between 6.7% (RCP 4.5 in 2035) and 17.7% (RCP 8.5 in 2065). SLR impacts are expected to be concentrated on the Tampa Bay coast, with less risk to the coast along Hillsborough Bay (Appendix C). Mangrove forest dominates the area most likely to be inundated by SLR.

Projections for a 20-yr SS, which have a 5% probability of occurring any given year, estimate possible inundation of between 3,735 acres (61.0% of the instillation area) for the RCP 4.5 scenario in 2035 to 4,296 acres (75.6% of the installation area) for the RCP 8.5 scenario in 2065. Projections for a 100-yr SS, which have a 1% probability of occurring any given year, estimate possible inundation up to 4,873 acres (85.7% of the installation area) for the RCP 8.5 scenario in 2065.

Table 3. Projected SLR and SS inundation for each of the climate scenarios.

Climate Scenario		2035		2065	
		Projected inundation (acres)	Projected installation inundation (%)	Projected inundation (acres)	Projected installation inundation (%)
RCP 4.5	**SLR**	381	6.7	675	11.9
	20-yr SS	3520	61.9	3926	69.1
	100-yr SS	4304	75.7	4589	80.7
RCP 8.5	**SLR**	524	9.2	1005	17.7
	20-yr SS	3735	65.7	4296	75.6
	100-yr SS	4420	77.7	4873	85.7

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

Installation Supplement

MacDill AFB is classified within the Humid Temperate Domain, Subtropical Division and Outer Coastal Plain Mixed Forest Province (Bailey, 2014). The annual average temperature at MacDill AFB has historically been around 73.2 °F. Ecosystems in this domain are subject to seasonal fluctuations in precipitation and temperature, winter season which results in vegetation such as prairie, broadleaf deciduous forest and evergreen conifer forests. These areas also experience high humidity, absence of very cold winters, ample rainfall heaviest in summer months, severe thunderstorms frequent in summer months, possibility of tropical hurricanes, and moderately wide range of temperatures.

2.3.2 Vegetation

Installation Supplement

MacDill AFB contains a wide variety of vegetation alliances and communities despite being a smaller base. Historic, current, and future vegetation cover, as well as, turf and landscaped areas, are discussed in detail in the following subsections.

2.3.2.1 Historic Vegetation Cover

Installation Supplement

The land upon which MacDill AFB was constructed was essentially vacant prior to its acquisition (USAF, 1993b). Upland areas were primarily pine flatwoods with wetlands. Coastal areas were undeveloped and included mangrove forests, tidal flats, and salt marshes. The 1938 aerial of the portion of the Interbay peninsula that eventually became MacDill AFB shows the pre-construction vegetation.

Figure 4: 1938 Aerial of Interbay Penninsula

2.3.2.2 Current Vegetation Cover
Installation Supplement

MacDill AFB had a base-wide vegetative classification and mapping project completed in September 2019 performed by CSU-CEMML. This project identified 33 different vegetation alliances/communities based on the United States National Vegetation Classification (USNVC) Version 2.03 and utilized the framework of the National Vegetation Classification Standard (NVCS), Version 2.0. The main vegetative covers include mangrove forests, tidal shrub salt marsh, pine flatwoods and oak-dominated forests. A large portion of MacDill AFB (62.86% / 3,751 acres) is currently developed, open water or lawn grass maintained for aesthetics and/or airfield operations. Figure 4: MacDill AFB Vegetation Classification Map gives a visual representation of the main communities types found at MacDill AFB. Table 4: Vegetation Communities and Land Cover Types at MacDill AFB gives a detailed breakdown of vegetation communities at MacDill AFB. A detailed breakdown of the vegetative communities found at MacDill AFB is found in Appendix G (Vegetation Classification and Mapping, MacDill Air Force Base, Florida).

The City of Tampa (2004) evaluated seagrass beds throughout Tampa Bay including MacDill's coastline and surrounding marine waters. Seagrasses are found along much of the base's eastern and southern coastline with the dominant seagrasses being shoal grass (Halodule wrightii) and manatee grass (Syringodiumm filiforme). Seagrass coverage within Tampa Bay is currently monitored by several organizations in the Tampa Bay region including TBEP, TBW and Pinellas County, with permanent transects throughout the Tampa Bay region. Studies have shown a drastic increase in the amount of seagrass coverage in the waters surrounding MacDill AFB since the late 1980's (Sherwood, 2017).

In 1998, 1,195 acres of wetlands were identified, delineated, and quantified on MacDill AFB (IT Corporation, 1998). The acreage and classification of these wetlands were 880 acres of estuarine scrub/shrub emergent wetlands, 200 acres of palustrine wetlands, and 115 acres of needle-leaved forested wetlands. Current wetland acreages are based on the National Wetlands Inventory, which is maintained by the U.S. Fish and Wildlife Service.

There is little potential for commercial forestry at MacDill AFB due to relatively small monetary benefits and issues with access to the areas identified as potential harvesting. Commercial forestry-type actions can serve as an important forest ecosystem and land management tool and is considered when developing land management and natural resource projects or guidelines.

Table 4: Vegetation Communities and Land Cover Types at MacDill AFB

Vegetation Communities and Land Cover Types at MacDill AFB

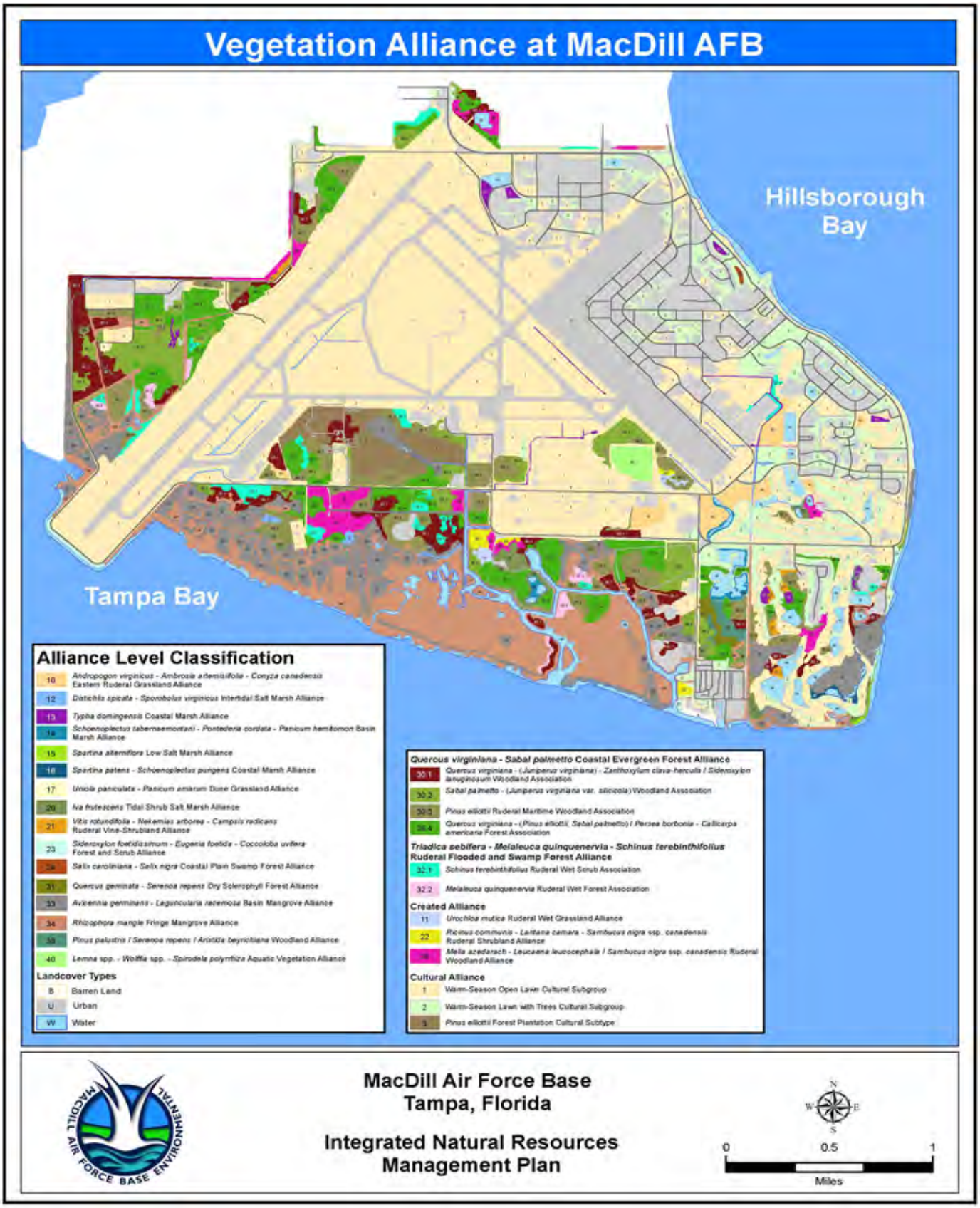
Alliance Name	*Map Indicator*	*# of Communities*	*Hectares*	*% of Total*
Warm-Season Open Lawn with Trees Cultural Subgroup	1	82	138.01	5.99%
Warm-Season Open Lawn Cultural Subgroup	2	127	772.15	33.50%
CST007170 *Pinus elliottii* Forest Plantation	3	2	36.5	1.59%
A3321 *Andropogon virginicus - Ambrosia artemisiifolia - Conyza canadensis* Eastern Ruderal Grassland Alliance	10	7	22.2	0.96%
USAF_A_070 *Urochloa mutica* Ruderal Wet Grassland Alliance	11	2	2.45	0.11%
A3956 *Distichlis spicata - Sporobolus virginicus* Intertidal Salt Marsh Alliance	12	3	2.37	0.10%
A3399 *Typha domingensis* Coastal Marsh Alliance	13	12	9.04	0.39%
A3407 *Schoenoplectus tabernaemontani - Pontederia cordata - Panicum hemitomon* Basin Marsh Alliance	14	4	3.89	0.17%
A1471 *Spartina alterniflora* Low Salt Marsh Alliance	15	1	0.65	0.03%
A3692 *Spartina patens - Schoenoplectus pungens* Coastal Marsh Alliance	16	1	1.6	0.07%
A1199 *Uniola paniculata - Panicum amarum* Dune Grassland Alliance	17	1	0.57	0.02%
A1023 *Iva frutescens* Tidal Shrub Salt Marsh Alliance	20	12	14.24	0.62%
A4154 *Vitis rotundifolia - Nekemias arborea - Campsis radicans* Ruderal Vine-Shrubland Alliance	21	5	3.72	0.16%
USAF_A_069 *Ricinus communis - Lantana camara - Sambucus nigra* ssp. *canadensis* Ruderal Shrubland Alliance	22	4	4.49	0.19%
A2031 *Sideroxylon foetidissimum - Eugenia foetida - Coccoloba uvifera* Forest & Scrub Alliance	23	5	3.64	0.16%
A1914 *Salix caroliniana - Salix nigra* Coastal Plain Swamp Forest Alliance	24	1	0.57	0.02%

Alliance Name	Map Indicator	# of Communities	Hectares	% of Total
A3192 *Quercus virginiana - Sabal palmetto* Coastal Evergreen Forest Alliance	30	139	305.63	13.26%
CEGL003523 *Quercus virginiana - (Juniperus virginiana) - Zanthoxylum clava-herculis / Sideroxylon lanuginosum* Woodland	30.1	31	60.23	2.61%
CEGL003526 *Sabal palmetto - (Juniperus virginiana var. silicicola)* Woodland	30.2	26	63.48	2.75%
CEGL004864 *Pinus elliottii* Ruderal Maritime Woodland	30.3	45	86.14	3.74%
CEGL007032 *Quercus virginiana - (Pinus elliottii, Sabal palmetto) / Persea borbonia - Callicarpa americana* Forest	30.4	37	95.78	4.16%
A0052 *Quercus geminata - Serenoa repens* Dry Sclerophyll Forest Alliance	31	1	3.72	0.16%
A3339 *Triadica sebifera - Melaleuca quinquenervia - Schinus terebinthifolius* Ruderal Flooded & Swamp Forest Alliance	32	26	25.35	1.10%
CEGL003799 *Schinus terebinthifolius* Ruderal Wet Scrub	32.1	20	18.46	0.80%
CEGL007051 *Melaleuca quinquenervia* Ruderal Wet Forest	32.2	6	6.89	0.30%
A0075 *Avicennia germinans - Laguncularia racemosa* Basin Mangrove Alliance	33	71	119359	5.19%
A3188 *Rhizophora mangle* Fringe Mangrove Alliance	34	22	190.05	8.25%
A3160 *Pinus palustris / Serenoa repens / Aristida beyrichiana* Woodland Alliance	35	2	4.41	0.19%
USAF_A_068 *Melia azedarach - Leucaena leucocephala / Sambucus nigra* ssp. *canadensis* Ruderal Woodland Alliance	36	13	24.35	1.06%
A4147 *Lemna* spp. - *Wolffia* spp. - *Spirodela polyrrhiza* Aquatic Vegetation Alliance	40	1	7.74	0.34%
Barren Land	B	2	1.64	0.07%
Urban	U	2	522.22	22.66%
Water / Ocean	W	64	83.98	3.64%
	Totals	**612**	**2,304.76**	**100%**

* Light blue highlighted cells represent mapped USNVC associations that are nested within the corresponding dark blue highlighted alliance. Alliance A3192 contained four associations and alliance A3339 contained two associations.

** To account for coastal boundary discrepancies at MacDill AFB, a 20-meter buffer was applied to the installation boundary. This ensured the actual boundary was mapped and that coastal vegetation (e.g., mangroves) occurring across the boundary line (and likely still under MacDill AFB management) were accounted for. While additional acreage was mapped, values reported in this summary table reflect the actual installation acreage per the official boundary.

Figure 5: MacDill Air Force Base Vegetation Classification



2.3.2.3 Future Vegetation Cover
Installation Supplement

Seven predominant ecosystems were identified at MacDill AFB from the September 2019 Vegetation Classification and Mapping survey accomplished by the Center for Environmental Management - Military Lands; classifications include mangrove forest, forest, scrub & shrub wetland, scrub or shrub, grassland, forested wetland and open water. Land cover at MacDill AFB is summarized in Table 5.

Table 5. Ecosystem coverage by area. Ecosystem Type Area (acres) Coverage

Ecosystem Type	Area (acres)	Coverage
Mangrove Forest	765.82	13.4%
Forest	934.7	16.4%
Scrub & Shrub Wetland	68.5	1.2%
Scrub or Shrub	55.5	1%
Grassland	59.65	1.1%
Forested Wetland	59.65	1.1%
Open Water	202.8	3.6%
Developed & Barren Land	3543.5	62.2%

The dominant ecosystems present at MacDill AFB are mangrove forest (13.4%) and forest (16.4%). Mangrove forests are among the most productive ecosystems on earth, and serve many crucial functions, including water filtration, prevention of coastal erosion, coastal protection from storms, carbon storage, food, timber, and livelihood provision, and biodiversity protection, among others. Despite the breadth of services these ecosystems provide, mangrove forests are vulnerable to degradation by land use change, exploitation, coastal development and climate change. Climate change is likely to have a considerable impact on mangrove ecosystems through processes including SLR, changing ocean currents, increased storminess, increased temperature, changes in precipitation and increased emissions (Ellison, 2015).

In general, forests and flatwoods are susceptible to climate change. There is a temperature below which the equilibrium state of the forest appears constant, but above which the equilibrium forest cover declines steadily. This threshold represents a point where some degree of loss of the forest is inevitable. As the threshold is exceeded, there is a gradual increase in the committed die-back, with changes that are more progressive than sudden. Therefore, forest vegetation at MacDill AFB may experience some degree of die-back before impacts are observed. For example, if climate was stabilized at 2050, a significant die-back could still occur over the next 100-200 years.

Slight changes in temperature and precipitation can substantially alter the composition, distribution, and abundance of species, and the products and services they provide. The extent of these changes will also depend on changes in precipitation and fire. Increased drought frequency could also cause major changes in vegetation cover. Losses of vegetative cover coupled with increases in precipitation intensity and climate-induced reductions in soil aggregate stability will dramatically increase potential erosion rates.

Wetlands are also important vulnerable ecosystems at MacDill AFB. These ecosystems could face increases in air and surface water temperatures, alterations in the magnitude and seasonality of precipitation and run-off, and shifts in reproductive phenology and distribution of plants and animals. Wetlands provide linear ecosystem connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change.

Rising temperatures under various climate change scenarios will likely enhance soil decomposition. Together with reductions in rainfall, this may also reduce plant productivity over large areas. Changes in climate may also alter important biomes such as forests.

2.3.2.4 Turf and Landscaped Areas
Installation Supplement

The predominant types of turf and ground cover in developed areas of MacDill AFB include St. Augustine and Bahia grass, and xeriscaping. The grounds maintenance contract outlines the mowing, weeding, fertilization, pest management and other aspects of controlling the aesthetics of these areas. Several of the large turf and landscaped areas at MacDill AFB include the Bay Palms Golf Complex, the cantonment area and associated residential housing, and the airfield complex.

2.3.3 Fish and Wildlife
Installation Supplement

MacDill AFB does not have a large amount of natural areas but it does support an abundance of fish and wildlife. The base is relatively isolated at the tip of the Interbay peninsula, which reduces immigration and emigration of terrestrial species. The base is largely urban which reduces its use by wildlife that require larger home ranges. The quality of native natural areas has been degraded due to historic lack of prescribed fire and extreme non-native and invasive plant infestations.

The general types of fish and wildlife habitats found at MacDill AFB are presented in the following documents:

- Per the MacDill Air Force Base Wildlife Survey (Paul and Schnapf, 1992) six habitat types are present, including: 1) paved runways and taxiways, mowed lawn areas; 2) slash pine plantations; 3) pine flatwoods; 4) mixed pine and oak woodlands; 5) creeks, bays and lagoons, dredged channels; and 6) mangroves and high marsh.
- The draft Habitat Enhancement Survey (Geraghty & Miller, 1994) and Final Endangered Species Population Survey (Geraghty & Miller, 1996a) delineated habitat types on MacDill AFB using the Florida Land Use, Cover, and Forms Classification System (FDOT, 1985). The delineation used 31 land use/cover codes. Figures are available in that report, but were not digitized for GIS use, and acreages of each habitat type are not available.

Much of MacDill AFB is primarily suited to wildlife species adapted to urban environments. However, portions of the installation have considerable habitat values, especially pine forest, wetland, and coastal ecosystems. The general types of wildlife found at MacDill AFB are summarized in the following documents:

- In 1992, the FWC (Beever, 1992) and the National Audubon Society (Paul and Schnapf, 1992) surveyed MacDill AFB for wildlife. These surveys confirmed one reptile, 10 mammal, and 79 bird species. A literature review resulted in the expected occurrence of 20 reptiles, 17 mammals, and 158 birds. Paul and Schnapf (1992) noted that MacDill AFB has very limited value as a breeding site for colonial coastal birds due to a lack of areas isolated from terrestrial predators, especially raccoons. Only scattered pairs of green-backed herons (Butorides virescens), yellow-crowned night herons (Nycticorax nycticorax), and great blue herons (Ardea herodias) are expected. Other "noteworthy" species that might breed include the gray kingbird (Tyrannus dominicensis), black-whiskered vireo (Vireo altilaquus), prairie warbler (Dendroica discolor), and possibly the mangrove cuckoo (Coccyzus minor), all of which are limited to mangrove communities. However, none of these species have been identified as nesting at MacDill AFB. The 1992 survey also identified the presence of the Florida manatee (West Indian manatee, Trichechus manatus latirostris).
- In 1994, a Florida Natural Areas Inventory (FNAI) of MacDill and surveys (Anonymous, 1994; Meshaka,1994; and Woolfenden, 1994) identified several species. Meshaka found 19 reptile and nine amphibian species in surveys during April and August 1994. These included three lizard and two frog non-native species, two species of special concern (gopher tortoise {Gopherus polyphemus} and gopher frog {Rana capito}), and the eastern diamondback rattlesnake (Crotalis adamanteus), an element species. Herpetofauna found comprised 39% of species predicted to occur on wetland, sandhill, and estuarine habitats of the base. The major causes of missing species appear to be a loss of freshwater wetlands and a lack of fire. Woolfenden (1994) reported 109 species of birds during his eight field trips in 1993-1994.
- Geraghty & Miller's (1995-1996) endangered species survey observed one reptile and 13 bird species, including the following: gopher tortoise, roseate spoonbill (Platalea ajaja), burrowing owl (Athene cunicularia), little blue heron (Egretta caerulea), reddish egret (Egretta rufescens), snowy egret (Egretta thula), tricolored heron (Egretta tricolor), American oystercatcher (Haematopus palliates), bald eagle (Haliaeetus leucocephalus), wood stork (Mycteria americana), brown pelican (Pelecanus occidentalis), black skimmer (Rynchops niger), least tern (Sternula antillarum), and white ibis (Eudocimus albus).

- The 2003-2004 endangered species survey by the University of South Florida (USF) observed one reptile and 12 bird species, including the following: gopher tortoise, roseate spoonbill, burrowing owl (Athene cunicularia), little blue heron, reddish egret, snowy egret, tricolored heron, American oystercatcher, bald eagle, wood stork, brown pelican, black skimmer, and white ibis. Figure Protected Species Location Map illustrates the locations of protected species observed during this survey.
- The 2012 Threatened and Endangered Species Survey completed by AMEC Inc. identified 15 bird species and two reptile species including the following: American oystercatcher (Haematopus palliates), bald eagle (Haliaeetus leucocephalus), black skimmer (Rynchops niger), brown pelican (Pelecanus occidentalis), Florida burrowing owl (Athene cunicularia), least tern (Sternula antillarum), little blue heron (Egretta caerulea), piping plover (Charadrius melodus), roseate spoonbill (Platalea ajaja), snowy egret (Egretta thula), Southeastern American kestrel (Falco sparverius paulus), tricolored heron (Egretta tricolor), white ibis (Eudocimus albus), wood stork (Mycteria americana), gopher tortoise (Gopherus polyphemus), and gopher frog (Rana capito).
- 2018-2019: Ecosphere/ESA Scheda performed a T&E species survey over the entire installation. This included gopher tortoise and Florida burrowing owl surveys within the installation's airfield and surrounding natural areas, shorebird surveys throughout the installation's coastline, Audubon's crested caracara (Polyborus plancus audubonii) surveys, acoustic bat surveys, field camera and small mammal trapping. No new federal or state-listed species were discovered during the surveys and the gopher tortoise population was estimated to be stable from the previous survey in 2012.

It is clear that conservation and ecosystem management measures implemented to date at MacDill AFB have improved habitats for the species historically identified on base, as demonstrated by the following:

- Wading birds (e.g., great egret, snowy egret, cattle egret, great blue heron, white ibis, and wood stork) use MacDill primarily for feeding. Conditions seem to be improving for these species due to wetlands improvements.
- Only small mammals are present in notable numbers, including marsh rabbits, raccoons, opossums, armadillos, and gray squirrels. As with songbird species, many mammal habitats are limited by dense forest undergrowth.
- Smallmouth and largemouth bass are the primary freshwater fish species in ponds at MacDill AFB. These fish feed on bream species. There is little freshwater habitat for these fish. The few ponds are shallow due to shallow bedrock, which in turn, creates oxygen stresses. Other species found in Lewis Lake, in particular, include Nile perch, redfish, mullet, and snook. This lake tends to be brackish during at least part of the year.

Fish and wildlife species at MacDill AFB will experience changes due to loss in habitat from climate change. Rising temperatures and rainfall have the potential to alter existing vegetation on MacDill AFB. Invasive plant species such as kudzu and cogon grass are likely to benefit from a changing climate and will potentially become prevalent on post (Bradley, Wilcove, & Oppenheimer, 2010). Changing vegetation communities will have a negative impact on specialist wildlife species which have historically depended on specific native plant species for their survival (Dukes & Mooney, 1999). It will also create open niches for invasive wildlife species to expand into MacDill AFB. Newly arriving invasive species often have the ability to outcompete native species which are already experiencing reduced fitness due to environmental conditions shifting away from historic standards (Hellmann, Byers, Bierwagen, & Dukes, 2008).

SLR will inundate a substantial portion of MacDill. Even in the best-case scenario (RCP 4.5, 2035) 6.7% of MacDill will be submerged due to SLR and in the worst (RCP 8.5, 2065), 17.67% of the installation is likely to be inundated, displacing many terrestrial wildlife species. Mangrove forests will account for the majority of habitat lost due to SLR. Mangroves are an important habitat for a number of wildlife groups such as snakes, lizards, turtles, frogs, birds, rodents and large mammals, which will all be displaced if mangrove habitat is lost. Though mangroves are aquatic to some degree, they require a specific depth of water, and the rate of SLR will push them inland towards higher elevations (Ellison & Stoddart, 1991). Mangroves will not be able to move further inland as urban landscape prevents their movement (Gilman, Ellison, & Coleman, 2007).

Extreme weather events such as 20-year and 100-year Storm Surges will also lead to displacement of a number of species. In 2065, as much as 85.7% of MacDill AFB may be inundated in the 8.5 RCP 100-year SS scenario in which case almost all of the natural landscape on post would be submerged. This will have a drastic effect on species with low dispersal abilities. Birds will be able to evacuate during major storm events and return when floodwaters have subsided but other wildlife and plants may be damaged.

