
**Integrated Natural Resources
Management Plan
for
Naval Air Station Key West
Florida**

2020 Update



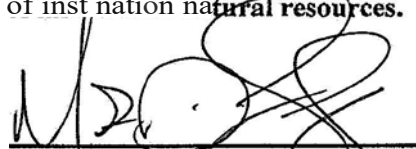
Prepared By:

Department of the Navy
Naval Facilities Engineering Command Southeast

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NAVAL AIR STATION KEY WEST
 KEY WEST, FLORIDA
 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
 (INRMP) - 2020 OPERATIONS AND EFFECT CONCURRENCE

The Sikes Act and Department of Defense instruction require that annual and 5-year operation and effect reviews of INRMPs occur with federal and state partners. Representatives of the Navy, U.S. Fish & Wildlife Service, Florida Fish and Wildlife Conservation Commission, and National Marine Fisheries Service are invited annually to participate in the yearly Naval Air Station Key West INRMP and Natural Resources Metric review. The last operation and effect review of this INRMP was completed in June 2015. We have revised 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.



 Commanding Officer,
 Naval Air Station Key West

5 Nov 2020

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Environmental Program Manager, Commander Navy Region SE

16 July 2020

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Natural Resources Manager, Commander Navy Region SE

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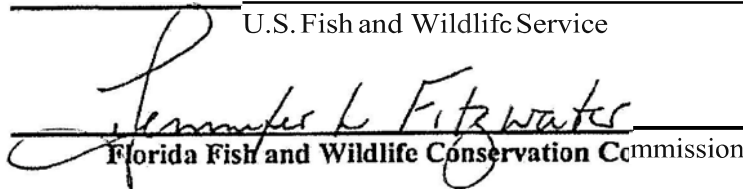
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U.S. Fish and Wildlife Service


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 Florida Fish and Wildlife Conservation Commission

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National Marine Fisheries Service

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

ES.1 Type of Document

This document is an Integrated Natural Resources Management Plan (INRMP).

ES.2 Purpose of Document

The purpose of this document is to meet statutory requirements under the Sikes Act Improvement Act (SAIA), Public Law 105-85, Div. B. Title XXIX, Nov. 18, 1997, 111 Stat 2017-2019, 2020-2022. In November 1997, the Sikes Act, 16 United States Code (U.S.C.) § 670a et seq., was amended to require the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate this program, the amendments require the Secretaries of the military departments to prepare and implement INRMPs for each military installation in the United States unless the absence of significant natural resources on a particular installation makes preparation of a plan for the installation inappropriate.

The INRMP is to provide for integrated land management, fish and wildlife management, forest management and outdoor recreation management by implementing an ecosystem approach to natural resources management without interfering with the military readiness or mission of the Installation. This INRMP is updated no less than every five years and has the flexibility to accommodate changes in the ecosystem and military mission. Annual updates to the management program and review and revision, when necessary, will ensure that the INRMP integrates the latest scientific knowledge and evolves to meet the future requirements of the military mission and natural resources.

ES.3 Overview of the Natural Resources Program

The natural resources of Naval Air Station (NAS) Key West (or NASKW) are managed to provide an aesthetic outdoor setting with diverse and abundant fish and wildlife, therefore improving the quality of life for military personnel, their dependents, and nearby civilian populations. NAS Key West began managing specifically for fish and wildlife resources in 1983, when the Installation's first Bird/Aircraft Strike Hazard (BASH) Assessment was completed by the Air Force BASH Team. In 1984, a Tripartite Fish and Wildlife Cooperative

Agreement with the United States Fish and Wildlife Service (USFWS) and the State of Florida was executed. The first Long Range Fish and Wildlife Management Plan for NASKW was approved in 1986. In 1989, the Navy, the National Park Service (NPS), and the Florida Division of Recreation and Parks signed a tripartite agreement to provide NASKW with professional and technical information and assistance necessary to coordinate actions pertaining to outdoor recreation. The Natural Resources Management Plan was updated in 1992 and the National Park Service completed a Long Range Outdoor Recreation Plan in 1993. In 1996, the fish and wildlife management section of the Natural Resources Management Plan was updated. In 2001, as required by the amended Sikes Act, an Integrated Natural Resources Management Plan was prepared to implement the natural resources management at NASKW. In coordination with the USFWS, Florida Fish and Wildlife Conservation Commission (FWC), National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), and NOAA Florida Keys National Marine Sanctuary (FKNMS), the Navy has completed reviews of the INRMP every year since. Routine updates are performed at least every five years to account for INRMP project accomplishments, new species listings, and management recommendations from the conservation partners.