Species that inhabit freshwater ecosystems at MacDill AFB such as smallmouth bass, largemouth bass, and amphibians are vulnerable to climate change. Freshwater habitats on post include shallow ponds that are limited in depth by bedrock and are susceptible to rapid fluctuations in water parameters. Increasing air temperatures will likely cause water temperatures to increase, creating more favorable environments for algal blooms (Paerl, Hall, & Calandrino, 2011). As water temperatures rise in benthic systems, dissolved oxygen content will lower, further decreasing habitat quality for freshwater fish and amphibians. SLR and increased storm intensity will likely lead to saltwater intrusion on MacDill AFB, resulting in conversion of freshwater habitats to brackish ones, further restricting freshwater fish and amphibians.

2.3.4 Threatened and Endangered Species and Species of Concern

Installation Supplement

Several historical surveys have been performed at MacDill AFB to identify any threatened or endangered (wildlife or plant) species as summarized in the following sections.

Wildlife surveys at MacDill AFB identified threatened or endangered wildlife species as summarized below:

- In late 1994, the FNAI and surveys (Anonymous, 1994; Meshaka, 1994; and Woolfenden, 1994) were completed and served as precursors for MacDill's development of a management plan for such species. The 1994 surveys found no new federally-listed threatened or endangered species. Meshaka (1994) found two state-listed species of special concern (gopher tortoise and gopher frog) and one element species (eastern diamondback rattlesnake). Woolfenden (1994) found 24 of the 32 bird species from the FNAI that he predicted would occur on MacDill AFB.

- During 1995 and 1996 Geraghty & Miller, Inc. performed wildlife surveys to identify protected faunal and floral species on MacDill AFB. Survey results were incorporated into the Endangered Species Management Plan (ESMP), MacDill Air Force Base, Florida (Geraghty & Miller, 1996b). These surveys confirmed four protected species previously documented on the base, including: one state-listed threatened species (Least tern) and three state-listed species of special concern (Snowy egret, Black skimmer, and White ibis).

- In 2003, MacDill contracted USF to conduct a threatened and endangered (T&E) species survey. This survey collected data during the winter of 2003 and spring of 2004 and documented findings similar to the 1996 (Geraghty & Miller) survey. Most notably this survey estimated a fairly significant increase (nearly 43%) in the gopher tortoise population on base.

- In 2012, MacDill contracted AMEC Inc. to conduct a T&E species survey. This survey mimicked the protocols and survey methods of the 2003 T&E species survey to allow the best comparison of results between the two surveys. The 2012 survey observed a general increase in bird species, particularly bald eagles, oyster catchers, black skimmers, and wood storks. This survey did note a 27% decrease in the gopher tortoise population when compared to the 2003 survey.

- In 2019 Ecosphere/ESA Scheda performed a T&E species survey over the entire installation. This included gopher tortoise and Florida burrowing owl surveys within the installation's airfield, shorebird surveys throughout the installation's coastline, Northern crested caracara surveys, acoustic bat surveys, and field camera and small mammal trapping. No new federal or state-listed species was discovered during the surveys and the gopher tortoise population was estimated to be stable from the previous survey in 2012.

Special concern wildlife includes those species whose legal or other special interest status is such that special provisions may be needed for their management and protection. Within this category are threatened and endangered species (both federal and state-listed), species at the edge of their ranges, and species with high public interest.

MacDill AFB, and the surrounding waters, have the potential to support 11 federally-protected wildlife species including the bald eagle, and several state-protected species or species of special concern. These species are further elaborated in Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats.

Previous plant surveys at MacDill AFB indicate no threatened or endangered plant species are present on the base, as summarized below:

- In 1993 the FNAI undertook a survey for rare plants on MacDill AFB. This survey originally considered 14 species of plants based on potential plant communities. After the first site visit, the survey concentrated on Hairy beach sunflower (Helianthus debilis spp. Vestitus) and Necklace pod (*Sophora tomentosa*). Neither species was found on installation.

- Only one federally-listed threatened or endangered plant species has been confirmed in the vicinity of MacDill AFB, the Florida golden aster (*Chrysopsis floridana*). It is an endangered plant found in sand pine scrub habitats but historically on beach dunes. In Hillsborough County, the species is only found on small privately-owned sites near Ruskin and Riverview, Florida. This site is over 8 miles from the closest potential habitat at MacDill AFB and has never been confirmed on base.

However, MacDill AFB has sea oats (*Uniola paniculata*) and sea grapes (*Coccoloba uvifera)* on its shoreline; these plants are protected within the state of Florida, not as threatened or endangered species, but under Florida Statutes Chapter 161.242. The purpose of this regulation is to protect the beaches and shores of the state from erosion by preserving natural vegetative cover to bind the sand. This regulation states: "It is unlawful for any purpose to cut, harvest, remove, or eradicate any of the grass commonly known as sea oats or *Uniola paniculata* and *Coccolobis uvifera* commonly referred to as sea grapes from any public land or from any private land without consent of the owner of such land or person having lawful possession thereof."

Climate Change Effects on Threatened and Endangered Species

Sea turtle species utilize beaches as nesting habitat. Beach habitat will most likely be lost due to SLR. Sea turtle embryo mortality occurs when temperatures are above 91.4 °F (33 °C) and the projected increases in temperature on MacDill AFB could result in mortality inducing temperatures for incubating eggs, though no sea turtles have been documented nesting on base. Sea turtles are temperature-dependent sex determination species in which higher incubation temperatures result in the development of female hatchlings while lower incubation temperatures result in the development of male hatchlings. The projected increases in temperature on MacDill AFB could result in higher incubation temperatures that result in female sex-biased populations developing. Additionally, a study suggests that hatchling size for loggerhead sea turtle (Caretta caretta) can be influenced by temperature with higher temperatures resulting in smaller hatchling sizes. The projected increase in temperature could potentially result in smaller hatchlings developing on the base's property. SLR and/or storm surge inundation that is projected to occur on MacDill AFB could also indirectly impact sea turtle species by causing nesting habitat loss.

2.3.5 Wetlands and Floodplains

Installation Supplement

In May 2019, a vegetation ecology project was initiated at MacDill AFB and most accurately detailed the different vegetation communities located on base. There are 1,195 acres of identified wetlands quantified on MacDill AFB (CEMML, 2019). The acreage and classification of these wetlands: 880 acres of estuarine scrub/shrub emergent wetlands, 200 acres of palustrine wetlands, and 115 acres of needle-leaved forested wetlands.

More than 20% of MacDill AFB is wetlands, including more than 500 contiguous acres of prime mangrove community along the installation's southern coastline. This mangrove community was impacted through past human disturbance (mosquito ditching and landfilling activities). MacDill AFB has developed an Ecosystem Restoration Master Plan (ERMP; Appendix E) that outlines a multi-phased approach to restoration of this mangrove system. Wetlands restoration work that is completed within the "Ecosystem Restoration" area will be tracked for wetlands credits with the appropriate state and county resource agencies. These credits offset possible future wetlands impacts for base maintenance activities or projects. The USACE will not issue wetland credits for the mangrove restoration work outlined in the ERMP unless a mitigation bank is established on MacDill AFB. The time and money needed to permit the creation of a mitigation bank on base is not warranted given the unknown return of mitigation credits, which may or may not be needed in the future.

The most critical wetland issue is the invasion of wetlands by invasive plant species, particularly Brazilian pepper, and is discussed more thoroughly in Section 7.11 Integrated Pest Management. A second issue is the infilling of drainage canals and ditches by mangroves within the urbanized area of MacDill AFB. Mangroves are a security hazard (i.e., blocked fields of vision) and an impediment to proper drainage (i.e. obstruct canal flow). In many cases, mangroves are very close to highly built-up areas with a high amount of public use.

Generally, MacDill AFB has high quality wetlands and issues involved with them are not threatening to the military mission. Resolving the above issues requires securing funding for the control of invasive species and restoration projects.

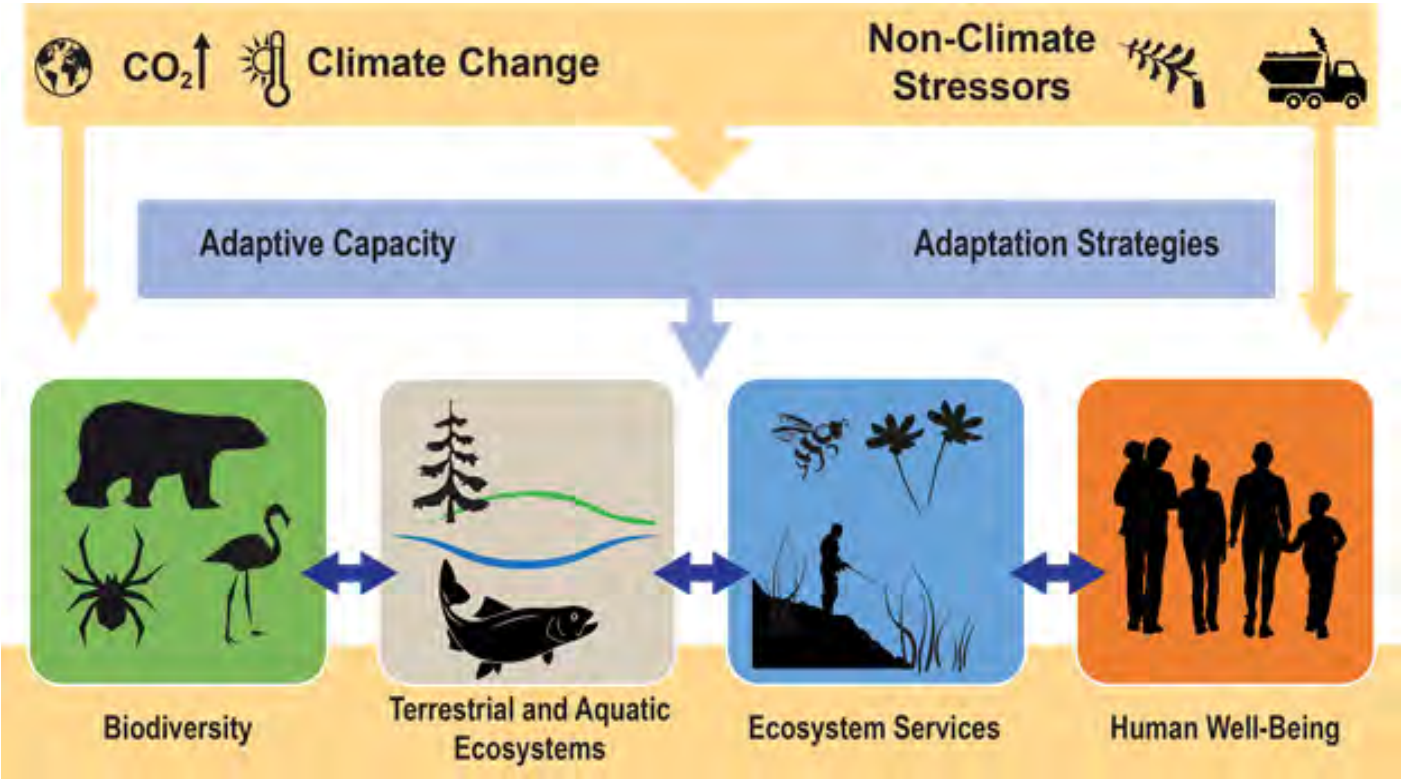
2.3.6 Other Natural Resource Information

Installation Supplement

Ecosystem Services

The natural environments at MacDill AFB provide numerous ecosystem services. It is difficult to assign a monetary value to the majority of these services, and therefore many times they are not adequately valued against other competing demands that provide a clear economic benefit. Current and former members of the military, and their families, can enjoy a multitude of recreational activities including but not limited to hiking, biking, canoeing, fishing, wildlife viewing, and golfing. Fishing opportunities provide both recreational and provisioning services. The same forests and waters used by recreationists also provide supporting services such as nutrient cycling, water filtration, carbon sequestration, and air purification. The activities detailed in this INRMP strive to maintain and improve these valuable ecosystem services. Figure 6 shows how ecosystem services interact with several aspects of an adaptive natural resource management strategy (Lipton et al 2018).

Figure 6: Climate Change, Ecosystems, and Ecosystems Services (Source: Lipton et al 2018)



2.4 Mission and Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Installation Supplement

There are several natural resource constraints to the military mission at MacDill AFB. Although none of these constraints are likely to result in the prevention of mission execution, they influence planning decisions and management actions. When mission planning MacDill AFB has three major constraints: a majority of area is within 100-year floodplain, a significant amount of wetlands/surface waters are found within the property, and a large portion of the installation and adjacent property comprises of habitat suitable for T&E species. These constraints can be looked at separately but provide a greater picture when looked at as a whole.

The installation is naturally constrained due to the amount of physical land available within the installation boundaries, and the urban interface outside of the installation. The 100-year floodplain covers a significant portion of the installation, and surrounding peninsula, and this impacts military operations during large tropical rain events and extended high flood events. The impacts from heavy rain events occur to the airfield and military housing, and recreation, units by increasing the possibility of flooding and access to these locations. The floodplain constrains the areas that can be further developed or expanded to accommodate additional mission needs and requirements. An additional constraint is the large amount of wetlands (1,195 acres) occurring on installation and the associated surface water these provide. Both wetlands and surface water attract several avian species for foraging, shelter, and breeding habits that become a hindrance to flight operations.

A final constraint is the large amount of T&E species habitat present within the installation boundaries and in the surrounding marine ecosystems. These ecosystems include pine flatwoods, beaches, tidal flats, canals, and open water. Several areas with developed or semi-developed habitat, like the airfield and associated aircraft ramps, also support T&E species. The maintenance and restoration of these habitats can constrain the current or future military missions by, such as the 100-year floodplain and wetlands, preventing further development needed for mission activities and support.

The Environmental Element staff works cooperatively with the MacDill AFB BASH team, pest management department, golf course grounds crew, civil engineering, and other installation units/teams to ensure no net loss of military missions due to natural resource or environmental constraints. While many more aspects of the environmental management and compliance program could be considered mission constraints, most are accepted as normal and routine and are not currently identified as constraints.

Climate Change Impacts to Mission and Mission Planning

The primary resource requirement for the sustainment of the military mission at MacDill AFB is open space in which to provide air refueling, airlift, and contingency response capabilities. Climate change will have negligible to no effect on the amount of open space available. The climate at MacDill AFB is expected to get hotter, which could have secondary effects on the mission such as vegetation shifts and species migrations leading to an increased regulatory environment. Several key assets at MacDill are in danger of frequent inundation, and could provide the biggest natural resource threat to the military mission and planning at MacDill AFB. Virtually all installation infrastructure at MacDill AFB will be highly vulnerable during at least one climate change scenario, with many assets being highly vulnerable under all conditions. Significant impacts to the military mission could occur at MacDill AFB due to possible inundation of more than 85% of the installation associated with the 100-yr SS projections for 2065.

Future impacts to the mission at MacDill AFB linked to climate change could include:

- increases in temperature and wind velocity leading to unsafe environmental conditions for the launch of current and planned weapons and equipment, resulting in increased maintenance requirements, requirements for new equipment, or decreased launch capacity (DoD, 2014);
- increased dust generation affecting equipment and visibility (DoD, 2014);
- increased wind velocities damaging vital mission infrastructure (Sydeman et al., 2014);
- increased drought potential (Scanning the Conservation Horizon A Guide to Climate Change Vulnerability Assessment, 2011);
- potential loss of future training areas that may be needed in light of a changing geopolitical landscape and base realignment.

In addition to these direct effects, climate change has the potential to disrupt the acquisition and transportation of materials required for the maintenance, construction, and storage of the equipment required for these systems (DoD, 2014).

2.4.2 Land Use

Installation Supplement

MacDill AFB covers approximately 5,695 total acres. This includes a total of 1,290 acres of improved and urban lands (housing, paved surfaces, facilities), 2,253 acres of maintained improved areas (airfield, lawns, golf course), 208 acres of fresh and marine waters, and 1,944 acres of natural areas. The amount of natural areas has decreased since 2017 due to the construction of multiple new facilities [UH-60 Army Reserve Aviation Support Facility and SOCCOM Military Information Support Operations (MISO) Facilities] and outdoor recreation features (skeet and grenade range). The estimated breakdown of land uses at MacDill AFB is shown in Table 6 below.

Table 6: Summary of Land Use at MacDill AFB

Land Use Categories	Approximate Area (acres)
Urban	1290
Natural Areas	1944

Water/Ocean	208
TOTAL	**5695**

2.4.3 Current Major Mission Impacts on Natural Resources

Installation Supplement

Due to the nature of the activities and proximity to sensitive habitats, the military mission at MacDill AFB affects natural resources. The following sections described these impacts. This INRMP documents projects and management processes to be implemented on installation to minimize such impacts on natural resources and conservation efforts.

Air and Water Pollutant Point Sources

MacDill AFB has a non-Title V (synthetic minor) permit for several air discharge point sources from multiple emergency generators. All other sources of air emissions are considered exempt including natural gas fired units, painting, parts washers, woodworking, etc. A detailed tracking and accounting system known as the Air Program Information Management System (APIMS) is used to identify and track sources of air pollution. There are no significant sources of air pollution from the base with the exception of pollution typical of urban areas associated with vehicles, or from periodic prescribed burns. MacDill AFB coordinates all prescribed burns through the Florida Forest Service (FFS). Historically, MacDill AFB has only conducted one prescribed burn every 1-3 years; each event covered an area of approximately 40 acres or less, and took one day to complete, with additional days for secondary procedures such as "mop-up". Since the establishment of the Air Force Wildland Fire Branch in 2012, MacDill AFB has increased its prescribed burn program, conducting an average of one or more prescribed burn every year since 2014. The acreage burned is planned to be increased on a rolling 5-year average until all of the forested areas are burned once every 3-5 years, according to ecosystem type, and in accordance with historical fire return intervals. The Air Force Wildland Fire Branch calculates burned acreage in fiscal year time frames and 77 acres were burned in fiscal year 2021.

There is only one wastewater discharge point source, the Defense Fuel Supply Point (DFSP) tank farm, which has an industrial discharge outfall permitted under the National Pollutant Discharge Elimination System (NPDES). Historical use and/or releases of various chemicals or petroleum products have impacted groundwater at the base, as described in the following subsection Groundwater Contamination.

Noise Pollution

Aside from aircraft operations, there are no other significant noise sources at the base. Detailed information related to noise pollution at MacDill AFB can be found in the Air Installation Compatible Use Zone (AICUZ) study (Parsons Corporation August, 2008). Land close to MacDill AFB is subject to high noise levels associated with aircraft maintenance and operations. MacDill AFB has attracted development to the immediate surrounding area, and in the absence of compatible land use controls, inappropriate uses may eventually cause conflicts between flight operations and landowners. As previously stated, the City of Tampa controls zoning and development in areas outside the base boundaries, and the AICUZ addresses the coordinated, ongoing effort between City and base personnel to ensure land uses are compatible.

Per the AICUZ, some of the measures MacDill AFB implements in order to alleviate accidents and noise pollution associated with aircraft operations include:

- Utilize well-maintained aircraft and well-trained aircrews.
- Restrict flying activities to the extent practical by actions such as:
    - Route flights over sparsely populated areas as regularly as possible.
    - Conduct flying operations during daylight hours when expected noise disruptions are less.
    - Adjust flight pattern altitudes and the runway approach angles.

- Periodically review traffic patterns, instrument approaches, weather minima and operating practices with respect to populated areas and local conditions, and adjust as applicable.

- Work with the federal and local governments to acquire property located in the clear zone (CZ) for MacDill's runways, and properly zone property located in the accident potential zone (APZ).

- Continue to coordinate with local governments, agencies and populace to identify and if possible, prevent potential land use conflicts. Land use restrictions should include density, height restrictions, construction requirements for noise load control, etc.

Hazardous Materials/Wastes

Hazardous materials used or stored on base include various organic solvents, chlorine, Freon, paints, thinners, oils, lubricants, compressed gases, pesticides, herbicides, nitrates, chromates, stripping materials, waste oils, waste paint- related materials, and other miscellaneous wastes. A detailed tracking and accounting system known as the Air Force Enterprise Environmental, Safety, and Occupational Health Management Information System (EESOH-MIS) is used to identify potentially hazardous materials and ensure that organizations are approved to use specific materials. Hazardous and toxic wastes generated at MacDill AFB are not released into the environment with the exception of minor pollution of groundwater as described in the preceding subsection 2.2.4 Hydrology.

Several hazardous waste Initial Accumulation Points (IAPs) are located throughout the base. The main hazardous waste facility (permitted for 90-day storage) is located at a secure facility within MacDill AFB. Wastes are collected from the satellite IAPs and transported to the main storage facility by 6 CES Environmental Element staff. The Defense Reutilization and Marketing Office is responsible for the final disposition of hazardous wastes.

Waste oil is accumulated at sites throughout the base and is periodically picked up by an outside contractor for recycling. Waste antifreeze, tires, batteries, and fluorescent bulbs are also picked up by outside contractors for recycling.

Groundwater Contamination

The only pollution of the local environment caused by MacDill AFB is the minor pollution of the groundwater within the surficial aquifer and Floridan aquifer from various past releases of petroleum products and/or solvents from industrial areas, storage tanks, etc. MacDill's Environmental Restoration Program (ERP), formerly known as the Installation Restoration Program, is responsible for identifying impacted sites on base and completing assessment, remediation and closure of these sites in accordance with applicable laws and regulations (e.g., FDEP cleanup criteria). The types of ERP sites on base currently include petroleum contamination sites, solid waste management units, areas with land use controls in place to prevent exposure to contaminants, areas subject to long-term monitoring, oil water separators, and general compliance sites. The status of active ERP sites range from undergoing assessments to long term monitoring of remediation systems and/or land use controls.

2.4.4 Potential Future Mission Impacts on Natural Resources

Installation Supplement

MacDill AFB is currently being considered as a home base for the KC-46A Pegasus as part of the Main Operating Base (MOB) 6 Environmental Impact Statement (EIS). The aircraft would replace the existing KC-135 Stratotanker on a one-to-one basis. No part of the proposed beddown would cause a change to management of natural resources at MacDill AFB as the mission of the base would remain the same. It is anticipated that approximately 38 percent fewer flights would occur with the KC-46A aircraft, which would have an overall net positive impact on natural resources at the installation. Currently, hazardous materials and petroleum products used to accomplish the mission at MacDill AFB present the highest potential impacts to installation natural resources. Due to the materials handling, storage and disposal procedures implemented at MacDill AFB, and the proven record of prompt response to accidental releases or disposal from unforeseen conditions or accidents, it is unlikely that pollution impacts would occur.

3 ENVIRONMENTAL MANAGEMENT SYSTEM

The USAF environmental program adheres to the Environmental Management System (EMS) framework and its Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13834, *Efficient Federal Operations*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and International Organization for Standardization (ISO) 14001 standard, *Environmental Management Systems – Requirements with guidance for use*, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively manage associated risks, and instill a culture of continual improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

4 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities that are necessary to implement and support the natural resources program are listed in the table below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Installation Supplement

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Installation Commander	6 ARW Commander: • evaluates planned mission activities and considers the effect of those actions on base natural resources; • provides the input, data and support needed to maintain a successful natural resources program.
AFCEC Natural Resources Media Manager/Subject Matter Expert (SME)/ Subject Matter Specialist (SMS)	Provides technical support and reviews / planning, programming, budgeting, and funding approval and execution of projects that support the INRMP and Sikes Act.
Installation Natural Resources Manager/POC	Responsible for: • proposing, requesting funding, scheduling and completing the projects necessary to achieve those goals and objectives. • supervision of the natural resources program through the collection and interpretation of data, adjusting management practices, building community partnerships • briefs leadership and ensures the base natural resources continue to support the military mission.
Installation Security Forces	Provides conservation law enforcement (CLEO) support as needed.
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	Provide support for conservation initiatives and community events through distribution/advertising within respective units.
Installation Wildland Fire Program Manager	Supports implementation of prescribed burn activities, including technical support, updates to Wildland Fire Management Plan, site preparation, and burning.

Range Operating Agency	Not Applicable at MacDill AFB
Conservation Law Enforcement Officer (CLEO)	FWC provides 20 hours of CLEO presence weekly. Ensures public compliance with state wildlife laws and regulations.
NEPA/Environmental Impact Analysis Process (EIAP) Manager	These duties are performed by the Natural Resource Manager to ensure accurate evaluation of potential effects associated with Proposed Actions. Avoids or minimizes natural resource impacts through completion of EIAP documents.
National Oceanic and Atmospheric Administration (NOAA)/ National Marine Fisheries Service (NMFS)	Federal agency providing oversight and guidance on natural resources management practices that may affect aquatic wildlife resources, particularly those protected under the ESA. Participates in INRMP reviews and revisions.
US Forest Service	Provides technical support related to forestry actions as needed.
US Fish and Wildlife Service	Federal wildlife agency providing assistance and guidance on natural resources management practices that may affect wildlife resources, particularly those protected under the ESA. A USFWS biologist is currently embedded at MacDill AFB.
6th Civil Engineer Squadron Director	Responsible for: • maintaining an organization with the resources available to accomplish the INRMP; • implementing this INRMP and its programs to ensure the inventory, delineation, classification, and management of all applicable natural resources; • coordinating with local, state, and federal governmental and civilian conservation organizations relative to natural resources management; • ensuring the ongoing and timely coordination of current and planned land uses between mission, natural resources, environmental, legal, and master planning; • ensuring all installation personnel are aware of and comply with procedures and requirements necessary to accomplish objectives of this INRMP together with laws, regulations, and other measures that promote environmental quality; • reviewing all environmental documents, construction designs, and proposals to ensure adequate protection of natural resources and ensuring that technical guidance presented in this INRMP is adequately considered; and • inspecting and reviewing mitigation measures that have been implemented or recommended for the protection of natural resources.
AF Wildland Fire Branch	A collaborative organization including personnel from the USFWS, Air Force and Colorado State University established by the AF to manage implementation of prescribed burns throughout the AF. A wildland fire module is stationed at Avon Park Air Force Range and oversees the implementation of wildland fire operations at MacDill AFB. Administratively

	run by AFCEC in Joint Base San Antonio.
Audubon of Florida	A non-profit organization providing support for the preservation, protection, and improvement of terrestrial and marine resources that support avian species in Florida, including the Tampa Bay region.
Environmental Protection Commission of Hillsborough County (EPC)	A local county agency providing guidance on any activities that have the potential to affect the environment within Hillsborough County.
Florida Department Environmental Protection (FDEP)	A state agency providing guidance on any activities that have a potential to affect the environment within the State of Florida. Their regulatory authority covers a broad range of resource areas, including but not limited to, solid waste management, contamination assessment and remediation, air emission sources, wetlands, and water resources.
Florida Fish and Wildlife Conservation Commission (FWC)	A state wildlife agency providing CLEO support, oversight, and guidance on natural resources management practices that may affect wildlife resources, particularly those protected under Florida state law.
AFCEC Installation Support Section (ISS) Staff	Provide support to base level natural resources management through expert advice and management recommendations, as well as the evaluation and support of projects developed for natural resources management.
Judge Advocate	Provides legal advice, counsel, and services to command, staff, and subordinate elements at the 6 ARW. Specific Judge Advocate responsibilities with regard to integrated natural resources management include: • conducting legal research and preparing legal opinions pertaining to interpretation and application of laws, regulations, statutes, and other directives; • coordinating with the Department of Justice, Litigation Division of the Office of the Judge Advocate General, and other governmental agencies on matters pertaining to litigation for the federal government; and • advising the 6 ARW on compliance with environmental laws.
Southwest Florida Water Management District (SWFWMD)	A state agency guiding the use and management of groundwater and surface water resources within the southwestern portion of Florida. They have supported the management and restoration of natural resources systems through partnership on restoration projects and the award of grants
Tampa Bay Estuary Program (TBEP)	A local non-profit organization striving to protect and improve the resources of Tampa Bay. They have supported the MacDill AFB natural resources program through funding and volunteer support.

	and oyster dome/reef installation) throughout the past 17 years on installation.

5 TRAINING

USAF installation NRMs/POCs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Installation Supplement

Natural resources management training is provided to ensure that base personnel, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Natural resources training and records can be found on the installations eDASH page or at the link below:

MacDill AFB Training Records

6 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records IAW Air Force Manual 33-363, *Management of Records*, and disposes of records IAW the Air Force Records Management System (AFRIMS) records disposition schedule (RDS). Numerous types of records must be maintained to support implementation of the natural resources program. Specific records are identified in applicable sections of this plan, in the Natural Resources Playbook, and in referenced documents.

Installation Supplement

MacDill AFB follows the guidelines and recommendations set out in AF Manual 33-363, Management of Records.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC Natural Resources Media Manager and SMS should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

Installation Supplement

MacDill AFB follows the guidelines and recommendations set out in the Environmental Reporting Playbook for proper guidance and execution of data gathering, quality control/assurance, and report development.

7 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

Installation Supplement

MacDill AFB uses an ecosystem management approach, as described in Section 1, for the basis of natural resources management. Ecosystem management provides a holistic perspective to the lands and waters at MacDill AFB, encompassing the sustainability and biological diversity of terrestrial and aquatic ecosystems while supporting sustainable economies and communities. The Environmental Element staff at MacDill AFB is small and relies heavily on adaptive management of the natural resources within the installation's boundaries. The plans for Wildland Fire Management, Fish and Wildlife Management, Coastal Zone Management, Wetland Management, General Land Management, and Outdoor Recreation Management are closely related and integrate into a single ecosystem and adaptive management approach. Conversely, Grounds Maintenance is a separate activity/contract since it is the responsibility of persons and organizations outside of 6 CES Environmental Element.

Under an ecosystem management approach, MacDill's component management strategies are integrated into an all-encompassing natural resources management plan as outlined in this section. In addition, the programmatic framework for achieving natural resources program goals at MacDill AFB is presented in this section, encompassing activities such as legal compliance, land and water stewardship, and the protection of biological diversity. The programmed projects designed to manage the resources described below and achieve INRMP goals and objectives are listed in INRMP Work Plan Implementation Table.

Invasive plant species are the most detrimental problem affecting upland natural resource management at MacDill AFB, adversely affecting habitat for native fish and wildlife in both wetlands and uplands, including habitat for federal and state threatened and endangered species and species of special concern. Proper management of invasive plant species via an integrated pest management approach is crucial and offers the highest overall benefit for base resources and mission support. Management tools used to address invasive species and habitat restoration are discussed in the following sections.

7.1 Fish and Wildlife Management

Installation Supplement

Applicability Statement

This section applies to all AF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Fish and wildlife management issues on MacDill AFB, including those related to threatened and endangered species, are related to a long-term decline in quality of habitat, primarily upland forests and wetlands. As these issues are resolved over time, fish and wildlife populations are likely to respond in a positive manner. For example:

- The increased growth of invasive plant species is a fish and wildlife issue that affects both wetland and upland habitat. Non-native invasive species displace native vegetation and do not provide suitable habitat for native fish and wildlife.
- The exclusion of fire from installation's forested land has significant wildlife implications. It allows for the increase in invasive plant species, decreases wildlife habitat quality and foraging opportunities and prevents the growth of native herbaceous plant species among more detrimental effects.
- The invasion of freshwater and coastal systems by aquatic invasive plants reduces and degrades the quality of aquatic habitats.

The following sections describe or reference day-to-day ecosystem management activities and issues for protection of fish and wildlife. The control of hunting harvest is a common wildlife population tool, but this is not applicable to MacDill AFB. Fishing harvest is controlled by Florida state regulations and overseen by FWC personnel.

Climate Change Impacts to Fish and Wildlife Management

Large areas of natural habitat found at MacDill AFB are likely to be inundated by sea-level rise (SLR) or are at risk of flooding. Formal threatened and endangered species surveys are conducted every 5 years to monitor changing wildlife communities. Incidental observations of threatened and endangered species are collected as they occur and are reported to the 6 CES Environmental Element. Climate change is expected to enhance the spread of vector-borne diseases, introduce new vector-borne diseases (Githeko, Lindsay, Confalonieri, & Patz, 2000), and promote continued proliferation of invasive species. Invasive species management strategies are flexible and adapt to accommodate an evolving array of issues (Hellmann et al., 2008).

Potential for algal blooms will increase as temperatures rise, which can reduce dissolved oxygen in aquatic environments and potentially harming freshwater fish and amphibian populations. Management efforts should focus on removal of non-native aquatic plants and algae as well as reducing nutrient rich run-off into water supplies to help maintain stable dissolved oxygen levels, which will reduce the changes of algal blooms. The eastern Gulf of Mexico has historically been prone to toxic algal blooms with a severe bloom occurring along the entire western shoreline of Florida in 2018. This bloom did not enter Tampa Bay but had been detected at the mouth of the bay for several months. Providing shade through planting trees around water sources will help to prevent excessive increases in water temperature (Poff, Brinson, & Day, 2002).

SLR and increasing flooding will likely have a negative impacts on wildlife communities found on installation. For those species with high dispersal abilities such as birds, temporary floodwaters will not pose serious concerns. Other wildlife groups such as mammals and reptiles will have a harder time evacuating, as much of the wildlife habitat on installation is located at the tip of the peninsula. Wildlife will have to evacuate through urban environments and will not likely migrate back to MacDill AFB after floodwaters have subsided, as no wildlife corridor exists. Construction of wildlife corridors would be beneficial for maintaining more diverse wildlife communities on MacDill AFB but would need to be coordinated with local communities and is highly unlikely to occur in the near future.

7.2 Outdoor Recreation and Public Access to Natural Resources
Installation Supplement

Applicability Statement

This section applies to all AF installations that maintain an INRMP. MacDill AFB is required to implement this element.

Program Overview/Current Management Practices

Public access to MacDill AFB, including outdoor recreation, is limited to personnel with military identification. The high security nature of the installation precludes such use by the general public. The demand for public access to the installation for outdoor recreation is low as most outdoor recreation options offered on the installation are readily available off-installation. There are provisions for installation personnel to bring supervised guests to participate in many outdoor recreational activities. Hunting is not allowed due to the risk to human safety and the close proximity of equipment and facilities to natural areas. MacDill AFB conservation law enforcement officer (CLEO) presence is currently provided by FWC law enforcement for 20 hours/week since June 2019. This is further expounded upon in Section 7.3 Conservation Law Enforcement.

Outdoor recreational opportunities for personnel with access to MacDill AFB include, but are not limited to, fishing (with appropriate state license), hiking, biking (road and trail), kayaking, canoeing, golfing, birding, skeet-shooting, boating, disc golf, jogging, and swimming.

Outdoor recreation is tied to the natural resources upon which it depends. Though the term “non-consumptive” is used for many of the activities available at MacDill AFB, it is important to ensure that the recreational use of the installation’s natural resources is consistent with the ecosystem management philosophy. Much of the information for this section comes from Outdoor Recreation Plan for MacDill Air Force Base, Dec 92 to Dec 97 (Haukaas, 1992).

Several recent, or continuous, projects have enhanced the outdoor recreation areas at MacDill including:

- The Phase III Surface Water Improvement and Management (SWIM) Restoration project recently restored 110 acres of wetlands around Lewis Lake and the Bay Palms Golf Course, expanding the lake, creating fishing peninsulas, and improving habitat for wildlife, which creates additional wildlife viewing opportunities around both.
- Installation of oyster reefs along MacDill's southeastern shoreline have created marine habitat and increased species diversity along the shoreline, which has provided enhanced fishing and wildlife viewing opportunities.
- Relocation of a 12-hole disc golf course from around Lewis Lake to the Bay Palms Golf Complex: North Course by the Force Support Squadron.
- Dredging of the marina channel was accomplished in 2005 and again in 2017.
- Restocking of catfish in Lewis Lake and McLellan Pond by USFWS for recreational purposes.

- Prescribed fire within recreation areas reduces invasive plant species coverage that restrict viewshed opportunities, and promotes wildlife usage of the areas which enhances hiking.

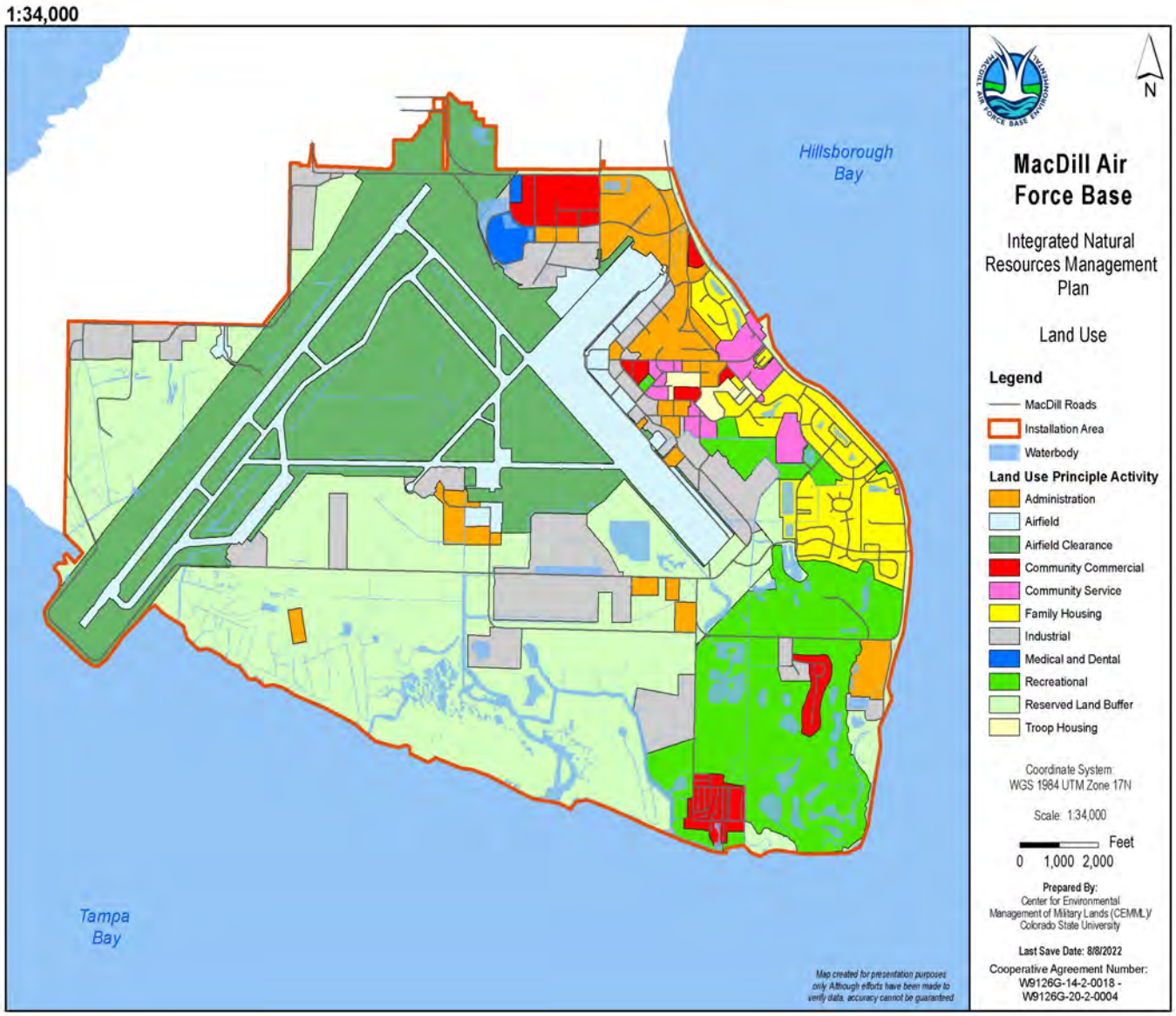
The base has approximately 60 acres of freshwater ponds and 8.7 miles of shoreline, a small portion of which is suitable for beach activities. MacDill AFB has one hiking trail (1.5 miles), one nature trail (1.0 mile), and one jogging trail (6.0 miles). Table 7 (Land Use Categories at MacDill AFB) indicates the status of recreation areas at MacDill AFB. There are no Open Areas accessible to the general public. All unimproved lands available for recreation are Restricted Areas. These Restricted Areas are accessible to the base population including: active duty military, DoD civilians, active duty dependents and family, military retirees, DoD civilian retirees, and installation prime contractors. Several Off-Limit Areas are present on base and include fenced environmental restoration sites, the airfield, the small arms range safety zone, the explosive ordnance disposal (EOD) range, wastewater treatment plant (WWTP) effluent ponds, and the marine security zone. The marine security zone has been opened to the general public for fishing on few occasions. When this occurs, access is granted to both the marine security zone and the small arms range safety zone. There are no scheduled dates or times for when this occurs and is at the discretion of the installation commander.

There is limited consumptive recreational use of fishing resources at MacDill AFB and no wildlife take is allowed. The freshwater fishing program is minimal, and hunting is not compatible with the urban landscape and security of the installation. Fresh and/or saltwater fishing requires Florida state licenses obtained through FWC, even if fishing occurs from a pier or shoreline. Boats are no longer allowed to enter the waters around MacDill AFB due to the marine security zone; however, some saltwater wade fishing does occur from piers on the east side of the base, and by wading along the shallow shorelines. Recreationist compliance with fishing regulations is largely voluntary. Violations of state fishing regulations (size, bag limits and lack of proper license) are to be reported directly to the local Florida Fish and Wildlife Conservation (FWC) CLEO office. FWC CLEO officers can write violations of state fishing regulations when encountered during patrols. Signs and other resources that present the state fishing regulations (size limits, bag limits, and open seasons) are posted/available in various locations helping to notify and educate the general public (particularly out of state visitors to the Family Campground) and reducing the occurrence of violations.

Climate Change Impacts to Outdoor Recreation and Public Access to Natural Resources

Outdoor recreation and access to natural resources is likely to be greatly impacted by climate change. Freshwater fishing opportunities may be lost due to the possible loss of freshwater habitat by saltwater intrusion on MacDill AFB. However, brackish and saltwater fishing opportunities are likely to persist. Facilities and infrastructure associated with golf, disc golf, camping, beach access, picnicking, mountain biking, running, hiking and wildlife viewing are likely to be impacted by SLR and flooding due to storm surge. Infrastructure associated with recreation can be moved further inland but are likely to continually be damaged by an increasing frequency and intensity of storms. Infrastructure associated with recreation that is moved inland could become incompatible with the military mission and land area constraints of the installation.

Figure 7: Land Use Categories



7.3 Conservation Law Enforcement
Installation Supplement

Applicability Statement

This section applies to all AF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Section 107 of the Sikes Act (16 USC § 670e-2) requires that a sufficient number of professionally trained natural resources law enforcement personnel be available to carry out the tasks required in the Sikes Act. The act also gives the MacDill AFB commander the authority to directly enforce federal laws relating to fish and wildlife when violations occur on the installation.

MacDill AFB has concurrent jurisdiction for enforcement purposes. This allows both state and federal enforcement officials to enforce conservation and natural resource laws within the installation boundaries. Historic presence of state and federal CLEOs on installation was minimal, but recent cooperation with FWC and SFS has increased the amount of monitoring and patrolling.

The FWC currently has a rotation of CLEOs, based out of the Tampa field office, that monitor MacDill AFB for 20 hours per week to enforce Florida state conservation and natural resource laws. The USFWS has a regional CLEO presence but does not routinely monitor the installation. The USFWS Law Enforcement (LE) division is involved with issues pertaining to species covered under the ESA, Bald and Golden Eagle Protection Act, and other federal conservation, natural resource and cultural resource laws. USFWS LE is contacted for situations involving these federal laws. Close collaboration between the Environmental Element and the AF Office of Special Investigation (OSI) Tampa Field Office, located at MacDill AFB, is crucial for the proper authorities to be contacted and expedient administration potential criminal activity. The MacDill AFB NRM is informed of all natural and cultural resource violations reported.

As of 2014, the FWC has begun sending agency representatives to the installation on a routine basis to survey anglers and determine the species that are being caught, and if anglers are complying with state size and limit regulations. The collection of anecdotal information on fish populations and water conditions is periodically performed. FWC representatives typically visit the base on weekends (Friday to Sunday) to perform these tasks, when there is higher chance of base personnel angling or utilizing these resources.

7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats
Installation Supplement

Applicability Statement

This section applies to AF installations that have threatened and endangered species on AF property. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

Management for threatened and endangered species does not currently have a current negative affect on MacDill AFB's military mission. Ongoing implementation of MacDill's INRMP and other supporting management plans and documents (Appendices), along with the overarching ecosystem management processes outlined in this INRMP, will ensure protection of species and habitats, enable the combination of tasks or projects to address management issues, and prevent conflicts in future planning of land or resource use**.**

The following are descriptions of the federal T&E and candidate species known, or with the potential, to occur inside the boundaries of MacDill AFB:

American crocodile (*Crocodylus acutus)*

American crocodiles (*Crocodylus acutus)* were listed as endangered under the Endangered Species Act in 1975. The American crocodile is a large, greenish-gray crocodilian with black mottling. In Florida, adults reach lengths of about 3.8 m, although a specimen measuring 4.7 m was reported in the late 1800s. The species is similar in appearance to the American alligator (*Alligator mississippiensis*), and is the reason why the American alligator is listed as Threatened due to Similarity of Appearance. A lateral indentation of the upper jaw leaves the fourth tooth of the lower jaw exposed when the mouth is closed. Compared to the alligator, the American crocodile may be distinguished by its longer, narrower, more tapered snout and the exposed fourth tooth of the lower jaw.

The American crocodile is found in mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps, such as Tampa Bay. Natural nesting habitat includes sites with well drained sandy shorelines or raised marl creek banks adjacent to deep water. Crocodiles also nest on elevated man-made structures such as canal berms and other places where fill has been introduced. Recent changes to the species distribution within southwest Florida now includes Tampa Bay at the extreme northern extents of the species range. Several confirmed sightings within the past several years has prompted this change, and several of those sightings have occurred near MacDill AFB. While MacDill AFB does contain suitable nesting habitat for the species along the southern shoreline and within the adjacent wetlands, no sightings of the American crocodile have occurred on MacDill AFB, and there is no known critical habitat for the species within Tampa Bay.

Audubon's crested caracara *(Polyborus plancus audubonii)*

The Audubon's crested caracara *(Polyborus plancus audubonii)* was listed as a threatened species under the Endangered Species Act in 1987. It's range was extended in 2022 to included additional locations, including the land upon which MacDill AFB sits. The caracara has a long neck, long yellow legs, and massive gray-blue bill which make its appearance unique among the raptors. About 58 cm in length, the crested caracara has a white head and throat, white wing tips, and white tail contrasting with a dark body, red face, and signature black crest. The diet of Audubon's crested caracara primarily consists of carrion (dead animal carcasses), amphibians, reptiles, mammals, eggs and other birds.

Audubon's crested caracara inhabits wet prairies with cabbage palms. It may also be found in wooded areas with saw palmetto, cypress, scrub oaks and pastures. Audubon's crested caracara is found throughout south central Florida, and also occurs in Texas, Arkansas, Mexico, Cuba and Panama. Little is known about the reproduction of the caracara. Eggs from caracaras in Florida have been found from September to April, with the breeding season seeming to peak from January to March. Nests are constructed with sticks, dry weed stalks and long and narrow segments of vine. The average clutch size is two eggs, with juveniles reaching adult size at five weeks of age, and fledgling occurring at seven to eight weeks old. Surveys were conducted for the species during the 2018/2019 Endangered Species Survey and none were found. Additionally, no incidental sightings of the species has occurred.

Bottlenose dolphins (*Tursiops truncates truncates*)

Bottlenose dolphins (*Tursiops truncatus truncatus*) in US waters are protected by the Marine Mammal Protection Act (MMPA). Under the Marine Mammal Protection Act, the Tampa Bay stock of bottlenose dolphins is considered strategic because the level of direct human-caused mortality likely exceeds the potential biological removal level (i.e., maximum number of animals, not including natural mortalities that may be removed from a stock while allowing that stock to reach or maintain its optimum sustainable population). Resident bottlenose dolphins are often considered a "keystone species" – shifts in their habitat usage or trends in their abundance may be indicative of larger scale changes in the ecosystem (Heithaus *et al.* 2008). In Tampa Bay, threats to bottlenose dolphins likely include entanglement in or ingestion of recreational fishing gear, vessel strikes, fishermen retaliation, illegal feeding, and pollution (Hayes *et al.* 2016). Additionally, behavioral harassment by vessels or aircraft can adversely affect individual health and reproduction (Hayes *et al.* 2016, Machernis *et al.* 2018).

Tampa Bay supports a large but relatively unstudied population of resident bottlenose dolphins. The last survey for bottlenose dolphins in Tampa Bay was conducted from 1988-1993 and estimated a population of 524 animals (Wells *et al.* 1996). From these data, five discrete communities of dolphins were identified within Tampa Bay (Urian *et al.* 2009), including a distinct community that utilizes the waters around MacDill Air Force Base (AFB).

This species description was provided by NMFS.

Eastern black rail (*Laterallus jamaicensis jamaicensis*)

The Eastern black rail is federally-listed as a threatened species under Sec. 4 § 1 of the Endangered Species Act as of November 2020. There are several different subspecies of Black rail found throughout a diverse number of ecosystems in North America, but the Eastern black rail is the smallest rail found in North America and the only subspecies known to be found within the state of Florida (Eddleman, Flores and Legare 1994). They are permanent residents of upper tidal marshes, which are infrequently inundated throughout much of the year, along the Gulf coast and remain secretive and elusive during most of its lifecycle. Eastern black rails are usually associated with tuft grass species (*Spartina sp.*) on the tidal marsh/upland ecotone edge and utilizing the 1-2m high cover to remain largely undetected (Eddleman, Flores and Legare 1994). Eastern black rails have not been detected on MacDill AFB, although some suitable habitat is present. Stevens and Conway (2019) modeled habitat suitability for the species across U.S. military installations and ranked MacDill AFB fifth highest for potential eastern black rail breeding habitat.