Since the beginning of the military presence in the Keys in 1823, the activities and installations have altered their physical environments to varying degrees, but remnant natural communities remain. These islands of habitat support diverse populations of plants and animals, many of which are rare, threatened and endangered species.

The Lower Keys marsh rabbit (LKMR), listed endangered by the USFWS in 1990, occupies habitats on NASKW properties including Boca Chica Key, East Rockland Key, and Geiger Key. The persistent absence of LKMR observed on Saddlebunch Key suggests LKMR have been extirpated from this location (TAMU 2019). Distribution of the LKMR on NAS Key West was determined by Forsy (1994) with subsequent distribution being updated by Faulhaber (2002). It is estimated that NASKW controls approximately one-third of the occupied habitat for the LKMR. In 1992, NASKW consulted with the USFWS on impacts to the LKMR from operational activities. As a result, the USFWS issued a Biological Opinion (BO) in 1993 pursuant to Section 7 of the Endangered Species Act (ESA) on operational activities at NASKW, including those at Boca Chica Field that may affect the federally-endangered LKMR. The BO considered motor vehicle usage (including off-road), habitat alteration (i.e., mowing of suitable

and occupied areas), habitat degradation (invasive exotic plant species), feral cats, people and their dogs, and raccoons as sources of potential impacts to LKMR on Navy lands. The BO identified reasonable and prudent measures to be implemented by the Navy for compliance with an incidental take of this species, which is not to exceed two rabbits annually. This number was temporarily increased to six rabbits annually in accordance with a BO issued in 2007 for restoration of clear zones and stormwater drainage systems on Boca Chica Field, but is now two rabbits again. Terms and conditions for the existing incidental take statement require the Navy to institute a “no mowing program” and actively manage sites of known LKMR-occupied habitat. Mowing regimes are depicted in the Boca Chica Grounds Maintenance Mapbook, which is available upon request. In 1994, NASKW developed a Lower Keys Marsh Rabbit Management Plan, updated in 2016, to outline measures to maintain rabbit populations at existing levels or above, to protect viable populations and to promote the rabbit’s recovery in ways and in areas that do not compromise the primary mission at NASKW.

The Florida Keys region is dominated by three marine habitat types: mangroves, seagrass, and coral reef. The near-shore land/water interface is dominated by the mangrove community, seagrass is the principal marine benthic vegetation, and different forms of coral reef habitats are interspersed throughout the lower Keys. The species of mangroves present represent a major coastal wetland habitat and much of the mangrove habitat found at NASKW is *mangrove basin* type (South Atlantic Fisheries Management Council [SAFMC] 1998). This habitat type is often dominated by black mangrove and water containing low dissolved oxygen and high levels of hydrogen sulfide (Odum et al. 1982). Seagrass habitat is found within many of the NASKW maritime areas, especially within several of the estuarine lagoons at Boca Chica Field. Seagrass habitats are ecologically important for many fish, sea turtle, and marine mammal species. Water quality and, in particular, water clarity is considered among the most critical factors in the maintenance of healthy seagrass habitats. The Florida coral reef tract is the the third largest system in the world (ONMS 2019). The tract supports hundreds of species and helps protect the shoreline from destructive tropical storms and hurricanes. Various coral and hardbottom benthic habitats occur immediately adjacent to Boca Chica Field. Executive Order (EO) 13089 (*Coral Reef Protection of June 11, 1998*) provides Federal protection for coral reefs, and seven species of coral are listed as threatened under the Endangered Species Act. Surveys conducted in 2006 and 2013 found three of the seven listed coral species attached to, or in the

vicinity of, any NASKW-owned property. Corals are adversely affected by sedimentation, as are seagrasses. Erosion and stormwater runoff control are two key management strategies employed by NASKW that will benefit coral and seagrass communities. Additionally, Project 13 (Marine Resources Survey; Appendix A) involves recurring quantitative monitoring of seagrass and coral resources within NASKW properties.

Important animals that use the lower Florida Keys oceanic and estuarine habitats include state and federally managed fish species, marine mammal species, migratory bird species, and sea turtles. There are 88 species of fish that occur in the waters proximate to the NASKW that are federally managed. There are approximately 29 species of marine mammals (baleen whales, toothed whales, and manatees) found in the Gulf of Mexico, many of which are present within the Lower Keys region, and all are protected under the Marine Mammal Protection Act. Five species of sea turtles are known to inhabit the waters of the Keys, and the loggerhead is the most common. Portions of the shoreline owned by the Navy on Boca Chica Key and Truman Annex are considered sea turtle nesting habitat.

NAS Key West has in the past and continues to be active in protecting and monitoring endangered species and improving their habitat when possible. Ecological surveys have been conducted to identify rare plant and animal species, natural communities and occurrences of invasive and exotic plants on all NASKW properties. Other important environmental concerns, such as wetlands and non-point source pollution, are always being addressed to ensure that the Installation is in compliance with Federal and State mandates. Efforts continue to be made to protect the diverse and abundant resources that create the aesthetic outdoor setting at NASKW and to develop outdoor recreation opportunities therefore improving the quality of life for military personnel, their dependents, and nearby civilian populations.

ES.4 Goals and Objectives of the INRMP

The goal of the INRMP is to implement an ecosystem-based conservation program that provides for conservation and rehabilitation of natural resources in a manner consistent with the military mission; integrates and coordinates all natural resources; provides for sustainable multipurpose uses of natural resources; and provides public access for use of natural resources subject to safety and military security considerations. Four (4) Installation-wide ecosystem management goals and nineteen (19) objectives have been identified for NASKW.

- Goal 1:** Protect and maintain the land and water resources of NAS Key West by continuation and enhancement of ecologically appropriate and best management practices compatible with the military mission.
- Goal 2:** Protect, maintain, and restore native vegetation communities, threatened and/or endangered species, including resident and migratory animal populations while supporting the military mission.
- Goal 3:** Provide facilities and implement programs that encourage outdoor recreation and educational use of natural resources on NAS Key West, and improve the quality of life for user groups.
- Goal 4:** Protect and conserve the ecological value and diversity of natural resources by fostering knowledge of, and participation in, adaptive ecosystem management.

The following 19 objectives have been identified as necessary measures for achieving the natural resources program goals at NASKW.

- 1) *Protect wetlands and their natural functions while upholding Installation's mission and facility development.*
- 2) *Continue existing and establish new programs and procedures to monitor, maintain, and enhance wetland resources.*
- 3) *Develop corrective and preventative measures to reduce the damage caused by flooding to Installation infrastructure and natural resources, including the maintenance and expansion of living shorelines.*
- 4) *Continue and establish new procedures as part of the natural resources program to control soil erosion and sedimentation.*
- 5) *Protect water quality of wetlands and other water bodies from non-point source and point source pollution including erosion.*
- 6) *Implement environmentally beneficial landscaping and grounds maintenance practices.*
- 7) *Control and eradicate invasive and exotic species.*
- 8) *Implement the conservation measures and mitigation actions as developed through the projects planning and consultation processes, and to adaptively manage the restoration and long term maintenance of the clear zones and stormwater drainage systems on Boca Chica Field.*
- 9) *Protect and conserve marine and near-shore estuarine habitats.*
- 10) *Preserve, protect and manage wildlife and their habitats to ensure healthy productive populations.*
- 11) *Protect and manage critically important habitats of resident and migratory threatened and endangered species, and species of special concern.*
- 12) *Monitor population demographic patterns of both resident and migratory threatened and endangered species, and species of special concern.*

- 13) *Protect and maintain ecological diversity in native plant communities including tropical hardwood hammock, transitional zones, and the mangrove fringe.*
- 14) *Control nuisance wildlife and wildlife diseases that may adversely affect human health or welfare, the health of the ecosystem, and/or the military mission.*
- 15) *Implement existing and further develop (where needed) natural resource-based outdoor recreation programs to support present and future outdoor recreation at NAS Key West.*
- 16) *Ensure that land use and natural resource planning decisions sustain the mission of NAS Key West and seek to resolve land use conflicts by integration with other planning processes.*
- 17) *Continue collaborative partnering to protect and conserve the natural resources in the Florida Keys, maintain environmental compliance, and enhance NAS Key West's ability to meet its mission critical objectives. When possible, coordinate funding of Navy natural resource conservation actions to help achieve multi-agency cooperative goals.*
- 18) *Provide the staffing, training, budgeting and technology support to ensure implementation of the INRMP.*
- 19) *Conduct annual meetings in cooperation with the USFWS, FWC, NOAA NMFS, and NOAA FKNMS to review and update the INRMP.*

ES.5 Species Management

The natural resource actions described in this INRMP are for the benefit of the plants, animals, and ecosystems occurring on this installation. Special attention is given to rare, threatened, and endangered (RTE) species, and their habitats, through management actions referenced in Table ES-1. These actions are long-term conservation measures that provide benefits for terrestrial and aquatic habitats on the installation. Management actions such as soil conservation and storm water management, for example, control sediment and pollutant runoff to protect nearshore water quality for species such as manatees, shorebirds, and corals. Actions such as invasive, exotic, and noxious species control help protect habitat and maintain resources for Lower Keys marsh rabbits, silver rice rats, and Blodgett's silverbush.