Due to the secretive and elusive nature of this species, Eastern black rails are historically surveyed and monitored by utilizing a call and playback survey method by playing an Eastern black rail call for a short amount of time and then listening for a response from the same species. These surveys have been performed across the state of Florida during a recent FWC-funded study (2017-2018) with the closest location to MacDill AFB was found at Avon Park Air Force Range in Avon Park, FL (Pers comm, Troy Hershberger). Surveys will be conducted at MacDill AFB in accordance with the USFWS National Protocol Framework for the Inventory and Monitoring of Secretive Marsh Birds with modifications based on installation staffing, time, and abilities. Call-playback surveys for the species were performed on the installation in March, 2021 and May, 2022, and none were detected. Due to its secretive nature there is still little information, when compared to other avian marsh species, about the impacts of human activity to the habitat and population. The main focus has been the degradation of tidal marsh habitat over the last several decades (Eddleman, Flores and Legare 1994). Unfortunately, MacDill AFB has undertaken a large amount of hydrologic transformation since the establishment of the installation through canal and mosquito ditch dredging, leading to the large drainage of several marshes. Work has been done within the last two decades to restore historical hydrology and future restoration projects are planned.

Eastern indigo snake (*Drymarchon couperi*)

The federally threatened eastern indigo snake is the longest native snake found in North America with some specimens reaching lengths of over 8 ft. They are notable for the iridescent black-blue coloration and red markings on the bottom side of the lower jaw. Their typical habitat is the sandy pine flatwood and scrub or sandhill habitat found throughout the Southeastern coastal plain. They are closely associated with gopher tortoises with both species utilizing the same habitat and the indigo snake shelters in gopher tortoise burrows. As stated, the species is listed as federally threatened within Florida and Georgia mainly due to habitat loss.

Eastern indigo snakes have not been observed at MacDill AFB either incidentally or during formal surveys (AMEC 2012). Although not being detected on base, due to the strong correlation of Gopher tortoise burrows and habitat with indigo snakes the base has the potential for indigo snakes to utilize the installation. Another compounding factor for the low possibility of supporting eastern indigo snakes is the lack of upland natural areas surrounding the base. This creates an island effect that prevents the movement of indigo snakes to either immigrate or emigrate from the base. Eastern indigo snake will continue to be surveyed for during contracted and incidental surveys.

Giant manta ray (*Manta birostris*)

The giant manta ray (*Manta birostris*) was listed as threatened under the ESA in 2018. The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water. They feed on plankton offshore, in oceanic waters, and also near seamounts, island groups, upwelling zones, and productive coastlines. They can reach up to 7 meters in wing span (disk width). Giant manta rays occur throughout pelagic and nearshore waters of the Gulf of Mexico, with important juvenile rearing habitat in the Flower Garden Banks National Marine Sanctuary (Stewart et al., 2018). In the early 1900s, there were numerous recreational harpoon fisheries for manta rays near Tampa Bay (Gill 1910, Roosevelt 1917). Giant manta rays have been occasionally sighted in the Tampa Bay area, including a recent (Feb 2018) sighting off Shell Key. Detecting the presence of giant manta rays in Tampa Bay would improve our understanding of how this species might be impacted by federally-permitted activities in the area.

This species description was provided by NMFS.

Gopher tortoise (*Gopherus ployphemus*)

One of the most iconic species within the Southeastern United States, the gopher tortoise is identified as a keystone species within the upland communities due to the large amount of commensal species that have been observed utilizing its burrows. Found in upland sandhill or sandy soil habitats, the gopher tortoise is easily distinguishable by its elephantine back legs, tan color, and clawed feet that allow it to dig extensive burrows (Ashton and Ashton 2008). Adults can grow up to 38 cm and weigh several kg, with a possible home range of 7 acres (Ashton and Ashton 2008). A majority of a gopher tortoise's life is spent underground with minimal time devoted for foraging, mating, and other behaviors above ground (Ashton and Ashton 2008).

The Eastern population of gopher tortoise is a proposed species for federal-listing and in 2008 the Air Force entered into a Candidate Conservation Agreement (CCA) with several other federal and state agencies to implement monitoring and mitigation guidelines on Air Force property. This includes monitoring of known burrows and gopher tortoise activity, reducing hardwood mid-story encroachment within known or possible gopher tortoise habitat, and conducting prescribed burning of known or possible gopher tortoise habitat (GTCCA). MacDill AFB has a population of gopher tortoise, approximately 129 individuals, observed since the early 1990's and monitored sporadically through contracted wildlife studies beginning in 1992 (Paul and Schnapf 1992). A majority of the known population occurs on the airfield, where access is highly restricted, which reduces the amount of monitoring that can be performed on a routine and consistent basis. Additional burrow and tortoise locations have been found within the installation's Bay Palms Golf Complex and other upland natural areas on base (Paul and Schnapf 1992).

Figure 8: Gopher tortoise Utilized Areas

Gulf sturgeon (*Acipenser exyrinchus desotoi*)

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) were listed as threatened under the Endangered Species Act (ESA) in 1991. Their population was greatly reduced or eliminated throughout much of their range by overfishing, dam construction, and habitat degradation. Past records indicate the range of Gulf sturgeon may have extended from Florida Bay in the east to as far west as the Rio Grande River in Texas and Mexico. Tampa Bay historically provided over-wintering habitat for a large population of Gulf sturgeon and supported a short but intense commercial fishery in the late 1800's (Sulak et al. 2016). Recently, tagged Gulf sturgeon have been detected by an acoustic receiver array maintained by Florida Fish and Wildlife Conservation Commission at the mouth of Tampa Bay, two Gulf sturgeon were recovered near Davis Island (both dead) in March 2018, and one dead Gulf sturgeon was recovered at Anna Maria Island at the mouth of Tampa Bay in January 2019 (Sulak et al. 2016; NMFS unpublished data). Based on these recent sturgeon recoveries and sampling areas in other estuaries, suitable Gulf sturgeon habitat is likely present in deeper sand flats adjacent to MacDill AFB (Fox et al. 2000). Recording potential Gulf sturgeon range expansion into Tampa Bay is useful in gauging overall habitat quality and species recovery.

This species description was provided by NMFS.

Piping plover (*Charadrius melodus*)

As a small member of the plover family, the federally-endangered piping plover gets its name from the series of high-pitch calls it makes during flight. Piping plovers migrate from breeding grounds in the Midwest to upper-Midwest to nonbreeding grounds along the Gulf and Southern Atlantic shores (Elliott-Smith and Haig 2004). Migration to nonbreeding locations typically begins in June with migration back to the breeding grounds beginning in February or March. Piping plovers forage for invertebrates in sand or mudflats along Gulf coastlines, including the Eastern and Southern portion of the Interbay peninsula.

There have been incidental observations of Piping plovers along the MacDill AFB coastline including the 2018-2019 Threatened and Endangered Species Survey (AMEC 2012). No critical habitat has been determined in any portion of the Interbay peninsula. The extreme Southern portion of Pinellas County and the Northern coastal areas of Pinellas County, which extends into the Southern portion of Pasco County, has been designated as critical habitat due to the large amount of Piping plovers that utilize it during the nonbreeding season (USFWS, 2015). The US Fish and Wildlife Service (USFWS, 2018) manage these critical habitats as part of the Crystal River National Wildlife Refuge Complex. Similar to the Red knot, climate change and reduction in habitat have been identified as a potential challenge in maintaining Piping plover nonbreeding and foraging habitat (Elliott-Smith and Haig 2004).

Red knot (*Calidris canutus rufus*)

Known for one of the longest migration patterns in the avian world, the federally-endangered red knot is a shore bird that utilizes the Gulf and Atlantic coast for resting during migration and the nonbreeding season. While having a striking red plumage during the breeding season, by the time they arrive to the Gulf of Mexico their plumage has changed to a more subdued grey and white mottled pattern (Baker, et al. 2013). Red knots typically arrive along the Gulf coast starting in September and will starting migrating back to their breeding grounds of the Arctic Circle in February (Baker, et al. 2013). Foraging mainly on small invertebrates and mollusks along tidal flats, beaches, or sand flats that follow the rise and fall of the tides (Baker, et al. 2013). Population counts have shown a decrease in size of all known populations of Red knots for several decades, with possible estimates of the Florida population being below 10,000 individuals (Baker, et al. 2013). Changes associated with climate change including sea level rise and seasonal temperature changes pose risks to Red knot migration pattern due to food and suitable habitat availability (Baker, et al. 2013).

MacDill AFB has had Red knot sightings over the last several years including the 2018-2019 Threatened and Endangered Species Survey (AMEC 2012). There are local areas known to support non-breeding populations on the Western and Southern portions of Pinellas County and occasional individuals or groups have been observed along MacDill's shoreline. With previously implemented shoreline projects along the East and Southern portions of the Interbay peninsula, there is hope that sediment buildup will result in larger areas for Red knots to forage during the winter months.

Figure 9: Areas Utilized by Shorebirds

Sea turtles (Several species throughout the Gulf region)

Sea turtles are marine turtles that spend the vast majority of their life within marine waters, only coming onshore to nest at sandy beaches around the world. They can range anywhere from ~75 to several hundred pounds and several feet in length. Sea turtle nesting season is typically described from March-October along beach coastlines and known nesting beaches are closely monitored during this time for signs of activity. Sea turtles are known to be omnivores with the majority of their diet being vegetative matter such as seagrass and algae, but several have been known to feed on mollusks, sponges, jellyfish, and other crustaceans (NatureServe 2018). Several species of federally-threatened or endangered sea turtles that have the potential to inhabit the waters surrounding MacDill AFB include the green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), Atlantic loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*) and hawksbill sea turtle (*Eretmochelys imbricata*) (NatureServe 2018). However, the occurrence of a Kemp's ridley sea turtle or a leatherback sea turtle would be extremely unlikely. Only the Atlantic loggerhead sea turtle is identified as occurring within MacDill AFB marine waters, though resting and foraging habitat does occur near the installation, and to a very limited extent, within the installation boundary in shallow creeks and basins. MacDill AFB has a very small segment of sandy shoreline that could be used for sea turtle nesting and is monitored during the sea turtle nesting season for signs of nests.

Smalltooth sawfish (*Pristis pectinata*)

The U.S. distinct population segment of smalltooth sawfish (*Pristis pectinata*) was listed as endangered under the ESA in April 2003. Adults use coastal waters to approximately 120 meters while juveniles rely upon shallow (<1 meter) estuaries as nursery habitat. Within the United States this species once ranged from North Carolina to Texas; however, mortality as bycatch in a variety of fisheries and habitat loss led to a marked population decline and a subsequent range contraction (NMFS 2000). The species is now generally only found in southwest Florida. The Tampa Bay Estuary was historically used by smalltooth sawfish (Burgess et al 2010) and the shallow, mangrove-lined shorelines near MacDill AFB are ideal juvenile sawfish habitat (Wiley and Simpfendorfer 2010, Simpfendorfer et al. 2011, Poulakis et al. 2011). Given the quality of remaining habitat, the Smalltooth Sawfish Recovery Implementation Team expects the species to recolonize this area as the population recovers (NMFS 2009). Detecting the presence of smalltooth sawfish in the Tampa Bay area would be an important milestone for the recovery of this unique species. MacDill AFB, in partnership with USFWS and NMFS will place marine acoustic receivers into the marine security zone around the installation at a time and location to be agreed upon in the future. Data collection and maintenance of the receivers will be accomplished through a collaboration among several agencies and organizations.

A portion of this species description was provided by NMFS.

West Indian manatee (*Trichechus manatus*)

The West Indian manatee was listed as federally endangered but relisted as threatened in March 2017 based on the improvement of habitat and increasing population trends (USFWS 2018). There are currently two known subspecies of manatees that occur within the Gulf region, the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*), with the Florida manatee subspecies being federally-threatened and found within the waters surrounding Florida's coastline, including MacDill AFB (USFWS 2018b).

Florida manatees can be found throughout most of the coastal marine habitat throughout the year, but prefer areas near shore where they can access both freshwater river systems and deep-water channel systems (USFWS 2018b). Manatees are herbivores and feed primarily in grass beds, but will also feed on floating and emergent plant matter when available (USFWS 2018b). Manatees have a low reproductive rate, with one calf birthed every 3-5 years, combined with a long 13-month gestational period (Commission 2018). Birthing of calves can occur throughout the year but typically, peaks within the spring months and calves will stay with the mothers for up to two years after birth.

As indicated in the table below, MacDill AFB has several federal and state protected species and the responsible management of these species are into all future development plans for the base. It is doubtful; however, that MacDill AFB is critical to the survival of any of these species, which reduces the potential concern. MacDill AFB can and will be required to improve conditions for those protected species that use or migrate through the base, but the base likely will not play a major role in their long-term survival and recovery.

Climate Change Impacts to Management of Threatened and Endangered Species and Habitats

A primary focus of the suggested adaptation strategies is to address challenges and opportunities of transitioning to a climate resilient future and produce a positive, cost-effective "no-regrets" transition agenda. Adaptation strategies should be oriented towards longer-term security and sustainable practices and results. Suggested strategies are based on current strategies and practices augmented with strategies and knowledge that address emerging climate challenges. Based on identified vulnerabilities for projected climate periods, both retrospective and prospective adaptation strategies are suggested. Retrospective adaptation strategies include: a) resistance strategies that aim to reduce direct impacts of climate change and b) resilience strategies that aim to secure the capacity to cope with the effects of climate change by ensuring that critical ecological process. If possible, prospective transformation strategies focused on preventing climate change impacts are suggested. In some cases, missing knowledge made assessment difficult and reduced confidence in vulnerability determination. These gaps are highlighted as areas that need to be addressed before adaptation strategies can be developed.

Table 8: Federal and State Listed Species Potentially Occurring at MacDill AFB

Common Name	Scientific Name	Federal	State	MAFB
Reptiles/Amphibians				
American alligator	*Alligator mississippiensis*	T (SA)	T (SA)	X
American crocodile	*Crocodylus acutus*	T	T	-
Atlantic loggerhead turtle	*Caretta caretta*	T	T	X
Atlantic green turtle	*Chelonia mydas*	T	E	-
Eastern diamondback snake	*Crotalus adamanteus*	UR	-	X
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	E	-
Leatherback turtle	*Dermochelys coriacea*	E	E	-
Eastern indigo snake	*Drymarchon couperi*	T	T	-
Hawksbill turtle	*Eretmochelys imbricata*	E	E	-
Gopher tortoise	*Gopherus polyphemus*	C	T	X
Gopher frog	*Lithobates capito*	UR	-	X
Florida pine snake	*Pituophis melanoleucus mugitus*	UR	T	-
Short-tailed snake	*Stilosoma extenuatum*	UR	T	-
Birds				
Scott's seaside sparrow	*Ammodramus martimus peninsulae*	-	T	-
Florida scrub jay	*Aphelocoma coerulescens*	T	T	-
Florida burrowing owl	*Athene cunicularia*	-	T	X
Red knot	*Calidris canutus rufa*	T	T	X
Piping plover	*Charadrius melodus*	T	T	X

Snowy plover	*Charadrius nivosus*	-	T	-
Little blue heron	*Egretta caerulea*	-	T	X
Reddish egret	*Egretta rufescens*	-	T	X
Tricolored heron	*Egretta tricolor*	-	T	X
Southeastern American kestrel	*Falco sparverius paulus*	-	T	X
Florida sandhill crane	*Grus canadensis pratensis*	UR	T	X
American oystercatcher	*Haematopus palliatus*	-	T	X
Bald eagle	*Haliaeetus leucocephalus*	DL BGEPA	-	X
Eastern black rail	*Laterallus jamaicensis jamaicensis*	T	-	-
Wood stork	*Mycteria americana*	T	T	X
Red-cockaded woodpecker	*Picoides borealis*	E	E	-
Roseate spoonbill	*Platalea ajaja*	-	T	X
Least tern	*Sterna antillarum*	-	T	X
Black skimmer	*Rynchops niger*	-	T	X
Audubon's crested caracara	*Polyborus plancus audubonii*	T	T	-
Mammals				
Florida mouse	*Podomys floridanus*	UR	-	-
West Indian (FL) manatee	*Trichechus manatus*	E	E	X
Tricolored bat	*Perimyotis subflavus*	P	-	X
Florida bonneted bat	*Eumops floridanus*	E	E	-
Fish				
Giant manta ray	*Manta birostris*	T	-	-
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	T	-
Smalltooth Sawfish	*Pristis pectinata*	E	E	-
Insects				
Monarch Butterfly	*Danaus plexippus*	C	-	X

T=Threatened, T(SA)=Threatened/Similarity of Appearance, E=Endangered, C=Candidate for listing, DL=Delisted, SSC=Species of Special Concern, UR=Under review, BGEPA=Bald and Golden Eagle Protection Act, P=Petitioned

Sources: AMEC Environmental 2012; AMC 2010a; MacDill AFB 2015b; FFWCC 2016, USFWS IPaC 2016

Species Inventories and Monitoring

Inventory is commonly described as the first step in biodiversity protection. Inventory was seldom formally used at MacDill AFB until the early 1990s. Surveys for general wildlife, as well as protected species, that have been completed since that time include:

- 1992: A general wildlife survey was performed by the FWC. The survey was performed by James Beever with the FWC and Rich Paul and A. Schnapf with the National Audubon Society. The survey was conducted over the base. The survey confirmed one reptile, 10 mammals, and 79 bird species on the base. A literature review of species found for the regional area resulted in the expected occurrence of 20 reptiles, 17 mammals, and 158 birds. Paul and Schnapf noted that MacDill has very limited value as a breeding site for colonial coastal birds due to the lack of areas isolated from terrestrial predators, especially raccoons.

- 1994: A second wildlife survey was performed as part of a Florida Natural Areas Inventory study which focused on reptiles and birds. The survey was performed by W.E. Meshaka Jr., who looked at herpetofaunal communities and G.E. Woolfenden who surveyed for rare and endangered bird species. Both researchers were with the Archbold Biological Station. The survey which was conducted over multiple visits to the base during 1994, found 19 reptile and nine amphibian species on base, including two species of special concern (gopher tortoise and gopher frog) and one element species (eastern diamondback rattlesnake). Woolfenden reported 109 bird species found on base.

- 1996: Geraghty & Miller, Inc. performed wildlife surveys to identify protected wildlife species located on base. The surveys were performed throughout the entire base but focused attention on areas identified by the base Natural Resources Manager where protected species were historically known to occur. The surveys documented four additional bird species protected by state law that were previously undocumented on base.

- 2003: The University of South Florida performed a follow-up survey which mimicked the collection approach and methods used during the 1995/1996 protected species survey. The intent of the 2003 survey was to determine population trends for protected species that permanently or temporarily reside on MacDill AFB. The survey generally noted population increases for protected species identified and most notably estimated a significant increase in gopher tortoises on base. The entire survey is provided in Appendix B Threatened and Endangered Species Management Plans.

- 2012: AMEC Inc. was contracted to perform a follow-up T&E species survey. The survey mimicked the collection approach and methods used in 1996 & 2003 to allow the best comparison of results between these surveys. The 2012 survey observed a general increase in bird species, particularly bald eagles, oyster catchers, black skimmers, and wood storks. This survey did note a 27% decrease in the gopher tortoise population when compared to the 2003 survey.

- 2019: Ecosphere/ESA Scheda performed a T&E species survey over the entire installation. This included gopher tortoise and Florida burrowing owl surveys within the installation's airfield, shorebird surveys throughout the installation's coastline, Northern crested caracara surveys, acoustic bat surveys, and field camera and small mammal trapping. No new federal or state-listed species was discovered during the surveys and the gopher tortoise population was estimated to be stable from the previous survey in 2012.

Monitoring is an integral aspect of ecosystem management. Monitoring is designed to track the trends (and absolute numbers if needed) of individual species, communities and overall ecosystems. Ideally, monitoring would be done on a regular basis, and targeted at species with high economic or human use values, endangered species and indicator species of overall ecosystem health. Monitoring of ecosystems has generally not occurred at MacDill AFB. MacDill AFB strives to perform wildlife inventories on a regular basis, approximately every five years. This INRMP includes projects to ensure the frequency of those inventories.

Habitats of Concern and Relation to Local Natural Areas/Habitats

No portion of MacDill AFB, or the surrounding marine system, has been designated as critical habitat. The closest critical habitat to the installation is located at the mouth of the Little Manatee River in Southern Hillsborough County approximately 7 miles South of MacDill AFB. This habitat has been designated for the West Indian manatee wintering grounds. Additional critical habitat has been designated on the Western coastlines of Pinellas and Manatee County for the Piping plover and Aboriginal prickly-apple, respectively. The smalltooth sawfish has designated critical habitat within the Charlotte Harbor marine waters approximately 70 miles to the South of MacDill AFB. Critical habitat has been designated for Loggerhead sea turtle nesting habitat along the barrier islands of Manatee County, approximately 20 miles to the Southwest of MacDill AFB. Additional information, including spatial data, can be found through the USFWS and NMFS websites. MacDill AFB continues to provide valuable foraging and breeding habitat for many species of special concern. MacDill AFB strives to maintain and improve habitats necessary to encourage use of the installation by state and federally listed species.

Habitat management activities at MacDill AFB primarily revolve around invasive plant species eradication and control through application of herbicides and other land management activities. Invasive plant species are chemically-treated in both wetland and upland habitat areas. Prescribed burns are implemented in upland systems to mimic natural fire cycles that are typical in hyper pyrogenic Florida ecosystems. Prescribed fires can improve habitat values and benefit wildlife populations. Wetland habitat areas are common throughout MacDill AFB, especially mangrove forests, and these areas are legally protected under the Florida Mangrove Trimming and Preservation Act. Management of wetland habitat primarily involves the control of invasive species, which are managed through the application of herbicides and occasionally mechanical clearing. Only herbicides developed for aquatic use are used in wetland systems to control invasive species.

The relative isolation of MacDill AFB benefits and detracts from management of threatened and endangered species, and species of special concern. Since a large amount of threatened and endangered species habitat on the Interbay Peninsula is located within the installation's boundaries, there will be few issues involving co-management with neighboring entities. MacDill AFB's isolation also means that beneficial management results for terrestrial threatened and endangered species, in particular, will not be easily expanded onto other conservation lands. This geographic restriction is less applicable for avian and marine species. However, and specifically as it relates to marine species, MacDill 6 Security Forces Squadron - Marine Patrol, conducts on-going vessel patrols to Enforce unauthorized entry restrictions in accordance with 33 CFR 334.635(c) of the 1,000m Marine Restricted Zone surrounding MacDill AFB. The Marine Restricted Zone acts as a de facto aquatic preserve by restricting unauthorized entry and activity by the public which by default reduces stressors on species and habitats found within.

Current Biological Opinions and Consultations

There are currently no Biological Opinions on file for MacDill AFB concerning Section 7 of the Endangered Species Act (ESA). MacDill AFB coordinates closely with the USFWS North Florida Field Office and the NOAA Fisheries St. Petersburg Field Office to ensure compliance of all projects implemented within the installation's boundaries.

7.5 Water Resource Protection

Installation Supplement

Applicability Statement

This section applies to AF installations that have water resources. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

MacDill AFB has several plans that outline how the installation strives to protect its watershed, including this INRMP. Although the plans are separate documents, they are coordinated with each other and all emphasize the elimination of pollution streams into surface or groundwater systems. These management plans seek to reduce or eliminate contaminants to the environment to prevent degradation or damage to natural ecosystems and impacts to wildlife. Consequently, these management plans are inextricably linked to the INRMP by the goal of reducing pollution to improve base ecosystems, decrease compliance vulnerability, protect public health and improve quality of life.

Watersheds on MacDill AFB are heavily influenced by stormwater runoff from built-up areas that are drained through a series of ditches and other manmade drainage systems. MacDill's watersheds are susceptible to heavy rains that transport commercial, industrial, residential, and recreational pollution to surface waters. These concerns are discussed in the MacDill Storm Water Pollution Prevention Plan.

The management of MacDill's golf courses is a natural resources-related program that creates non-point pollution within the MacDill AFB watershed. The golf course follows management practices that will improve their current level of environmental stewardship. Practices that reduce fertilizer and herbicide usage and improve water conservation are central to reducing their impacts. Other sources of contamination at the golf course are being managed through the ERP. Concerns regarding groundwater contamination associated with storage of chemicals, fuels, and oils are not covered within this INRMP, but they are included within other environmental plans and programs at MacDill AFB such as the Spill Prevention Control and Countermeasures Plan, Environmental Restoration Program, and the Hazardous Materials Management Process.

Pond Management

MacDill's named ponds include Lewis Lake and Lake McClelland. In addition, there are several small ponds scattered throughout the north and south golf courses (totaling ~35 acres). Improving the quality and habitat of these lakes would benefit wildlife and outdoor recreation opportunities.

The development of Lewis Lake into a system of stormwater runoff control ponds alleviates watershed pollution and provides outdoor recreation opportunities. The Lewis Lake project was permitted by the SWFWMD before restoration began.

Warm season fish die-offs on installation were relatively common due to oxygen depletion. This situation is worsened when weeds (such as cattails) are killed and allowed to decompose in place. The addition of electric aerators in several ponds has reduced the threat of oxygen depletion. Pond maintenance in 2000-2004 involved the removal of large volumes of aquatic nuisance species, including cattails (Typha sp.); mechanical clearing of the vegetation reduced the likelihood of oxygen depletion within the lake. This practice is not cost effective, and currently the removal of these nuisance species is being accomplished using herbicides. In 2014, the USFWS has began assisting MacDill AFB with controlling nuisance and exotic aquatic species, primarily cattails. The USFWS chemically treats Lewis Lake, Lake McClelland, the SWIM III restoration area ponds, and other ponds and ditches throughout the installation. Treatment is accomplished in stages during each visit to reduce the risk of oxygen depletion. Ponds were initially stocked in 1997 and again in 1998. Lewis Lake was re-stocked in 2005, but there has not been any restocking efforts since. A pond maintenance effort was implemented in 2007, which involved an assessment of Lake McClelland's water quality, to develop options for improving water quality and potential fish and wildlife foraging habitat in the lake.