The "Threatened and Endangered Species and Natural Communities" section of this INRMP (Section 4.3.2) includes additional goals, objectives, strategies, and projects for the benefit and long-term conservation of RTE species found, or potentially found, on the installation. Animal and plant species explicitly accounted for in this INRMP are listed on the following page.

- American Crocodile
- Bald Eagle
- Blodgett’s Silverbush (plant)
- Corals
 - Boulder Star Coral
 - Elkhorn Coral
 - Lobed Star Coral
 - Mountainous Star Coral
 - Pillar Coral
 - Rough Cactus Coral
 - Staghorn Coral
- Dwarf Seahorse
- Eastern Black Rail (bird)
- Florida Tree Snail
- Garber's Spurge (plant)
- Giant Manta Ray (fish)
- Key Ringneck Snake
- Least Tern (bird)
- Lower Keys Marsh Rabbit
- Lower Keys Brown Snake
- Monarch Butterfly
- Nassau Grouper (fish)
- Osprey (bird)
- Piping Plover (bird)
- Red Knot (bird)
- Rim Rock Crowned Snake
- Roseate Tern (bird)
- Sea Turtles
 - Green Sea Turtle
 - Hawksbill Sea Turtle
 - Kemp’s Ridley Sea Turtle
 - Leatherback Sea Turtle
 - Loggerhead Sea Turtle
- Silver Rice Rat
- Smalltooth Sawfish
- West Indian Manatee
- White-Crowned Pigeon

Table ES-1. Habitat Management Actions at NAS Key West

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Stormwater and Water Quality Control	4.1.4
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Wildlife Management	4.3.1
Threatened and Endangered Species and Natural Communities	4.3.2
Essential Fish Habitat	4.3.3
Prevention and Control of Wildlife Damage and Disease	4.3.4

ES.6 Projects of the INRMP

Projects are discrete actions for fulfilling a particular strategy (strategies implement objectives). Projects may be required in order for NASKW to fulfill regulatory requirements regarding natural resources management, or to enhance existing measures for ensuring compliance. Projects of the INRMP are listed in Table A-1 of Appendix A, and all the projects are discussed further in that appendix.

Funding for implementation of the INRMP will come from the Installation, Commander Navy Region Southeast, or other natural resources fund sources. The natural resources programs and projects described in this INRMP are divided into mandatory and stewardship categories to reflect implementation priorities. Every effort will be made to acquire Navy Operations and Maintenance (O&M[N]) Environmental, or other funding to implement Department of Defense (DoD) mandatory projects in the timeliest manner possible. Stewardship-type projects will be funded through fish and wildlife, Legacy, or other fund sources as funding and personnel resources become available.

All actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under Federal Law. Nothing in this INRMP is intended to be nor must be construed to be a violation of the Anti-Deficiency Act (31 U.S.C. 1341 et. seq.).

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LIST OF ACRONYMS

°F	Degrees Fahrenheit
ACM	Air Combat Maneuver
ADA	Americans with Disabilities Act
ADID	Advanced Identification of Wetlands
APHIS	USDA Animal, Plant Health Inspection Service
AOC	Area of Concern
ASN	Assistant Secretary of the Navy
AST	Aboveground Storage Tank
AAW	Anti-Air Warfare
BASH	Bird/Animal Aircraft Strike Hazard
BCC	Birds of Conservation Concern
BCP	Bird Conservation Plan
BEQ	Barracks Enlisted Quarters
BHC	Bird Hazard Committee
BMP	Best Management Practice
BO	Biological Opinion
BOS	Base Operating Services
CAA	Clean Air Act
CECOS	Civil Engineer Corps Officers School
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CNATRA	Chief of Naval Aviation Training
CNO	Chief of Naval Operations
CNRSE	Commander Navy Region Southeast
CO	Commanding Officer
CSG	Carrier Strike Group
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DEO	Florida Department of Economic Opportunity
DoD	Department of Defense