Surface Water Improvement Management (SWIM)

SWFWMD's SWIM program focuses on water quality and habitat restoration projects within the district. MacDill AFB works cooperatively with SWFWMD to execute SWIM projects on base. A copy of the cooperative agreement for SWIM projects between SWFWMD and MacDill is provided in Appendix F, "SWIM and NOAA Cooperative Agreements". Phase I of the SWIM project included the restoration of 14 acres of wetlands near the installation's wastewater treatment plant and was completed in 1997.

Phase II of the SWIM project was completed in 1999. This project restored approximately 36 acres of coastal wetlands in areas along the southeastern shoreline. The Phase II project removed Brazilian pepper and other invasive species, restored natural hydrology in existing tidal creeks and basins, and replanted disturbed portions of the site with native species. The invasive and exotic species in Phase I and II SWIM restoration areas are maintained under the installation Habitat Restoration contract.

MacDill AFB and the SWFWMD completed a Cooperative Agreement for Phase III of the SWIM project in 2008. Construction of Phase III began in the summer of 2012 and was completed in early 2013. The project consisted of three main components with a similar objective of improving storm water treatment and increasing oligohaline habitat where possible. A portion of the project involved restoration of the mangrove estuary system by improving the tidal connection to the bay, repair of hydrology altered by mosquito ditching, removal of invasive plant species, and replanting with native vegetation. The second component of the project involved the alteration of a tidally influenced storm water drainage system to direct storm water runoff though a series of treatment ponds. This accomplished the slowing of water movement through the area and allowed greater retention time while facilitating increased biological treatment of storm water runoff. Over time, the interconnection of the drainage canal with adjacent water bodies has expanded oligohaline habitat. A third component of the project involved the modification of Lewis Lake and its associated drainage canal to slow storm water movement and increase pollutant treatment before the storm water discharges to a tidally influence drainage canal.

In total, Phase III restored approximately 100 acres of upland and wetland habitat in the southeastern portion of MacDill AFB. The restoration removed 12 acres of invasive exotic vegetation, restored more than 9 acres of wetlands and created 22 acres of new wetlands. The project excavated 120,000 cubic yards of earth and replanted disturbed areas with 187,000 native plants.

This large-scale habitat restoration and storm water improvement project was funded through multiple sources and serves as an excellent example of the partnerships and collaborative work that MacDill AFB accomplishes with local and regional conservation and natural resource agencies. In accordance with the Cooperative Agreement with the SWFWMD, MacDill AFB has been able to accomplish invasive plant control work at the Phase III project areas. The Phase III project was the honored recipient of the National Military Fish & Wildlife Association award for Natural Resources Conservation Communication, Conservation Partnerships. Due to program funding drawdowns within the SWFWMD there are currently no Phase IV projects being planned at this time

7.6 Wetland Protection
Installation Supplement

Applicability Statement

This section applies to AF installations that have existing wetlands on AF property. This section IS applicable to MacDill AFB.

Program Overview/Current Management Practices

Since approximately 20% of the land at MacDill AFB is wetlands, the installation devotes significant resources to ensuring the quality of wetlands. The primary wetland protection projects include: routine wetland monitoring, invasive species management, mangrove control, NEPA assessments for every planned construction project, and wetland mitigation, as applicable.

MacDill AFB has been determined to maintain high quality wetlands and the presence of wetlands has not affected MacDill AFB military missions. Wetland restoration offers considerable opportunities for enhancing awareness about wetlands and provides excellent recreation opportunities. The bird observation towers and interpretative nature trail are evidence of these public interaction opportunities that have been implemented on installation.

The Environmental Impact Analysis Process (EIAP - Air Force specific NEPA process) is used to identify potential conflicts between base construction and/or military operations, and wetlands. MacDill AFB is committed to no net loss as required by Executive Order 11990 and state policy. When a project is planned for an area identified as wetlands, the first step is to look at avoidance and then alternative locations to prevent wetland loss since mitigation of wetland losses is both technically difficult and expensive. These are called alternative actions. If the project can't be moved due to construction requirements or inadequate alternative space, and wetland loss is inevitable, mitigation measures will be implemented, as in the following examples:

- Wetland mitigation was used successfully in 1992-94 to construct/enhance wetlands for a site damaged by a project to dredge the marina channel.
- A wetland mitigation project in 2004 offset impacts related to the trimming and alteration of mangroves along Bayshore Boulevard. The FDEP issued a permit and required the planting of 10,829 black mangroves on a 2.45 acre mitigation site on MacDill AFB.
- In 2002, MacDill AFB outlined plans to implement a drainage ditch maintenance program, which would include the removal of mangroves and other undesirable vegetation. MacDill strives to preserve and improve mangrove habitat to the maximum extent possible in undeveloped areas of the base; however, when the trees become a hindrance to the military mission, a reasonable balance is struck between conservation and military readiness. In 2003, the base received permission from the FDEP, in the form of an exemption from permitting, to remove vegetation (including mangroves) from the man-made drainage features in accordance with a ditch maintenance exemption described in Florida Administrative Code 40D-4.015(12)(j). The USACE followed suit and issued the base a permit for ditch maintenance in late 2003. Since 2004, MacDill has maintained its extensive ditch network through clearing of tree and shrub vegetation (primarily mangroves) from drainage ditches and continued routine mowing of the ditch banks to keep brushy vegetation suppressed. Today, most of the ditches and drainage canals on base are free from shrubby vegetation with well-maintained grassy banks.

- In 2007, construction of a limestone revetment to stabilize 2.5 miles of shoreline between the Bayshore Gate and the Bay Palms golf course resulted in the filling of wetlands through placement of limestone rip-rap along the shoreline. The SWFWMD determined that the shoreline stabilization project resulted in 6.47 acres of wetlands impacts and required on-site wetland mitigation to offset wetland impacts. The compensatory mitigation effort including the following: 2.47 acres of salt marsh and mangrove habitat enhancement, 0.91 acres of freshwater marsh enhancement, 0.19 acre of salt marsh habitat creation and 1.26 acres of freshwater forest creation.

- In 2015, construction of the Airfield Drainage Repair project was completed. This project restored degraded drainage systems around the runway by filling and grading low lying areas and re-established some of the original drainage features along the west side of the runway. This eliminated the ponding which frequently occurs during the rainy season. To offset wetland functional loss, three mitigation sites were created with 5.00 units of functional gain. The creation of the three mitigation areas provided 1.66 units of excess functional gain that is available to offset future wetland impacts at MacDill AFB according to SWFWMD permit.

- MacDill AFB completed the design of an Airfield Clear Zone Repair project which will clear and grade the vegetation within 1,000 feet of the runway centerline on the west side of the runway. The project will bring the Airfield Clear Zone into compliance with Air Force airfield requirements. The project will involve the filling and grading of ~ 14 acres of wetlands, and the relocation of several drainage ditches and a main road on the Northern portion of the installation. Mitigation is proposed to occur through the purchase of mitigation Credits from the Tampa Bay Mitigation Bank. The project is not currently funded and there is no projection for potential funding at this time.

- The US Army Reserve Aviation Support Facility for the relocation of UH-60 helicopters required the construction of hangar space, maintenance areas, and a new ramp. This project design was modified to avoid wetland impacts to the maximum extent, and was able to reduce the amount of wetland impacts from 6.9 acres to 4.0 acres. The 4 acres of unavoidable wetland impacts have been mitigated through the purchase of wetland mitigation credits. USACE required 3.38 acres of palustrine emergent and 0.017 acres of forested estuarine intertidal credits. The SWFWMD required 3.25 acres of freshwater marsh and 0.002 acres of tidal forest credits. The Hillsborough County Environmental Protection Commission (EPC) required 4.85 acres of freshwater marsh and 0.009 acres of tidal forest credits. This project began construction in January 2018 and was completed in January 2022.

MacDill AFB has developed an Ecosystem Restoration Management Plan (ERMP) and has secured permits to implement restoration work at some of the mangrove restoration sites identified in the ERMP. A wetland mitigation bank is a wetland area that is currently being restored, enhanced, or created, and set aside to compensate for future actions that may negatively impact other wetlands within the same watershed and provide in-kind wetland functions. Although not permitted as an official mitigation bank, the SWFWMD and EPC have agreed to allow MacDill AFB to 'bank' any credits gained through completion of wetlands restoration within the Ecosystem Restoration area. These credits can only be used by MacDill AFB to compensate for future wetland impacts. Wetland restoration credit is also only given for project work that is funded by the DoD. Money received through grants and external partnerships would not be applicable for earning mitigation credit.

The key to wetlands management at MacDill AFB is restoring wetlands that have been invaded by non-native species, protecting wetlands from damage and, if required, mitigating losses of wetlands associated with construction or military activities. MacDill continues to seek funding to implement invasive species removal programs and wetland restoration efforts. Invasive species control work is routinely funded although funding amounts vary from year to year. Over the past decade annual funding for invasive species control has ranged from a low end of $25K to a high of $200K, although wetlands are only a small portion of the identified invasive species treatment areas each year. More information is found in Section 7.11 Integrated Pest Management System of the INRMP.

MacDill AFB's ERMP serves as the long-term conceptual plan for the restoration of 500+ acres of wetlands along the southern boundary of the installation. To date, three phases of mangrove restoration work under the ERMP have been implemented including the completion of Sites 8, 9, 15, 16, and 18. A summary of the content/purpose of the ERMP is provided in Appendix J, Ecosystem Restoration Conceptual Masterplan. As per the ERMP, management tools for wetlands at MacDill AFB will include the following:

- Monitor constructed mitigation areas and maintain the areas as free from invasive species.

- Accomplish restoration of selected sites as outlined in the ERMP, and track credits for future use.

- Maintain airfield drainage ditches to discourage usage by avian species and emergent vegetation.

- Continue to control invasive vegetation that routinely encroaches on wetland areas throughout the installation.

To the maximum extent possible, MacDill AFB will avoid actions that would either destroy or adversely modify wetlands in accordance with Executive Order 11990, Protection of Wetlands. Periodic wetlands surveys are used to guide the evaluation/location of proposed projects. As applicable, MacDill will obtain jurisdictional delineation from the USACE for sited projects. In the event any wetlands actions require a federal license or permit, MacDill shall obtain a Water Quality Certificate from the SWFWMD pursuant to Section 401 of the CWA, certifying that the actions comply with state water quality criteria. There are no pending Section 401 permits, or proposed actions requiring such permits. Similarly, in the event dredging, filling, and/or activities that may displace soil into a wetland are planned or proposed, MacDill shall evaluate and obtain (if applicable) a Section 404 permit from the USACE per Section 404 of the CWA.

Climate Change Impacts to Wetland Protection

In Florida, climate change projections assess vulnerability of these ecosystems to SLR, water supply, water quality and storm surge (Association of State Wetland Managers, n.d.). At MacDill AFB, these areas cover a significant portion of the installation's land, and historically, there have been management actions on site to ensure wetland protection and restoration. According to climate projections in this study, wetland ecosystems at MacDill AFB will be particularly vulnerable to the increase of temperature (warming of approximately 2.0 °F (1.1 °C) average annual increase under both scenarios), which could increase evaporation rates in these areas. Wetland systems are vulnerable to changes in quantity and quality of their water supply, and it is expected that climate change will have a pronounced effect on wetlands through alterations in hydrological regimes (Erwin, 2009). Restoring wetlands that have been invaded by invasive and exotic species, protecting wetlands from damage and mitigating losses of wetlands associated with construction or military activities, are all actions that might mitigate the impact of climate change on wetlands at MacDill AFB.

7.7 Grounds Maintenance
Installation Supplement

Applicability Statement

This section applies to AF installations that perform ground maintenance activities that could impact natural resources. This section IS applicable to MacDill AFB.

Program Overview/Current Management Practices

A close partnership and collaborative effort has been established at MacDill AFB between the grounds maintenance contractor, golf course maintenance, and the natural resources program. The most significant issues involved with grounds maintenance on installation are watershed pollution associated with the Bay Palms golf courses, mangrove invasion of drainage ditch systems, and the spread of cogon grass (Imperata cylindrica) into areas which were previously maintained by mowing.

Reductions in the areas maintained by the grounds maintenance contractor have recently occurred in an effort to reduce maintenance costs. Some hard to access areas that were mowed regularly are now allowed to go fallow or are only mowed intermittently. This practice does improve foraging and habitat values for wildlife but the sites can't be left to go fallow due to the establishment of nuisance and invasive species. Routine invasive species control work is necessary to help these fallow fields transition through the early successional stages without being overtaken by non-native plant species. An additional reduction in grounds maintenance is the irrigation of 425 acres of landscaped areas with on-base treated wastewater. The grounds and golf course maintenance and natural resource programs work together to identify additional areas where grounds maintenance activities could be decreased below the current levels.

MacDill AFB uses a variety of tasks/tools for grounds and golf course maintenance including regular mowing, planting, pest control, fertilization, irrigation, and other innovative procedures such as xeriscaping, urban forestry and the planting of native Florida species. The following describes these specific tasks/tools and additional information from the grounds maintenance program. Also, general considerations for sustainable grounds maintenance include:

- Plant large trees that provide greater amounts of shade, require less maintenance, and typically last longer than annuals or ornamentals.
- Restrict use of smaller trees/shrubs to areas adjacent to buildings.

- Use evergreen, pest and climate resistant varieties when planting, native plants and xeriscaping are preferred.
- Design retention ponds using natural landscape, free form basins that replicate natural and historic features.
- Maintain an on-installation nursery where palms and small trees removed from construction sites are transplanted temporarily for later use.
- Utilize irrigation only for high profile landscaped areas on installation; use recycled water for irrigation whenever possible.
- Ensuring developers/contractors are required to replace any trees larger than 4" dbh that are moved or damaged during construction activities.

Airfield

Although the airfield represents a large portion of land on the installation, most habitat improvements would conflict with the BASH program goals of limiting the amount of wildlife present in and around the runway or taxiways. Due to this, these areas will remain at their current level of maintenance.

Mowing

There are significant portions of the installation that are currently mowed to Air Force specifications. These include the airfield, base housing area, golf course, and several administrative areas. The mowing schedules and cutting heights for these areas are maintained by the grounds maintenance crews and obtained through Air Force standards.

Planting

Two grasses are primarily planted by Grounds Maintenance at MacDill AFB. St. Augustine grass (Stenotaphrum secundatum) is used in areas that can be efficiently irrigated and Bahia grass (Paspalum notatum) is used where irrigation is not practical. The grounds maintenance program provides lists of plants for landscaping on installation. These lists are based on professional advice and proven effectiveness at MacDill AFB. Several species within these lists have been removed for environmental reasons. Australian pine and melaleuca are not planted due to their potential to compete with native vegetation and their large capacity to uptake water. Native pine trees are only planted in clusters in large open areas, not around buildings to avoid possible damage from storms and other maintenance issues. High maintenance plants are avoided, while low maintenance, native xeriscape plantings are encouraged.

Pesticides, Herbicides, and Fertilization

Environmental Protection Agency (EPA) guidelines, combined with restrictions by other regulatory agencies and the major command, are used by MacDill AFB to guide its choice of pesticides and herbicides. MacDill AFB only uses chemicals on an as-needed basis and the installation's Integrated Pest Management Plan (IPMP) outlines the overall pest management program on base. This includes multiple alternatives to the application of pesticides and herbicides. The IPMP integrates all agencies responsible for pest management on installation. Each organization using pesticides must document usage by recording the type, amount, and active ingredients used. This data is reported to the MacDill AFB Pest Management Officer on a monthly basis. Fertilization techniques and guidelines are found within the MacDill AFB IPMP. Additional information regarding the IPMP is provided in Appendix F, Integrated Pest Management Plan.

Irrigation

MacDill AFB irrigates lawns composed of St. Augustine grass daily for large portions of the year. This must be modified, as needed, to comply with Hillsborough County water restrictions. Areas irrigated include office buildings, home lawns, berms along boulevards, and traffic islands. A special category of irrigation is the use of treated sewage effluent to irrigate several fields. This project is required to keep the base in compliance with necessary discharge permits.

Urban Forestry

The urban forest at MacDill AFB is not managed independently of other base functions. The Base Civil Engineer (6 CES) has the responsibility to plan, regulate, and control planting, removal, maintenance, and protection of urban trees and forest; eliminate and guard against dangerous conditions; protect trees from undesirable conditions; and guard against the spread of disease or pests. The MacDill AFB natural resources program reviews construction projects and landscaping plans to determine their compatibility with the existing resources and base landscaping standards. Typical tree management activities conducted on base include:

- Removing dead, diseased, dying and severely damaged trees that pose safety concerns
- Routine trimming of large trees and palms for aesthetics or when branches become a nuisance or safety concerns
- Planting native trees as replacements for trees that were removed for safety concerns or for general beautification of the base.

MacDill AFB has been an active Tree City USA community since 1996. The Tree City USA program provides direction, technical assistance, public attention, and national recognition for urban and community forestry programs in thousands of towns and cities throughout the United States. MacDill has also been awarded the Tree City USA Growth award several times. The Tree City USA Growth Award recognizes environmental improvement and encourages higher levels of tree care throughout America. A robust urban forestry program benefits the installation by improving aesthetics, providing shade which can reduce energy costs by reducing overall heat, increase positive interactions with birds and other wildlife, improve base personnel morale, and demonstrate the installation's commitment to preserving and improving the environment. MacDill AFB aims to retain its designations as a Tree City USA and Tree City USA Growth Award community on a yearly basis.

Other Practices

Grounds maintenance personnel utilize additional reference materials, such as xeriscaping, Energy Efficient and Environmental Landscaping (Moffat, et.al., 1994) and Architectural Compatibility Standards (Waller, Todd, and Sadler Architects, Inc., 1996), for guidelines and recommendations for landscaping on MacDill. Planting information from the MacDill's grounds maintenance program is provided in Appendix D, Grounds Maintenance. The most current Grounds Maintenance Plan needs to be updated (2010), but provides a solid foundation and provides accurate information. Xeriscaping is the preferred landscaping method at MacDill AFB. This type of landscaping requires less water, fertilizer, maintenance, and pest control than traditional landscaping, while being aesthetically pleasing. Xeriscaping promotes water conservation by using native, drought-tolerant plants that thrive in the natural Florida environment, within a landscape carefully designed for maximum use of rainfall runoff and minimum care. By limiting landscape water needs, which can account for 30%-50% of residential water use, xeriscaping principles can significantly reduce water use and save money.

7.8 Forest Management
Installation Supplement

Applicability Statement

This section applies to AF installations that maintain forested land on AF property. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

Active timber harvesting and silviculture management does not currently occur at MacDill AFB. The primary strategies employed to maintain and improve forested ecosystems are invasive plant species control and the implementation of prescribed fire management. The future emphasis will be directed to understory management through a combination of prescribed burning, invasive species removal, and reintroduction of native plants.

Slash pine (*Pinus elliotti*) flatwoods and coastal hardwood forests dominate a large majority of the forested ecosystems found throughout the installation. There are few longleaf pines (*Pinus palustris*), whose life cycle and ecology is highly adapted to the historic fire-dominated ecosystems cycles found throughout Florida. These areas will benefit from the implementation of a more aggressive and robust prescribed burning program, and is described further in Section 7.9 Wildland Fire Management. Mechanical removal of overgrown understory and midstory is used to augment the reduction of unwanted plant species in the absence of consistent prescribe fire implementation.

Timber harvesting will continue to be investigated as a potential tool for habitat restoration and fuel load reduction on installation. The potential hurdles for implementation at MacDill AFB is the lack of profitable timber, consistent access to profitable timber, and currently low timber prices. Figure 10 shows the locations of previously planted pine plantations on installation.

Figure 10: Forest Stands at MacDill AFB

7.9 Wildland Fire Management

Installation Supplement

Applicability Statement

This section applies to AF installations with unimproved lands that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

Wildland fire management includes the use of prescribed fire to maintain natural pyrogenic systems and cycles including the planning for natural or accidental wildfires. Most importantly, prescribed fire reduces fuel loads, reducing the risk to human safety and property from wildfires. Prescribed burning benefits native wildlife, maintains fire-dependent native plant assemblages, provides a tool for restoration activities and supports threatened and endangered species. It is a critical management tool for most upland natural resources in Florida, including the predominant upland habitats at MacDill AFB.

Upland forest management through prescribed burning is the driving force of significant improvements to wildlife habitat at MacDill AFB. Over time, upland forest ecosystems at MacDill AFB have steadily declined in quality due to the exclusion of naturally occurring fire regimes and cycles. This results in a compromised understory with predominant vegetation species, including native grasses, eventually yielding to taller broad-leaf shrubs, and trees. This results in an understory with reduced biodiversity and foraging value. Dense litter accumulation can prevent the growth of plants used for foraging and movement. A larger concern is the large accumulation of organic material allows for the growth of pine tree feeder roots into this layer. These roots are primarily responsible for providing nutrient and water uptake into the tree. When fire is applied to the habitat, either intentionally or by wildfires, these feeder roots can be destroyed, along with the organic fuel layer, through extreme temperatures resulting in high degrees of tree mortality. If these conditions are left unattended to for several decades – which has become the case in several areas at MacDill AFB – the ecosystem will gradual change to a more oak-dominated structure. Properly applied prescribed fires can reduce the amount organic biomass known as "fuel loading", clear out excessive understory growth, increase carbon storage, open the over story canopy through limb removal and release nutrients for growth of native plants.

MacDill's Wildland Fire Management Plan (WFMP) (Air Force Wildland Fire Branch, 2022) (Appendix B) outlines wildland fire procedures that complement the ecosystem- based adaptive management strategies established in this INRMP. The current plan divides the natural areas that are suitable for burning (approximately 736 acres) into burn blocks separated by natural or manmade firebreaks, including power line right-of-ways, roads, ditches, ecosystem boundaries, and fence lines. A specific 21-element burn prescription for each burn block specifies the appropriate environmental and mission conditions that must exist for burning to be considered. In the past, MacDill has historically partnered with the FFS to accomplish prescribed burning, and more recently has utilized contractors to accomplish burns. In 2014, the Air Force Wildland Fire Branch, part of the Air Force Civil Engineer Center (AFCEC), was given the responsibility for implementing prescribed burns at MacDill AFB. This multi-agency organization is based out of Joint Base San Antonio-Sam Houston (JBSA). MacDill AFB is located within the East region of the Air Force Wildland Fire Branch (AFWFB) and prescribed fire operations are carried out through the Avon Park Air Force Range Wildland Fire Module. This module is manned by representatives from Colorado State University's Center for Environmental Management of Military Lands (CSU-CEMML) and USFWS.

Timing of prescribed burning depends on several factors with wind direction being the most critical factor. Extreme care must be taken to ensure smoke does not negatively impact the military mission by reducing visibility on the runway, airfield, control tower, or restricting other critical base operations. Prescribed burning may be conducted throughout the year, but most will take place in the dry winter season when cold fronts bring consistent North winds. 6 CES Environmental Element coordinates prescribed burn activities and provides advanced notice via email to the Prescribed Burn Notification Group, a distribution list containing base commanders, police, fire, public affairs, safety and other interested parties. Notice is sent 5-14 days before a tentative burn date and follow-up emails provide base personnel with updated information. Depending on the location of the burn, public outreach outside of the installation boundaries may be needed if impacts will be seen in the surrounding communities.

The WFMP describes personnel and equipment requirements. The burn boss (NWCG-qualified Prescribed Burn Boss Type 2 or higher) will obtain the necessary permit from the FFS on the day of the burn. Burn crews will perform mop-up activities and monitor the fire to reduce extended smoke disturbances. They will also return after the burn is complete to evaluate its effectiveness.

The MacDill AFB prescribed burn program was initially developed in partnership with the FFS. The program has been successful, but limited in scope. Prescribed burns have been conducted, but have yet make a substantial impact on restoration efforts of the forested habitats on installation. Approximately 241 acres of prescribed fire have been conducted on installation since 2017, with varying degrees of success. Due to MacDill AFB's location on a peninsula and the effects of the surrounding Tampa Bay waters on weather, quite a few potential prescribed fires were cancelled just before operations could begin due to significant changes in forecast.

MacDill AFB is working to increase the amount of prescribed fire acreage applied to the natural areas annually. This increased acreage will be in burn units that have little or no prescribed fire history and are adjacent to areas with potential or current gopher tortoise habitat. Conducting prescribed fire in these burn units will help to reduce the risk of natural or human-caused wildfires. It will increase the potential habitat for gopher tortoise to utilize throughout the installation, which can allow for a potential growth in population size. Additional benefits are the increase in vegetative biodiversity that can improve and increase the biodiversity of wildlife throughout the installation and the immediate surrounding communities. The increase in annual prescribed fire acreage will be implemented through a rolling 5-year average of prescribed fire implemented. This will allow for unforeseen staffing, weather and military mission constraints on implementing prescribed fire. Wildfire acreage will be included in the total prescribed fire acreage annually due to similar effects (clearing of vegetative material, increased canopy openings, etc.) of prescribed fire.