DoDINST	Department of Defense Instruction
DoN	Department of the Navy
DOQQ	Digital Orthophoto Quarter-Quadrangle
E & E	Ecology and Environment, Inc.
EFH	Essential Fish Habitat
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
FAC	Florida Administrative Code
FCMP	Florida Coastal Management Program
FDEP	Florida Department of Environmental Protection
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FDACS	Florida Department of Agriculture and Consumer Services
FWC	Florida Fish & Wildlife Conservation Commission
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FKIETF	Florida Keys Invasive Exotic Task Force
FKNMS	Florida Keys National Marine Sanctuary
FLEPPC	Florida Exotic Plant Pest Council
FMRI	Florida Marine Research Institute
FMP	Fishery Management Plan
FNAI	Florida Natural Areas Inventory
FRC	Fleet Readiness Center SE
FRS	Fleet Replacement Squadrons
ft	Feet
FWRI	Fish and Wildlife Research Institute
FY	Fiscal Year
GIS	Geographic Information System
ha	Hectares
HW	Hazardous Waste
HWMP	Hazardous Waste Management Plan

ICRMP	Integrated Cultural Resources Management Plan
ICW	Intracoastal Waterway
INRMP	Integrated Natural Resource Management Plan
INST	Instruction
IPMP	Integrated Pest Management Plan
IR	Installation Restoration
IRA	Interim Remedial Action
IRP	Installation Restoration Program
JIATF	Joint Interagency Task Force South
LKMR	Lower Keys marsh rabbit
LMD	Land Management Department
MBTA	Migratory Bird Treaty Act
MILCON	Military Construction Project
m	Meters
mgd	Million Gallons Per Day
mi	Miles
mld	Million Liters Per Day
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSGP	Multi-Sector General Permit
MSL	Mean Sea Level
MWR	Morale, Welfare and Recreation
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
NASKW	Naval Air Station Key West
NAVFAC SE	Naval Facilities Engineering Command Southeast
NAVY	United States Department of the Navy
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NO ₂	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRM	Natural Resources Manager
NWR	National Wildlife Refuge
O ₃	Ozone
O&M(N)	Navy Operations and Maintenance
OFW	Outstanding Florida Water
OPA	Oil Pollution Act
OPAREA	Operating Area
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSHA	Occupational Safety and Health Administration
P2	Pollution Prevention
PATA	Port Authority Transit Association
PIF	Partners In Flight
PM ₁₀	Respirable Particulate Matter
PMSP	Pest Management Service Provider
PSD	Personnel Support Activity Detachment
PWD	Public Works Department
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
RV	Recreational Vehicle
SAIA	Sikes Act Improvement Act
SAF	Saddlebunch Antenna Facility
SAFMC	South Atlantic Fishery Management Council
SARA	Superfund Amendments and Reauthorization Act
SAV	Submerged Aquatic Vegetation
SCA	Student Conservation Association
SIP	State Implementation Plan
SJRWMD	St. Johns River Water Management District
SFWMD	South Florida Water Management District
SO ₂	Sulfur Dioxide

SPCC	Spill Prevention Control and Countermeasures Plan
SRR	Silver Rice Rat
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
SWPPT	Stormwater Pollution Prevention Team
TCTS	Tactical Combat Training System
TMZ	Territory Management Zone
TNC	The Nature Conservancy
TSD	Treatment, Storage, and Disposal
UMAM	Uniform Mitigation Assessment Method
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank

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INTRODUCTION

1 INTRODUCTION

1.1 Purpose and Organization

The purpose of this document is to meet statutory requirements under the Sikes Act Improvement Amendment (SAIA), Public Law 105-85, Div. B. Title XXIX, Nov. 18, 1997, 111 Stat 2017-2019, 2020-2022. In November 1997, the Sikes Act, 16 U.S.C. § 670a et seq., was amended to require the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate this program, the amendments require the Secretaries of the military departments to prepare and implement integrated natural resources management plans (INRMPs) for each military installation in the United States unless the absence of significant natural resources on a particular installation makes preparation of a plan for the installation inappropriate.

The United States Department of the Navy (DoN) has prepared this INRMP for the Naval Air Station Key West, Florida (hereinafter identified as NAS Key West and NASKW), to comply with the SAIA and with DoD Instruction (DoDINST 4715.3). This INRMP also complies with the Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1E, Chapter 12, ASN (I&E) Memorandum of 12 August 1998, OUSD Memorandum of 21 September 1998, CNR ltr Ser N45D/8U589016 of 25 September 1998, and Chief of Naval Operations (CNO) ltr Ser N456F/8U589129 of 30 November 1998.