When applied in safe, carefully controlled situations, prescribed burns are the most cost-effective method for achieving the installation's natural resource objectives. MacDill AFB is working to expand its prescribed burn program so that all areas of concern are targeted in an implementation schedule that, at a minimum, ensures all areas of concern are burned roughly once every 3-5 years. Proper implementation of the projects proposed in this INRMP (see Section 8.0 Management Goals and Objectives) would increase the overall annual acreage of prescribed burns, and would lessen vegetation fuel loads, thereby reducing the potential frequency and intensity of natural or accidental wildfires.

Figure 11: 5 Year Prescribed Fire History at MacDill AFB

Climate Change Impacts on Wildland Fire Management

Wildfire frequencies and intensities are likely to remain similar to current day, or possibly decrease, at MacDill AFB due to increased precipitation offsetting relatively small increases in temperature. There is little unmanaged vegetation and relatively few ignition sources, mitigating any changes in the fire threat that may occur due to climate change. No changes in MC2 vegetation type are projected.

Temperature is projected to increase by 1-4 ºF across all scenarios during the current fire season of January through May. However, precipitation during this same time of year is expected to increase by 0.4 to 1.8 inches per month under the RCP 4.5 scenarios. This represents an average increase of 42% over these months. Increases in temperature could be offset by these substantial increases in precipitation.

However, under the RCP 8.5 2030 scenario, precipitation during fire season is expected to remain approximately stable, except for May in which an additional 1.6 inches of precipitation is expected. Fire ignition probability and intensity, under this scenario, could be expected to increase during fire season. Under the RCP 8.5 2050 scenario, precipitation is expected to increase, though not as much as under the RCP 4.5 scenarios. Without extensive additional analysis, it is not possible to determine whether the additional precipitation under this scenario will be sufficient to offset the temperature increases expected.

Substantial decreases in precipitation are projected in one or more summer months in the 2050 scenarios, but not in the 2030 scenarios, and may lead to an increased fire threat in June and July. These decreases are expected to reduce precipitation by 23 to 30%, which would likely be sufficient to expand the fire season into the summer, at least in drier years.

7.10 Agricultural Outleasing

Installation Supplement

Applicability Statement

This section applies to AF installations that lease eligible AF land for agricultural purposes. This section **IS NOT** applicable to MacDill AFB.

Program Overview/Current Management Practices

There is no agricultural outleasing program at MacDill AFB and there is no potential for such a program due to limited space, mission requirements and incompatibility, and land use needs.

7.11 Integrated Pest Management Program

Installation Supplement

Applicability Statement

This section applies to AF installations that perform pest management activities in support of natural resources management, e.g. invasive species, forest pests, etc. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

Integrated pest management is an environmentally sensitive approach to controlling pests, including insects, wildlife, and invasive species, while requiring routine monitoring of plants and structures to identify and diagnose pest problems. Pest control and invasive species management activities are incorporated into other management plans including the Integrated Pest Management Plan (IPMP). Invasive species management is one of the most important aspects of this INRMP.

The MacDill AFB IPMP outlines the overall pest management program and describes multiple alternatives to the application of chemicals for pest control. The IPMP integrates all of the agencies responsible for pest management on the base. Pest management involving insects and nuisance wildlife, and activities on base are conducted by the MacDill AFB Entomology Contractor. The MacDill AFB Entomology Contractor is responsible for pest and nuisance wildlife control throughout the base proper, except the Bay Palms golf course and privatized housing. Bay Palms golf course has a separate pest management staff responsible for conducting pest management activities within the limits of the golf course. The MacDill AFB Grounds Maintenance Contractor is responsible for pest plant and weed control throughout the entire installation, except for the Bay Palms golf course and natural areas. The MacDill AFB Ground Maintenance Contractor uses herbicides to control weed and nuisance plant growth in landscaped beds, maintained areas, and along fence lines throughout the base. The 6 CES Environmental Element natural resources program also relies on herbicides for the treatment and control of exotic, invasive plants throughout the natural areas of the base. The annual application of herbicides to control invasive vegetation is a necessary part of habitat restoration efforts for the natural resources program. All of these organizations must document herbicide usage, recording the type, amount, and active ingredients for all pesticides used. This data is reported monthly.

Wildlife Pests and Nuisance Species Management

MacDill AFB has several wildlife species defined as nuisance including Eastern grey squirrel, raccoon and Virginia opossum. These wildlife are notorious for causing problems around homes by getting into garbage and other nuisance activities. Raccoons are one reason why shorebirds do not nest to any significant degree within the installation boundaries. MacDill AFB has contracted with a local wildlife trapper to trap and remove nuisance species in the housing and administrative areas of the installation.

There are occasional issues with American alligators, Eastern diamondback rattlesnakes (*Crotalus adamantues*) and pygmy rattlesnakes (*Sistrurus millarius*) in proximity to the urban areas of MacDill AFB but these are uncommon. Reports of rattlesnakes within the vicinity of homes are handled by the MacDill AFB Pest Management Office. American alligators that are close to urban areas on MacDill AFB are removed by FWC and/or relocated by installation personnel to natural areas of the installation. The current pest management practice is to catch any venomous snakes and relocate them to an undeveloped area of the base.

Pest Control

Insect infestations normally result from poor management practices. Periodic surveillance enables identification of pests and minimizes the potential for any pest outbreaks. Such surveillance enables prevention and early detection, which are the best controls for pest management. MacDill AFB employs monitoring methods including visual observations and several types of trapping methods. Control methods include chemical, mechanical, biological, and proper sanitation practices.

Invasive Species Management

Invasive plant species are one of the most detrimental problems affecting natural resource management at MacDill AFB, adversely affecting habitat for native fish and wildlife in both wetlands and uplands, including habitat for threatened and endangered species. The high ecological and economic cost of these undesirable invasive species has been identified within the Tampa Bay region, statewide, and nationally. Invasive species treatments are performed by a contractor and overseen by the natural resources program manager.

In 2013, MacDill AFB prepared an Invasive Species Management Plan (ISMP) that outlines the installation's approach to invasive species management. This plan was last updated in 2021. The plan provides an overview of the program as well as specific prescriptions for the most significant invasive species being controlled. The most significant invasive species at MacDill AFB are discussed below. In 2016, invasive plant species management within natural areas moved from a rotational treatment of 4 different geographic zones to 2. In 2020, a rotational treatment of 5 different geographic zones was implemented. After each zone has under gone an "initial treatment", it will then be treated on a rotating annual cycle. A combination of chemical and mechanical treatments are employed for the treatment of invasive plant species. The following invasive plant species are currently targeted and treated on installation:

Brazilian pepper (*Shinus terebinthifoliuis)*

Brazilian pepper is the biggest threat to native species associated with wetlands at MacDill AFB. This program began in 1994 when Brazilian pepper was eradicated from about 64 acres. During 1995-99 about 506 acres were treated. Projects during 2000-2004 and 2005-2009 included herbicide treatment of Brazilian pepper on approximately 1,300 and 1,500 acres.

There are many available procedures for control of Brazilian pepper, including chemical, mechanical, and biological techniques. The central method of control at MacDill AFB to date has been foliar treatment. The treatment is generally effective, but must be followed up repeatedly to address re-sprouting from trees that were not completely killed and to control the growth of new recruits arising from seeds in the soil. The longer term goal is to achieve control of the Brazilian pepper and allow natural recruitment of native plant species, augmented by planting of natives, to establish a native understory that prevents Brazilian pepper recurrence.

Generally, Brazilian pepper control work at MacDill AFB rotated annually among two zones on the base. This has resulted in effective reduction and control of the largest infestations, but has not necessarily facilitated the establishment of native plants. With foliar application, the standing dead plants remain for some time and limit the growth of desired natives. The previous rotation schedule provided ample time for reestablishment. Current control efforts build on the effective work to date, while refining the general approach to target specific issues and maintain overall cost-effectiveness. The approach is moving from a mode of "reduction and control" towards a mode of "reduction and eradication" while acknowledging that complete eradication is likely not possible.

MacDill AFB will enhance coordination of Brazilian pepper controls with prescribed burning efforts, in order to develop efficiencies of combining both efforts. This coupling can entail preventive control of pepper recruitment in recently burned areas, and burning of standing dead treatment areas if fuel loads allow. However, burning of areas containing pepper must take care with smoke drift towards population areas, since Brazilian pepper can be an irritant when vaporized. Mechanical removal (roller chopping, extraction, Gyrotrac, etc.) of dead pepper will also continue to be used when appropriate.

In addition to foliar treatments currently employed, MacDill AFB will expand the Brazilian pepper controls to include small and medium scale herbicide applications. Basal bark ("hack and squirt") applications, using a USEPA/FDACS approved, triclopyr-based herbicide, are effective and use much lower volumes of herbicide than foliar applications. Repeated treatments, whether foliar or basal, are an effective means of dealing with the rapid re-infestation potential of the plant.

Biological control is Florida's preferred management strategy for Brazilian pepper. MacDill AFB may deploy state-identified forms of biological control in conjunction with other efforts. The USDA has implemented a biocontrol research project utilizing Brazilian pepper growing at MacDill AFB and other AF installations throughout the state of Florida. An additional element of this strategy is to establish native plants that inhibit growth of Brazilian pepper, such as Wax myrtle (*Myrica cerifera*) and Love vine (*Cassytha filiformis*). Nearly all Brazilian pepper recruitment is through fruits eaten and dispersed by birds or mammals as seeds.

Melaleuca (*Melaleuca quinquenervia*)

Another invasive non-native species that threatens wetlands at MacDill AFB is Melaleuca, better known as paper-bark or punk tree. Melaleuca was first introduced to Florida as an ornamental plant in the late 1800s. This water-loving tree's seeds were scattered aerially over the Everglades in the 1930s in an effort to reduce the water level and allow for further development. Melaleuca grows extremely fast, and produces dense stands that displace native plants, diminish wildlife habitat, and provide little forage for wildlife. It has become abundant in pine flatwoods, sawgrass marshes, and cypress swamps throughout south Florida and is established on installation. Though the species has since been taken off the approved landscaping list at MacDill AFB, it was once planted as an ornamental plant for landscaping on the base. This tree has been prolific at MacDill AFB and efforts will continue to target this species for removal.

Australian Pine (*Casuarina equisetifolia*)

Australian pine is an invasive tree at MacDill AFB. This tree does not spread as rapidly as Brazilian pepper or melaleuca. Australian pine will be removed when opportunities permit, generally in association with other habitat improvement projects. This tree has previously been planted throughout the installation as an ornamental species and is still present in several high profile locations.

Lead Tree (*Leucaena leucocephala*)

Lead tree is an aggressive invasive tree that has quickly filled in disturbed areas throughout the natural areas of MacDill AFB. This single-trunk tree establishes in coastal strand and hammock communities and in creek bank habitats on installation. It rapidly invades disturbed forest openings and sunlit edge areas, forming dense thickets that occupy the lower canopy. These stands have little wildlife value and displace native vegetation. Lead tree was originally introduced to Florida as a cattle fodder and pioneer plant for land reclamation and erosion control. Efforts will continue to target this tree for removal, primarily using a mix of mechanical and herbicide controls as the tree could regenerate from cuttings. Although no quantifying surveys have been accomplished, anecdotal evidence suggests that - as of 2019 - lead tree appears to be the second most common invasive tree species on MacDill AFB after Brazilian pepper.

Cogon Grass (*Imperata cylindrica*)

Cogon grass is found throughout MacDill AFB, generally in small patches (less than 400 sq ft) in open fields and near tree lines or roadways. Cogon grass is a tall perennial grass found throughout Florida and several other southeastern states. Introduced in Florida in the 1930's and 1940's as possible forage for cattle and for soil stabilization. It was later determined to have little forage value or economic benefit and was categorized as a Category 1 species on the Florida Exotic Pest Plant Council (FLEPPC) Invasive Plant Species list.

Cogon grass prefers full sun but can survive in partial shade conditions. It is most commonly found in open fields and pastures, and is frequently reported along roadways and utility corridors. The grass can survive in fine sand to heavy clay. It cannot survive in deep shade nor can it survive in cultivated areas, as the routine tilling disrupts root growth and spread.

Other Invasive and Nuisance Species

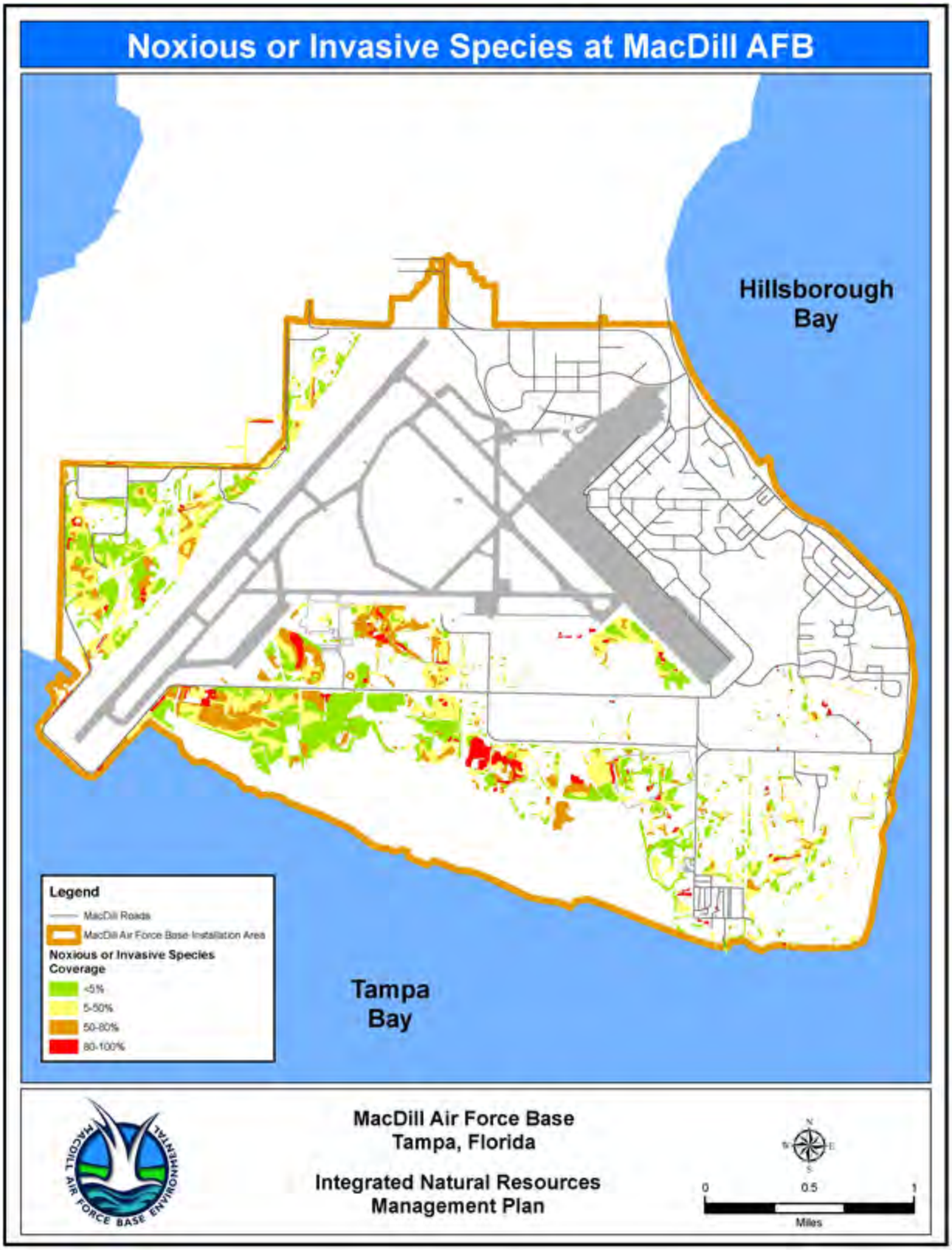
Other invasive and nuisance species that are common on MacDill AFB include water hyacinth (*Eichhornia crassipes*), castor bean (*Ricinus communis*), muscadine grape (*Vitis rotundifolia*), rosary pea (*Abrus precatorius*), lantana (*Lantana camara*), rose natal grass (*Melinis repens*), and Caesar weed (*Urena lobata)*. Several other invasive plant species are found at MacDill AFB but are not described in this plan.

Although cattails (*Typha sp.*) are native to Florida, they have created problems for wetlands on installation. Eutrophication of lakes has allowed this shallow water species to dominate vegetation in some places, which creates problems for the wetland ecosystem as a whole and greatly affects recreational access to such areas. This occurred at Lewis Lake, which is required to be kept free of such weeds as part of its storm water permit. Cattails were previously chemically sprayed and hand- pulled, and native aquatic vegetation was planted. In 2004, the cattail had again taken over much of Lewis Lake and mechanical removal of cattails was completed. This procedure was determined to not be cost effective and was not very successful at controlling cattails. MacDill AFB began routine chemical control of cattails, especially in Lewis Lake, around 2010. As of 2019, the USFWS has been providing chemical treatment control of cattails in Lewis Lake and the SWIM restoration areas.

Herbicide Application Requirements

All herbicide applications at MacDill AFB are completed through use of a contractor and federal employees. All contractor applicators on installation must have a valid Florida Department of Agriculture and Consumer Services (FDACS) commercial pesticide applicator's license with the proper natural resource or aquatic endorsement and government employees must have a valid public applicator's license. The current habitat restoration contract is tasked with a >95% control rate for initial treatments and a <5% control for maintenance treatments. As basal bark applications and biological controls are incorporated into current management efforts, the number and frequencies of follow-up applications will likely evolve, as will the overall rotational schedule for foliar applications.

Figure 12: Noxious or Invasive Species Coverage



7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)
Installation Supplement

Applicability Statement

This section applies to AF installations that maintain a BASH program to prevent and reduce wildlife- related hazards to aircraft operations. This section IS applicable to MacDill AFB.

Program Overview/Current Management Practices

Direct manipulation of wildlife populations on MacDill AFB is largely conducted under the Bird/Wildlife Aircraft Strike Hazard (BASH) program. The BASH program receives high priority given the potential for loss of human life, economic cost, and reductions in operational readiness due to bird/wildlife - aircraft collisions. MacDill maintains a bird database with information such as the number of birds seen, locations, and sources of attraction. Both resident and migratory birds pose the potential for strikes with aircraft on the runway, approaches, and airfield operations areas. The BASH management goal is to minimize that risk potential through techniques such as:

- Passive techniques – habitat manipulation including, but not limited to vegetation height control, seeding bare areas to discourage bird resting areas, and pond/ditch management near airfields to discourage use by wildlife, (MacDill AFB was issued an exemption from permitting from the FDEP for such ditch maintenance activities and has a permit with the USACE for ditch maintenance activities), exclusionary devices, removal of attractants, food sources, and areas of cover.

- Non-passive techniques – use of bioacoustics (recordings of bird distress or alarm calls), pyrotechnics (banger/screamer sirens, shell crackers, CAPA rounds, starter caps), lasers, effigies, trapping, translocation, and select lethal removal.

Efforts are ongoing to make the airfield and surrounding areas acceptable to BASH standards. Low-lying depressions on the airfield periodically flood and attract birds. The Airfield Drainage Repair project was implemented in 2015 and corrected some drainage issues around the runway by restoring historic drainage features, replacing blocked drainage pipes, re-grading the land surface, and filling in low lying areas. This project also involved the creation of three mitigation areas to offset the loss of wetland habitat. The project was necessary to ensure that hazards posed to Air Force personnel and aircraft are minimized to the greatest extent possible.

The 6 ARW OPLAN 91-2 Bird/Wildlife Aircraft Strike Hazard describes the BASH program in more detail, and can be found in Appendix C. The MacDill AFB BASH Plan was updated in 2019, and is currently under review. As of 2014, management of the BASH program shifted from a hired contractor to the U.S. Department of Agriculture (USDA) under a Memorandum of Agreement between the USAF and the USDA. The USDA utilizes a broad range of techniques to manage wildlife on the airfield, including select depredation. The USDA has increased research of local wildlife populations compared to previous contractors. One project tagged over 200 vultures with wing tags and four receiving GPS transmitters to track daily movement patterns in conjunction with aircraft operations. USDA has been able to reduce bird and wildlife strikes continually for the first four years and provided an 80% reduction of time spent in elevated bird watch condition compared to previous contractor USDA completed MacDill's first Wildlife Hazard Assessment in January 2016, cataloging wildlife utilizing the airfield and surrounding areas, breaking down historical strike data, categorizing the most hazardous species on installation, and highlighting wildlife attractants with recommendations to alleviate wildlife usage. The BASH program at MacDill AFB is an ongoing, constantly evolving program due to the always changing habitat, fluctuating wildlife species, and dynamic environment.

The United States Army Reserve (USAR) Aviation Support Facility (ASF) recently completed a beddown of 23 UH-60 helicopters relocated to MacDill AFB from St Petersburg/Clearwater Airport. The facility has an aircraft apron that abuts with taxiway Kilo on the airfield. Harassment of wildlife along the apron and taxiway occur as part of normal USDA BASH operations. Otherwise, the UH-60 helicopters function as their own BASH program due to noise produced by the rotors and by rotor-wash during take-off and landing procedures.

7.13 Coastal Zone and Marine Resources Management
Installation Supplement

Applicability Statement

This section applies to AF installations that are located along coasts and/or within coastal management zones. This section IS applicable to MacDill AFB.

Program Overview/Current Management Practices

Due to the unique location and peninsular layout of MacDill AFB, coastal zone management is a vital part of natural resources management. The eastern shoreline of MacDill is especially susceptible to erosion due to the lack of vegetation and larger wave energy produced by ships utilizing the shipping channels within Hillsborough Bay. The installation has implemented two efforts to reduce shoreline erosion since 2003. The use of concrete oyster domes and oyster shell bags to create near shore oyster reefs along the southeast shoreline to break up wave energy, trap sediment and encourage the recruitment of vegetation, and construction of a limestone revetment along the eastern shoreline of Bayshore Boulevard. Both projects are described below.

A shoreline stabilization demonstration project (Phase I) to construct 800 feet of oyster reef along a section of shoreline south of the installation's wastewater treatment plant, started in 2003. The Environmental Protection Commission of Hillsborough County (EPC), Tampa Port Authority, Florida Department of Environmental Protection (FDEP) and the USACE permitted the project. Volunteers from MacDill AFB and local community organizations installed marine-friendly concrete oyster domes in four different configurations to create approximately 8,400 square feet of solid substrate encouraging the recruitment of oysters. Different configurations were used to determine the most effective layout of the oyster domes to achieve maximum oyster recruitment and shoreline stabilization. Another 640 square feet of solid substrate was created through the installation of oyster shell bags in the between the zones of oyster domes.

Both the oyster domes and shell bags were installed in the near shore waters of the installation's coastline between 50 and 100 feet offshore. The purpose of the oyster dome project is to create a near shore oyster reef. This reduces wave energy, traps and accumulates sediment, increases filtration of seawater after establishment of oysters, and eventually enables the establishment of marsh vegetation, further stabilizing the shoreline.

Additional phases of shoreline stabilization have been implemented since 2003. These phases were primarily funded by the DoD with additional support from NOAA, USFWS, Hillsborough County EPC and the Tampa Bay Estuary Program (TBEP). Phase II involved the installation of oyster shell bags to create 1,600 square feet of substrate protecting mangroves on the southeast corner of the installation. Phase III effort installed another 15,750 square feet of near-shore oyster reef around the southeast corner of the installation. Phase IV effort constructed another ~20,000 square feet of oyster dome reef and 4,140 square feet of oyster shell bag reef. The Phase V effort constructed ~8,400 square feet of oyster dome reef and ~2,100 square feet of oyster shell bag reef. The Phase VI effort is funded and underway, and includes the installation of oyster shell bags and oyster domes.

The stabilization project has been highly successful and led to sand accretion, water quality improvement, improved habitat for small fish and stabilization of the installation's shoreline. The project has led to the re-establishment of native vegetation along a majority of the shoreline where oyster reefs are installed. At the end of 2016, all five phases of the stabilization project constructed 8,150 linear feet of oyster reef and stabilized ~2 miles of shoreline between the installation's Family Campground and the beginning of Bayshore Boulevard. Since 2016, the living shoreline has continued to be extended north along Bayshore Boulevard.

A potential seagrass restoration effort is in the planning stages for the Gadsden Point area, on the southeastern corner of the installation. This project involves the beneficial use of dredge spoil to fill historic dredge holes located at Gadsden Point. The dredge spoil source and amount is under assessment. Filling these historic dredge holes would raise the bay bottom up to an elevation similar to the surrounding area, which currently contains sparse to dense seagrass beds. The project would create ~9 acres of new bay bottom at an elevation conducive to the establishment of seagrass. Seagrass establishment in these newly formed shallow areas would occur through natural recruitment and/or transplanting from surrounding areas. The project could create ~9 acres of new seagrass beds which provide habitat for a variety of fish and other wildlife including Florida manatees.

The trimming of mangroves along the eastern shoreline in 2003, combined with an active hurricane season in late 2004, resulted in significant erosion along Bayshore Boulevard. The installation obtained permits for shoreline stabilization through the construction of a limestone boulder revetment along most of the eastern shoreline between the Bayshore gate and the installation's wastewater treatment plant. The revetment has been successful at controlling erosion along the shoreline.

AFMAN 32-7003 (Environmental Conservation) contains guidance for Coastal Zone Management compliance and requires that actions taken by MacDill AFB be consistent with coastal zone management objectives. MacDill AFB accomplished this through the Single Point of Contact in the State Clearinghouse (INRMP Stakeholders and Contact Information). This Single Point of Contact reviews documents (NEPA, projects, plans, etc.) produced by MacDill AFB and sends them to all pertinent agencies for review. Comments received by MacDill AFB are incorporated into projects and guidance as necessary.

Figure 13: Living Shoreline (North)

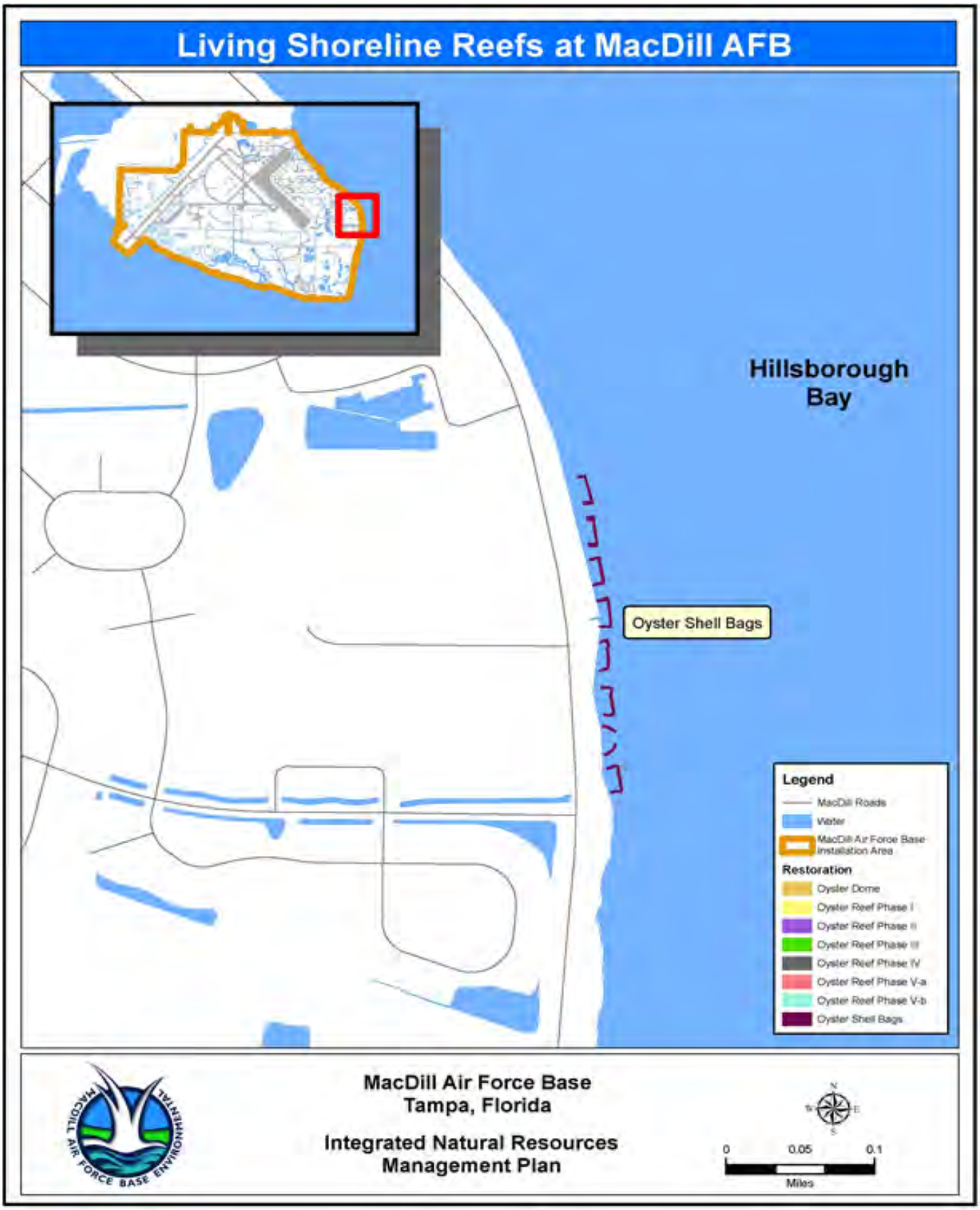


Figure 14: Living Shoreline (Middle)

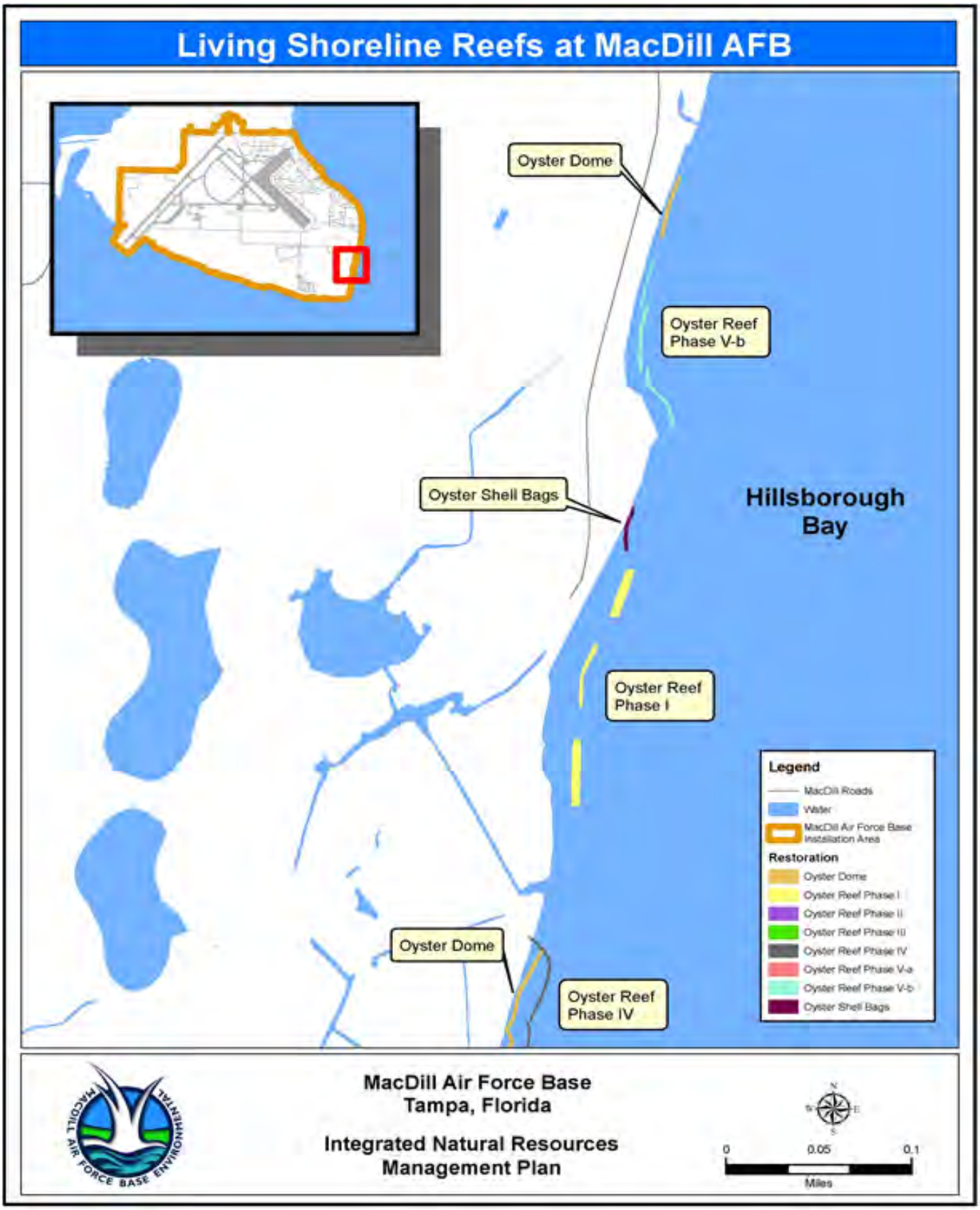
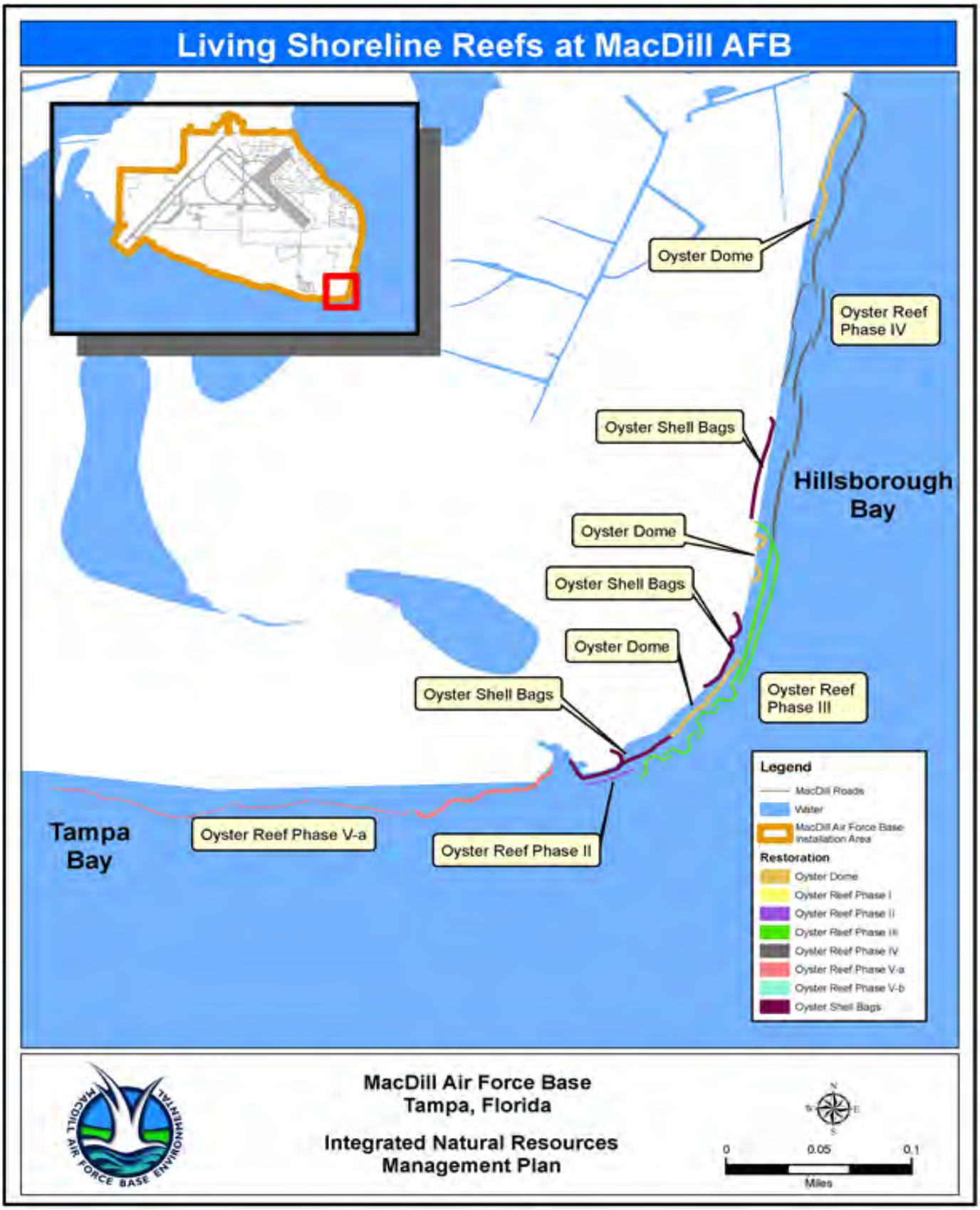


Figure 15: Living Shoreline (South)



Climate Change Impacts on Coastal Zone and Marine Resources Management

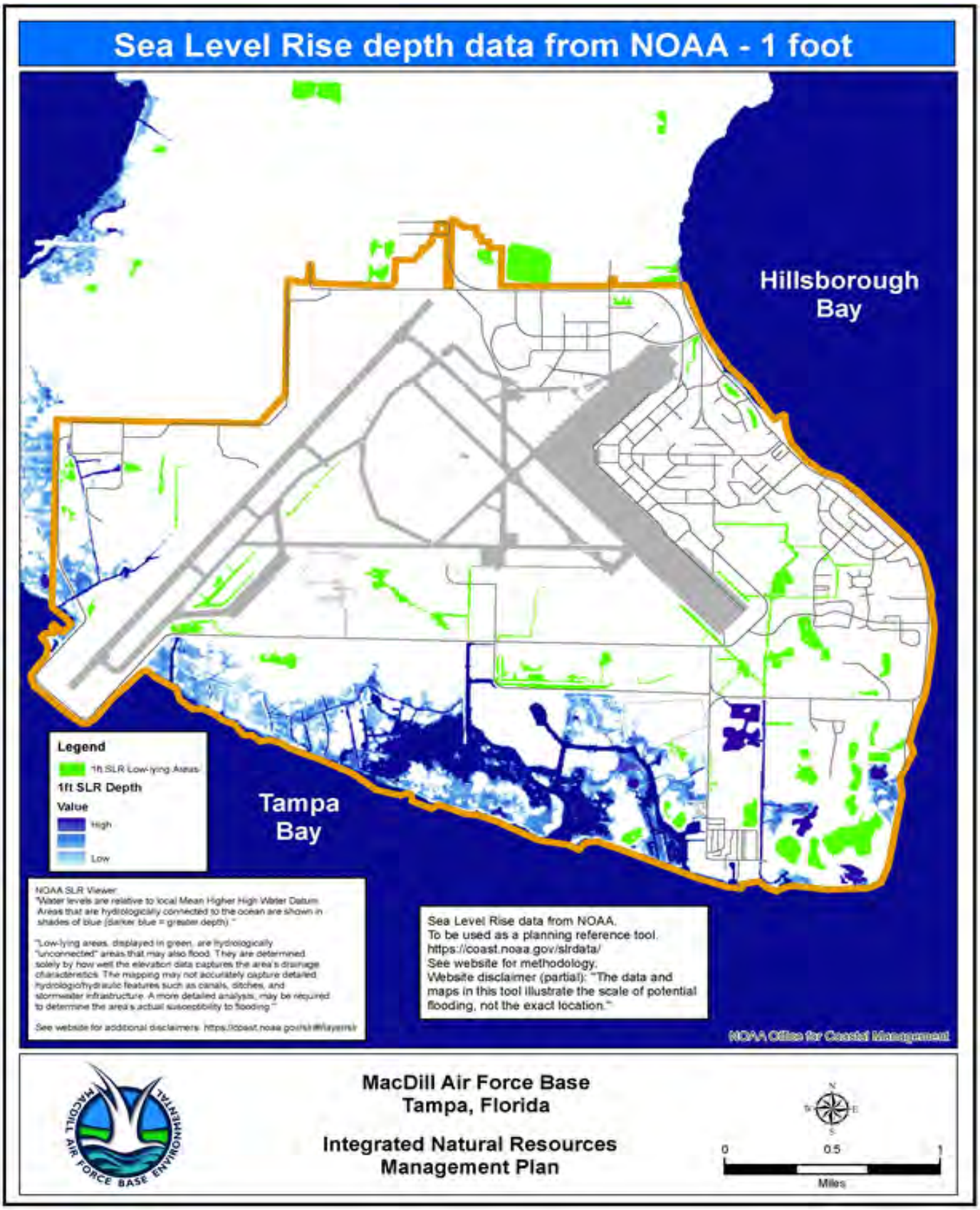
Based on the vulnerabilities projected due to flooding, the following set of adaptation strategies have been curated for consideration (Table 9). Suggested adaptation projects are rated by their difficulty to implement and their relative efficacy. Ease of implementation is ranked from 1 to 3, with 1 being most difficult to implement and 3 being the easiest to implement. Efficacy is ranked from 1 to 3, 1 being the least effective and 3 being the most effective.

The ecological impacts related to adopting each of these projects is stated to be positive if no negative impacts are expected. If these projects are expected to have negative ecological impacts, they are rated one (being minimal negative impacts) through three (being extensive negative impacts). Some of these measures have already been implemented at MacDill AFB including sea walls, rip rap and living shorelines along the Eastern and Southern portions of the installation.

Table 9: Summary of suggested adaptation strategies based on SLR/Storm Surge projections.

Strategy	Implementation	Efficacy	Ecological impacts	Ecological resources
Sea Walls	3	3	2	Gittman, Scyphers, Smith, Neylan, & Grabowski, 2016
Storm Surge Gates	3	3	1	Tam, 2009
Saltwater Intrusion Barriers	2	3	Positive	USEPA, 2015
Coastal Relocation	3	3	Site Specific	Bronen, 2011
Controlled Overtopping	2	2	Positive	NRC, 2013

Figure 16: 1-foot Sea Level Rise at MacDill AFB



7.14 Cultural Resources Protection
Installation Supplement

Applicability Statement

This section applies to AF installations that have cultural resources that may be impacted by natural resource management activities. This section **IS** applicable to MacDill AFB.

Program Overview/Current Management Practices

Cultural resources management at MacDill AFB is provided in accordance with Section 106 and Section 110 of the National Historic Preservation Act (16 USC 470, as amended), the Archeological Resources Protection Act (16 USC 470, as amended), the American Indian Religious Freedom Act (42 USC 1996), the Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.), Executive Order 11593 (Protection and Enhancement of Cultural Environment), DoD Directive 4710.1 (Archeological and Historic Resources Management, 1984), and AFMAN 32- 7003 (Environmental Conservation).

On 29 March 1950, The Honorable Mr. Fuller Warren, Governor of the State of Florida, executed a Deed of Cession to transfer ownership of land at the southern tip of the Interbay Peninsula to the United States of America. Pursuant to the transfer, the AF has exclusive jurisdiction over approximately 5,518 acres of land compromising MacDill Air Force Base. According to research done by the United States Army Corps of Engineers, approximately 112 acres were added to MacDill Air Force Base from 1940 to 1978. The additional land is located primarily along the northern boundary of the base and is proprietary jurisdiction. Events that occurred on September 11, 2001, prompted the establishment of a restricted area in the waters surrounding MacDill that extends 1,000 meters into the bay.

Multiple archaeological surveys have been accomplished on the installation over the years. Most recently, two basewide survey efforts evaluated a significant portion of the installation (4,535 acres), accounting for roughly 79% of the property owned by MacDill. The majority of the land not included in two year basewide survey effort (~1,160 acres) consists of land that has been individually surveyed as part of construction project planning, as well as the privatized family housing area; future surveys are in the planning stages for the lands management. The surveys resulted in the identification of 50 known archaeological sites, five of which are confirmed eligible for the National Register of Historic Places (NRHP), and two of which require additional study to determine eligibility. There are very few areas remaining on the installation that have not been surveyed.

Ground-disturbing natural resources projects in non-surveyed areas must have site-specific surveys performed within the action area prior to implementation. Review of projects by the Cultural Resources Manager and the EIAP process are used to ensure protection of known and potential cultural resources.

MacDill AFB developed an Integrated Cultural Resources Management Plan (ICRMP) in 2016 (ICRMP, USAF, 2016). The ICRMP deals primarily with the preservation of buildings and other structures on the base, but contains more detailed information regarding the installation's known and potential cultural resources. The ICRMP is undergoing a 5-yr review, and is compatible with this INRMP (Appendix E).

In December 2019, an investigation by the Tampa Bay Times indicated a potential African American burial ground, the Port Tampa Cemetery, was located within the MacDill AFB boundary. An archaeological investigation into the potential burial ground in 2020 concluded that it is most likely located within the installation's boundaries in a predominantly wooded area. The area affects most natural resource management activities (prescribed fire, invasive species management, mechanical treatments, restoration activities, etc.), and any proposed ground disturbing activities in the area would require consultation with the State Historic Preservation Officer to determine a path forward. While the general location of the Port Tampa Cemetery is established, the full extents of the site remain unknown. Additional surveys within the area to better delineate the boundaries of the site and to guide management of the Port Tampa Cemetery are planned to begin in FY23.

7.15 Public Outreach
Installation Supplement

Applicability Statement

This section applies to all AF installations that maintain an INRMP. MacDill AFB IS required to implement this element.

Program Overview/Current Management Practices

MacDill AFB provides information to the base personnel, general public, and surrounding communities to highlight natural resource activities on installation and other recreational opportunities. The MacDill Thunderbolt, the installation newspaper, promotes natural resource awareness through the coverage of events and activities. Examples include articles written by the Natural Resources Manager on dangerous wildlife, the oyster reef restoration project, and the prescribed burn program. In addition, the newspaper often develops and publishes stories prepared in-house. The 6 CES Environmental Element works with Public Affairs to produce Natural Resources-focused postings for social media. MacDill AFB also utilizes a digital, email-based public service announcement system (PSA). The PSA includes a weekly bulletin sent out to all base personnel with email access about potential volunteer opportunities. Additionally, the 6 CES produces a daily "Bull Sheet" announcement to the squadron and includes potential volunteer opportunities.

The 6 CES Environmental Element routinely coordinates several major natural resources conservation events per year, including the MacDill AFB Coastal Cleanup, oyster reef building events, Arbor and Earth Day events. The latter two events usually include 20-30 people, including children, parents, and teachers from the on-base elementary school and other volunteers from base squadrons. The Natural Resources Manager is available to lead walks and base tours to various points of interest and provides information regarding plants and wildlife in the area.

Wildlife Education Programs

A snake identification and information pamphlet was prepared by the MacDill AFB natural resources staff to help installation residents identify snakes that they may encounter and distinguish between non-venomous and venomous varieties. This information is provided to AF personnel stationed at MacDill AFB for short-term training missions, which routinely includes airmen staying in tents. The installation may prepare similar pamphlets, or adapt ones provided by DoD Natural Resources and DoD Partners in Amphibian and Reptile Conservation (DoD PARC), in the future as necessary for public information and education.

The 6 CES Environmental Element has installed interpretative signage along the existing nature trail at Lewis Lake and at selected areas along the eastern shoreline. The signs provide information to the base personnel and public about specific plant or wildlife species potentially encountered during a hike or visit to the shoreline. The intent of the signage is to inform personnel and the public about the types of native flora and fauna that could be found on MacDill AFB. Interpretative signs educate the base personnel and public on the benefit that specific species provide the ecosystem, and strengthen their understanding of the interconnection between all species and the need for active management of habitat to counteract the negative effects of disturbance and development that commonly occur in populated areas. Updating and creating additional signage is planned for the future.

7.16 Climate Change Vulnerabilities
Installation Supplement

Applicability Statement

This section applies to USAF installations that have identified climate change risks, vulnerabilities, and adaptation strategies using authoritative region-specific climate science, climate projections, and existing tools. This section is applicable to this installation.

Program Overview/Current Management Practices

The Tampa Bay region is one of the 10 most vulnerable in the United States with respect to the effects and impacts of climate change. This includes sea level rise (SLR), an increase in temperatures, saltwater intrusion of groundwater, increase in yearly temperatures, changes in landforms, and an increase in severe weather patterns or storms. More than 42% of the land within the Tampa Bay watershed is developed and a significant portion of the Tampa Bay population, including MacDill AFB, will feel these effects.

MacDill AFB is in a unique geographic position, located at the Southern end of the Interbay peninsula and having over 5 miles of coastline including several significant military assets located within 1 mile of the coastline, and the effects of climate change could have a substantial impact on the installation's military mission. Two major impacts to MacDill AFB are the increase of SLR and the change of landforms within and around the installation.

The DoD recognizes the forces of climate change and the effects that it can have on military installations within coastal zones (Security 2016). Major impacts to the military mission include effects on military readiness, operations, and the nation's national security strategy. Working with the most recent and accurate scientific information available, and continuously implementing strategies to build capacity for addressing infrastructural, operational, and strategic risks will allow the sustained operations of MacDill AFB. MacDill AFB Environmental Element continuously receives guidance from historic and current scientific data, and by collaborating with local, regional, and national agencies to understand how climate change will affect the installation. This allows installation staff to create and implement projects in anticipation and response to these threats.

7.17 Geographic Information Systems (GIS)

Installation Supplement

Applicability Statement

This section applies to all AF installations that maintain an INRMP, since all geospatial information must be maintained within the AF GeoBase system. MacDill AFB IS required to implement this element.

Program Overview/Current Management Practices

Modern GIS management tools allow for highly efficient development and synthesis of geographically-based spatial natural resource data. MacDill AFB has developed a standardized GIS database for comprehensive base planning purposes. The components of the base GIS database include information utilized to develop maps and tables for this INRMP, and utilized to document ecosystem status during implementation of this INRMP.

MacDill AFB will continue to coordinate with its natural resources partners to ensure the GIS database is maintained as current as possible and that any GIS data collection techniques are comparable with partners and others working on the same issues in the area of the base. Any new GIS data generated by projects associated with natural resources protection is submitted to the Geobase Information Office (GIO) to be added to the existing GIS database. A GIS Specialist, stationed at Patrick AFB, is tasked to help the MacDill AFB 6 CES Environmental Element maintain a current and organized geodatabase on installation.

8 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize USAF missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the 'Installation Supplement' section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Installation Supplement

Goal 1: Protect and improve the recovery of federally listed species and their associated habitats while ensuring mission sustainability.

Objective 1.1: Conduct management of gopher tortoises and eastern indigo snake required to achieve Endangered Species Act requirements within the Species Recovery Plan for the eastern indigo snake, and in accordance with the Gopher Tortoise Candidate Conservation Agreement (GTCCA).

Project 1.1.1: Restore, enhance, and maintain current and/or potential gopher tortoise and eastern indigo snake habitat by conducting mechanical and chemical treatment of invasive species and overgrown understory/midstory and replanting with native vegetation.

Project 1.1.2: Conduct gopher tortoise and eastern indigo snake monitoring and required relocations prior to conducting habitat restoration work involving any clearing/land alteration activities.

Project 1.1.3: Ensure proponents of construction projects conduct surveys and monitoring of gopher tortoises and eastern indigo snakes prior to land manipulation.

Project 1.1.4: Implement the "Standard Protection Measures for the Eastern Indigo Snake" developed by USFWS during construction or any clearing/land alteration activities.

Project 1.1.5: Conduct a basewide population survey/estimate at least every 5 years.

Project 1.1.6: Update the T&E species AF geobase with gopher tortoise/Eastern indigo snake observation, relocation, and burrow locations.

Project 1.1.7: Implement 50% of prescribed burn acreage in potential, or current, gopher tortoise habitat.

Project 1.1.8: Complete the GTCCA annual reporting data call by the end of the calendar year.

Objective 1.2: Conduct management of the federally protected bald eagle to ensure compliance with The Bald and Golden Eagle Protection Act and the bald eagle depredation permit requirements.

Project 1.2.1: Conduct monitoring of known bald eagle nests during nesting season (October - May) to determine nesting and/or fledging status.

Project 1.2.2: Complete annual reporting requirements, and permit renewal IAW USFWS depredation permits.

Project 1.2.3: Update the AF geobase with bald eagle observation locations year-round.

Project 1.2.4: Install temporary signage during bald eagle nesting season at publicly accessible nest locations.

Objective 1.3: Conduct management of the ESA threatened Florida Manatee (*Trichemus manatus latirostris*) to ensure its protection and recovery.

Project 1.3.1: Conduct Section 7 consultations when actions have the potential to adversely impact the Florida manatee.

Project 1.3.2: Ensure that MacDill's AFB in-water projects are implementing the USFWS "Standard Manatee Conditions for In-water Work".

Project 1.3.3: Conduct surveys for manatees within marine security zone and waterways.

Project 1.3.4: Maintain manatee protection signage along Southern and Eastern shoreline.

Project 1.3.5: Update the AF geobase with new manatee observation locations within base waters.

Objective 1.4: Conduct management of the ESA endangered smalltooth sawfish to ensure its protection and recovery.

Project 1.4.1: Document sightings and update the AF geobase and NMFS with smalltooth sawfish observation locations.

Project 1.4.2: Conduct Section 7 consultations when actions have the potential to adversely impact the smalltooth sawfish.

Project 1.4.3: Ensure that MacDill's AFB in-water projects are implementing "Sea Turtle and Smalltooth Sawfish Construction Conditions" developed by NOAA-NMFS.

Project 1.4.4: Maintain smalltooth sawfish protection signage along Southern/Western shorelines, and investigate other potential areas heavily utilized by the public for fishing and recreation.

Project 1.4.5: Publicize devices, through 6th Force Support Squadron, that reduce the capture, injury, and mortality from recreational fishing activities (e.g., corrodible and circle hooks).

Project 1.4.6: Coordinate annually, or as requested, with NOAA-NMFS to provide access to the installation's coastline for potential smalltooth sawfish research projects.

Objective 1.5: Conduct management of the ESA endangered/threatened sea turtles to ensure their protection and recovery.

Project 1.5.1: Document sightings, and update the AF geobase, FWC, NMFS, and USFWS (nests) with sea turtle observation locations.

Project 1.5.2: Conduct Section 7 consultations when actions have the potential to adversely impact sea turtles.

Project 1.5.3: Ensure that MacDill's AFB in-water projects are implementing "Sea Turtle and Smalltooth Sawfish Construction Conditions" developed by NOAA-NMFS.

Project 1.5.4: Investigate and define potential projects for restoring seagrass beds within the MacDill marine security zone.

Project 1.5.5: Provide sea turtle educational and safety presentations as requested/needed to public or for in-water construction activities.

Objective 1.6: Conduct management of the ESA endangered/threatened birds (red knot; piping plover; wood stork; eastern black rail; wood storks) to ensure its protection and recovery.

Project 1.6.1: Document sightings of federally listed birds, and update the AF geobase, and USFWS with observation locations.

Project 1.6.2: Conduct Section 7 consultations when actions have the potential to adversely impact any ESA listed birds.

Project 1.6.3: Report observations of banded red knots and piping plovers to the USGS year-round or as needed.

Project 1.6.4: Report observations of eastern black rails to the USFWS, should they occur.

Project 1.6.5: Monitor and document any shoreline erosion at MacDill AFB beach.

Project 1.6.6: Continue to support environmentally friendly coastal shoreline and wetland projects such as oyster reef construction and other living shoreline efforts to control erosion.

Project 1.6.7: Investigate and define potential projects for restoring areas around the installation to provide habitat for ESA endangered/threatened birds.

Objective 1.7: Conduct management of federally listed marine species not present but with the potential to access MacDill AFB waters, such as the giant manta ray and the Gulf sturgeon, to ensure their protection and recovery.

Project 1.7.1: Document sightings of federally listed marine species that have the potential to occur at MacDill AFB waters, and update the AF geobase, and NOAA-NMFS with observation locations.

Project 1.7.2: Coordinate annually, or as requested, with NOAA-NMFS to provide access to the installation's coastline for potential research projects.

Objective 1.8: Work with installation partners to promote conservation measures that ensure habitat integrity, minimize impacts, and reduce human disturbance to ESA listed species.

Project 1.8.1: Enforce unauthorized entry restrictions in accordance with 33 CFR 334.635(c) of the 1,000m marine security zone surrounding MacDill AFB.

Goal 2: Manage invasive species to minimize impacts to federal and state protected species and their native ecosystems, and to support mission sustainability.

Objective 2.1: Control invasive plant species and monitor effectiveness of treatment.

Project 2.1.1: Identify and prioritize areas for invasive plant removal.

Project 2.1.2: Utilize mechanical, chemical, and biological methods to remove and control invasive plant species.

Project 2.1.3: Monitor previously treated areas and retreat as needed.

Project 2.1.4: Survey 100% of prescribed burn areas for invasive plant species locations and coverage within 6 weeks of treatment.

Project 2.1.5: Ensure 100% compliance with vehicle washing and invasive species vector removal by natural resources contracting organizations, after work performed in areas with known invasive plant species.

Project 2.1.6: Conduct invasive plant species and natural communities surveys to aid in defining priority treatment areas and habitat restoration goals.

Project 2.1.7: Collect baseline natural communities and invasive vegetation data to aid in development of an Invasive Species Management Masterplan that would define habitat restoration goals and create habitat or community-specific restoration projects to improve natural areas.

Objective 2.2: Manage invasive wildlife species and monitor potential impacts to protected species and their habitats.

Project 2.2.1: Identify and update the AF geobase with invasive/nuisance wildlife species observations within, or around, the installation as observed.

Project 2.2.2: Provide guidance to the installation Integrated Pest Management Officer for annual reviews.

Goal 3: Provide management for native wildlife and state protected species by promoting biodiversity, monitoring, and implementing actions to protect and enhance their survival.

Objective 3.1: Conduct management of imperiled species.

Project 3.1.1: Provide imperiled species incidental observational data to state and local agencies on an annual basis, or as requested.

Project 3.1.2: Conduct annual imperiled species wading bird rookery surveys IAW current FWC guidelines to identify potential nesting/rookery locations on installation.

Project 3.1.3: Conduct periodic acoustic monitoring for gopher frog (*Lithobates capito*) in ditches and wetlands on the installation during known breeding season.

Project 3.1.4: Conduct periodic monitoring for tri-colored bat (federal candidate species) and Florida bonneted bat (federally endangered species) and update the AF geobase with observations.

Project 3.1.5: NRM accomplish training for management and/or relocation of imperiled species.

Objective 3.2: Conduct management of herpetological species.

Project 3.2.1: Complete a baseline herpetofaunal survey of the installation, targeted for 2023.

Project 3.2.1: Utilize the survey results to determine management actions and incorporate them in the INRMP.

Objective 3.3: Conduct management of migratory birds.

Project 3.3.1: Complete annual depredation permit reporting requirements and permit renewal.

Project 3.3.2: Conduct surveys for migratory bird nests prior to mechanical and/or prescribed fire treatment and mark nest areas to avoid their destruction.

Project 3.3.3: Ensure proponents of construction or improvement projects conduct surveys for migratory bird nests and mark to avoid their destruction.

Project 3.3.4: Coordinate and investigate access to installation by local Audubon groups to conduct annual Christmas Bird Counts.

Project 3.3.5: Participate in the Bird Hazard Working Group and coordinate wildlife and habitat management IAW the BASH plan.

Project 3.3.6: Participate in the Partners in Flight program.

Project 3.3.7: Perform annual shorebird surveys.

Goal 4: Manage natural resources with an adaptive ecosystem management framework to maintain, enhance, and restore natural habitat conditions and promote biodiversity.

Objective 4.1: Protect, enhance, and restore coastal habitat systems through maintenance, enhancement and/or restoration, monitoring, and collaboration.

Project 4.1.1: Conduct shoreline oyster reef and other living shoreline restoration events in conjunction with Tampa Bay Watch.

Project 4.1.2: Perform year-round inspections of shorelines, beach, navigable waterways/canals and document substantial signs of erosion or habitat degradation.

Project 4.1.3: Conduct coastal cleanups.

Project 4.1.4: Meet with Tampa Bay Watch biannually to discuss potential partnership opportunities and project statuses.

Project 4.1.5: Coordinate access to seagrass monitoring transects for Tampa Bay Estuary Program and partner organizations.

Project 4.1.6: Attend the Tampa Bay Region Planning Council's Agency on Bay Management meeting quarterly

Project 4.1.7: Attend the Tampa Bay Estuary Program Technical Advisory meeting annually.

Project 4.1.7: Attend the the Tampa Bay Estuary Program Habitat Restoration Consortium quarterly.

Objective 4.2: Maintain, enhance, and restore wetlands to achieve a no-net loss of overall quantity and quality.

Project 4.2.1: Control 56 acres of aquatic nuisance and invasive vegetation within the SWIM wetland system as mandated in Section 404 USACE permit #: SAJ-2012-00246(NW-LDD).

Project 4.2.2: Restore mangrove wetlands sites, including site 20, as described in the ERMP. Restoration work may include removal of invasive vegetation, restoring wetland hydrology and hydrological flows, and replanting with native wetland vegetation.

Objective 4.3: Maintain a wildland fire management program IAW MacDill AFB Wildland Fire Management Plan to restore natural habitats by mimicking historic fire regimes, reduce wildfire threats, and enhance sustainability of the military mission.

Project 4.3.1: Conduct prescribed fire annually, based on a 5-year average, on a 3-5 year fire return interval.

Project 4.3.2: Maintain current fire breaks, through the AF Wildland Fire Branch and MacDill AFB 6th Civil Engineer Squadron, to prevent wildfire threats to the military mission and critical infrastructure.

Project 4.3.3: Plan, coordinate, and schedule prescribed fire events with the Air Force Wildland Fire Branch throughout the year, and provide requested technical assistance for them to conduct prescribed burns on base.

Goal 5: Manage and support the standardized Air Force GeoBase (data collection, submittal, and integration) for the management of MacDill AFB natural resources.

Objective 5.1: Provide support and assistance for the standardization of Functional Data Sets (FDS).

Project 5.1.1: Coordinate with the AFCEC Environmental GIS Analyst to determine the current version being used for all software, data, and data standards.

Project 5.1.2: Collect and develop natural resources GIS data that complies with the most current and compliant applicable Data Layer Specifications provided on the Environmental GIS eDASH page.

Project 5.1.3: Deliver spatial data in the applicable Universal Transverse Mercator (UTM Zone 17 for MacDill AFB) coordinate system, and support requests for environmental data delivery and data calls.

Objective 5.2: Utilize natural resources data to support MacDill AFB decision-making.

Project 5.2.1: Use GIS data in project planning and NEPA environmental analysis to identify, delineate, and ensure protection to federally listed, state imperiled, and wildlife species and their associated habitats.

Project 5.2.2: Use GIS data and maps to provide natural resources related trainings, outreach, and AF leadership briefings.

Goal 6: Provide consumptive and non-consumptive recreational and educational opportunities to enhance the morale and welfare of individuals on base.

Objective 6.1: Conduct educational, volunteer, and public outreach activities to promote the involvement of base personnel in natural resource management.

Project 6.1.1: Support the MacDill AirFest on a biannual basis with natural resource guidance.

Project 6.1.2: Conduct an annual natural resource event for Earth Day.

Project 6.1.3: Conduct at least one Coastal Clean-up Day annually.

Project 6.1.4: Conduct at least one dive cleanup day annually.

Project 6.1.5: Conduct an annual natural resource event for Arbor Day.

Project 6.1.6: Advertise through the various squadron and/or base-wide public service announcement system all natural resource volunteer opportunities on installation to increase base personnel involvement.

Project 6.1.7: Meet standards for Tree City USA communities annually.

Objective 6.2: Coordinate with the 6 FSS and federal/state agencies to ensure proper implementation of consumptive recreational activities.

Project 6.2.1: Report all known natural resource infractions to FWC CLEOs as necessary.

Project 6.2.2: Coordinate with FWC to conduct angler surveys on base on an annual basis.

9 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation
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The MacDill AFB INRMP is a living document and reviewed annually to reflect changes in the natural resources management program, including completed and future projects, on installation. Changes to the INRMP are reviewed by USFWS, FWC, and NOAA Fisheries for comment and input. MacDill AFB relied upon foresters at Avon Park Air Force Range (APAFR) for natural resource planning and operations until the early 1990's. In 1992, MacDill AFB created the position of Natural Resources Manager (NRM) within the 6 CES Environmental Element. This position included NEPA and cultural resources responsibilities. With the NRM, MacDill AFB has in-house expertise to manage and/or obtain direct assistance from its partners for protection and management of MacDill's natural resources.

The day-to-day implementation of this INRMP requires vigilance on the part of the 6 CES Environmental Element staff and partners. Modifications are implemented as necessary to complete projects and prevent repeat of ineffective actions/processes.

The 6 CES Environmental Element is the executor of this INRMP, and the NRM is tasked with coordinating and communicating with applicable MacDill staff/command and outside entities regarding the requirements of this INRMP. The NRM is responsible for fostering and maintaining strong working relationships with partner agencies in order to identify mutually beneficial projects. In the event INRMP projects require an EA or EIS, such documents would be prepared under the direct supervision of the NRM. All 6 CES Environmental Element staff will assist the NRM with implementation of the INRMP.

9.2 Monitoring INRMP Implementation
Installation Supplement

INRMP projects and their progress are tracked in the Annual Work Plan (INRMP Section 10). Project descriptions and verification projects comply with NEPA and other natural resource or conservation regulations. The monitoring process identifies successes and issues discussed by all stakeholders during the annual INRMP review.

The 6 CES Environmental Element conducts implementation, oversight, and monitoring of the MacDill AFB INRMP through the NRM. The embedded USFWS/AF Liaison provides additional guidance and assistance with implementing projects that help achieve goals and objectives identified within the INRMP including projects related to guidance of the Endangered Species Act. The NRM oversees and monitors the implementation status of current projects identified within the INRMP, with help from additional staff within the 6 CES Environmental Element, federal and state agencies, contractors, and various other programs at MacDill AFB. Current internal staffing levels within the Natural Resource Management program are not enough to fully implement projects without assistance from partner or contractor organizations. There are no current training deficiencies identified.

9.3 Annual INRMP Review and Update Requirements
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The 6 CES Environmental Element NRM is responsible for ensuring implementation of this INRMP, including annual reviews to assess performance, progress toward achieving goals, change in conditions or mission(s), and the need for revision of the INRMP (if applicable). Such reviews will be coordinated annually with USFWS, FWC, and NOAA Fisheries to ensure INRMP implementation, compatibility with other installation plans, and addressing the current needs of the installation.

The MacDill AFB NRM will inform the ESOHC and Installation Commander if conflicts are identified. Conflicts arising from the implementation of this INRMP will be resolved by the MacDill Natural Resources Manager or, if necessary, the ESOHC.

This INRMP is a living document and any significant changes in mission(s), conditions of natural resources, land use, or regulatory requirements could affect implementation of this INRMP requiring revision of the plan. Any changes to the INRMP will be documented in an annual summary report, that is reviewed by the installation commander and submitted to USFWS, FWC, NOAA (signatory agencies), and other outside organizations that play pivotal roles in the installation's natural resource management and conservation, for their review and comment. The annual report will summarize changes to the management plan and request approval from the resource agencies. As part of the annual review process, the NRM will evaluate the status of projects outlined in this INRMP. The objectives of the annual review are to determine whether the INRMP is being effectively implemented, the natural resource management approach is effective, increase clarity of the document based on new information or guidance, and if changes are needed to achieve the goals and objectives. The NRM will meet with installation leadership and partner agencies to discuss progress of INRMP projects and collaborate on options for improving successful implementation of the management plan.

Meeting (or call) minutes will be prepared and maintained by the NRM, or other designated individual, to document discussions and any changes made to the INRMP. If it is determined that changes to the INRMP are necessary, the NRM will coordinate this process.

10 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. These projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source and priority for implementation. The work plans provide all the necessary information for building a budget within the USAF framework. Priorities are defined as follows:

- High: The INRMP signatories assert that if the project is not funded the INRMP is not being implemented and the USAF is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for Endangered Species Act (ESA) Sec 4(a)(3)(B)(i) critical habitat exemption.
- Medium: Project supports a specific INRMP goal and objective and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112, *Exotic and Invasive Species*. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within the programmed year due to other priorities.
- Low: Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or supports long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

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Annual Work Plans

Work Plans should extend out to current year plus 4 additional years

Project Title	OPR	Funding Driver	Priority Level	Description
INTERAGENCY/INTRAAGENCY, GOVERNMENT, USFWS	NVZR227406 NVZR237406 NVZR247406 NVZR257406 NVZR267406	ESA	High	USFWS Liaison

MGT, HABITAT, PINE FLATWOODS	NVZR227401 NVZR237401 NVZR247401 NVZR257401 NVZR267401	ESA	High	Invasive Species Management Contract
MGT, INVASIVE SPECIES	NVZR227011 NVZR237011 NVZR247011 NVZR257011 NVZR267011	ESA/EO 13112	High	Invasive Species Management Contract
MGT, WETLANDS/FLOODPLAIN	NVZR227402 NVZR237402 NVZR247402 NVZR257402 NVZR267402	USACE CWA Permit	High	USFWS Welaka aquatic invasive species management of SWIM restoration areas.
MGT, HABITAT	NVZRA53226119 NVZRA53236119 NVZRA53246119 NVZRA53256119 NVZRA53266119	Sikes Act	Medium	Oyster Reef/Living Shoreline Restoration/Natural Communities Survey
MGT, HABITAT-INRP	NVZR197403	Sikes Act	Medium	Mangrove Restoration Site 20 Construction
MGT, SPECIES	FY23	Sikes Act	High	Threatened and Endangered Species Survey/Herpetofaunal Survey
MGT, INVASIVE SPECIES	NVZRA53237120	ESA/EO 13112	High	Invasive Species Survey
MGT, HABITAT	Anticipated for FY24 or FY25 programming	Sikes Act	Medium	Mangrove Restoration Sites 5, 6, and 17 Construction
MGT, HABITAT	Anticipated for FY25 programming	Sikes Act	Medium	Freshwater Wetland Restoration Project
MGT, HABITAT	Anticipated for FY26 programming	Sikes Act	High	Habitat Restoration Masterplan

11 REFERENCES

Standard References *(Applicable to all USAF installations)*

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page

- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

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12 ACRONYMS

Standard Acronyms *(Applicable to all USAF installations)*

- eDASH Acronym Library
- Natural Resources Playbook – Acronym Section
- U.S. EPA Terms & Acronyms

Installation Supplement

- **AF** - Air Force
- **AFWFB** - Air Force Wildland Fire Branch
- **AMC** – Air Mobility Wing
- **ARW** – Air Refueling Wing
- **APIMS** – Air Program Information Management System
- **CEIE** – 6th Civil Engineer Squadron, Environmental Element
- **CERCLA** - Comprehensive Environmental Response, Compensation, and Liability Act
- **CES –** Civil Engineering Squadron
- **CWA** - Clean Water Act
- **DoD PARC –** Department of Defense Partners in Amphibian and Reptile Conservation
- **EESOH-MIS** – Enterprise Environmental, Safety, and Occupational Health Management Information System
- **EIAP** - Environmental Impact Analysis Process
- **EPC** - Environmental Protection Commission of Hillsborough County
- **ESA** - Endangered Species Act
- **ESMP** – Endangered Species Management Plan
- **ESOHC** – Environmental Safety and Occupational Health Council
- **FAC** - Florida Administrative Code
- **FDACS** - Florida Department of Agriculture and Consumer Services
- **FDEP** - Florida Department of Environmental Protection
- **FFS** – Florida Forest Service
- **FNAI** - Florida Natural Areas Inventory
- **FWC** - Florida Fish and Wildlife Conservation Commission
- **GIS** - Geographic Information Systems
- **IAP** – Initial Accumulation Points
- **IAW** – In accordance with
- **ICRMP** – Integrated Cultural Resources Management Plan
- **IDIQ** – Indefinite Delivery/Indefinite Quantity
- **IDP** – Installation Development Plan
- **IPMP** – Integrated Pest Management Plan
- **LE** – Law Enforcement
- **MSA** - Munitions Storage Area; Metropolitan Statistical Area
- **NOAA Fisheries** - National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- **NRM** – Natural Resources Manager
- **OSI** – Office of Special Investigations
- **RCRA** – Resource Restoration and Recovery Act
- **SWFWMD** - Southwest Florida Water Management District
- **SWIM** - Surface Water Improvement and Management
- **TBEP** - Tampa Bay Estuary Program
- **TBW** – Tampa Bay Watch
- **T&E** – Threatened and Endangered
- **USACE** – U.S. Army Corps of Engineers
- **USF** - University of South Florida
- **USCENTCOM** – United States Central Command
- **USSOCOM** – United States Special Operations Command
- **WWTP** – Wastewater Treatment Plant
- **WFMP** - Wildland Fire Management Plan

13 DEFINITIONS

Standard Definitions *(Applicable to all USAF installations)*

- Natural Resources Playbook – Definitions Section

Installation Supplement

There are no unique state, local, or installation specific definitions.

A ANNOTATED SUMMARY OF KEY LEGISLATION RELATED TO DESIGN AND IMPLEMENTATION OF THE INRMP

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, *Protection and Enhancement of Environmental Quality*	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, *Protection and Enhancement of the Cultural Environment*	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, *Exotic Organisms*	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, *Floodplain Management*	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.

EO 11989, *Off-Road vehicles on Public Lands*	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, *Protection of Wetlands*	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Invasive Species*	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management

	(e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a

	biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides

	enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500–1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory,

	and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.

	resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 *DoD Pest Management Program* dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, *Environmental Security*	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum – 17 May 2005 – *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands*	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum – 1 November 2004 – *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum – 10 October 2002 – *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes

	implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process (EIAP)	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-1015, *Integrated Installation Planning*	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations..
AFMAN 32-7003, *Environmental Conservation*	Implements AFPD 32-70, *Environmental Quality;* DoDI 4715.03, *Natural Resources Conservation Program*; and DoDI 7310.5, *Accounting for Sale of Forest Products*. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFMAN 32-7003, *Environmental Conservation*	This Manual implements AFPD 32-70 and DoDI 4710.1, *Archaeological and Historic Resources Management.* It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-10112 *Installation Geospatial Information and Services (IGI&S)*	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.
AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities

	wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

B WILDLAND FIRE MANAGEMENT PLAN
Installation Supplement

Available on MacDill Environmental Element's eDASH page, or at the following link:

MacDill AFB Wildland Fire Management Plan

C BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH) PLAN
Installation Supplement

Available at the following link:

MacDill BASH Instruction

D GOLF ENVIRONMENTAL MANAGEMENT (GEM) PLAN
Installation Supplement

MacDill AFB is not required to have a GEM Plan IAW AFMAN 32-7003.

E INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN (ICRMP)
Installation Supplement

Available on MacDill Environmental Element's eDASH page, or at the link below:

MacDill ICRMP

F INTEGRATED PEST MANAGEMENT PLAN (IPMP)
Installation Supplement

Available on MacDill Environmental Element's eDASH page, or at the link below:

MacDill IPMP

G THREATENED AND ENDANGERED SPECIES MANAGEMENT PLANS

MacDill AFB does not have an installation specific Threatened and Endangered Species Management Plan.

H FOREST MANAGEMENT PLAN

MacDill AFB does not have an installation specific Forest Management Plan.

I GROUNDS MAINTENANCE

Grounds Maintenenace is a contracted service at MacDill AFB, and management of that program is determined within the contract language.

J ECOSYSTEM RESTORATION CONCEPTUAL MASTERPLAN

Available on the MacDill Environmental Element's eDASH page, or at the link below:

Ecosystem Restoration Masterplan