In addition to the mandated requirement, the primary purpose of the INRMP is to provide NASKW with a foundation from which to manage the Installation's natural resources. The INRMP outlines the management of the Installation's natural resources and accounts for the goals of the natural resources program while sustaining the military mission of the Installation. The INRMP also considers the surrounding natural resources through implementation of an integrated approach to management.

The first three sections of this INRMP establish the existing conditions at NASKW. Section 1 provides a general overview of the purpose and intent of the INRMP and processes for review, implementation, and revision of the plan. Section 2 establishes the importance of the military mission within the DoN, discusses the organization of NASKW, provides a brief overview of the natural resources program, identifies Installation partnerships and stakeholders,

and briefly describes Installation plans, studies, and programs relevant to the natural resources program. Section 3 discusses the existing physical and biological characteristics of the local and regional environment. Physical characteristics include climate, topography, geology, soils, hydrology, groundwater, and land use. Biological characteristics include wetlands, wildlife, threatened and endangered species, coastal/marine resources, and natural vegetative communities.

Section 4 discusses ecosystem management at the Installation by dividing management into four components: land management, coastal/marine resources management, fish and wildlife management, and outdoor recreation. These components are further divided into subcomponents; for example, the land management discussion addresses wetlands, floodplain management, soil conservation and erosion control, stormwater/water quality control, landscaping and grounds maintenance and invasive, exotic and noxious species. Objectives, long-term management, project summaries, legal requirements, and sources for additional management information are addressed under each subcomponent. Section 5 discusses the planning, staffing, training and support necessary to implement the INRMP.

Appendix A describes the projects that will be implemented by NASKW. Projects were identified by the Installation's Natural Resources Manager (NRM) in collaboration with the conservation staff of Naval Facilities Engineering Command Southeast (NAVFAC SE). For each project, Appendix A discusses the purpose, location, description, baselines, monitoring requirements, legal requirements, and accomplishments. It is the intent of NASKW to implement the projects, as described in Appendix A, to the greatest extent possible. The implementation of projects is largely dependent upon availability of funds. Recognizing the uncertainties in funding and the possibility of changes to the military mission and its civilian and military staffing, the implementation of projects will proceed as directly and completely as possible.

1.2 Ecosystem Management

In November 1997, the Sikes Act, 16 U.S.C. 670 a et seq., was amended to require the implementation of a program to provide for the conservation and rehabilitation of natural resources on military installations. The Navy's approach for management of natural resources is holistic in that it incorporates an awareness of the broad regional setting in which the installation

is located. Appropriate and effective management of natural resources on Navy lands will be achieved in accordance with the principles and practices of ecosystem management.

Ecosystems are important components of environmental systems (Levine 1991). Ecosystem components, living and non-living, are linked together by numerous flows of matter and energy (Levine 1991). Ecosystems involve repetitive or cyclic phenomena and typically contain a great diversity and number of species, individual organisms, and abiotic components. The living members of ecosystems exhibit a wide array of behaviors, and intra- and interspecies interactions are varied and often subtle. Recognizing that crucial interdependencies exist within and between ecosystem components is important in establishing successful environmental management policies.

Ecosystem management is the centerpiece of environmental policy and is a unifying approach for the management of military lands. Ecosystem management's broad-based approach to natural resource management involves identifying, protecting, and restoring complete ecosystems — including abiotic structural components and natural processes — while fully incorporating social, economic, and other human concerns into planning (DoD 1996).

1.3 Goals of the INRMP

The INRMP is a management-planning document that establishes a guideline for the use and conservation of natural resources on lands and water under DoD control. DoD is one of the largest landholders in the United States, with more than 20 million acres. Some of the most environmentally-sensitive properties, including sensitive species and sensitive vegetative communities, occur within these lands.

The development and implementation of the INRMP is a dynamic, multidisciplinary planning process that incorporates as its primary goal the support and maintenance of the military mission while managing, protecting, and enhancing the biological integrity of military lands and waters. The military's use of land and water resources must comply with legal mandates and will, to the extent practicable, be integrated with ecosystem-level goals, plans, and use of lands and waters inside and outside the boundaries of military Installations. This plan adopts the following broad goals, which will be reflected in the more specific objectives for each management area.

- Goal 1:** Protect and maintain the land and water resources of NAS Key West by continuation and enhancement of ecologically appropriate and best management practices compatible with the military mission.
- Goal 2:** Protect, maintain, and restore native vegetation communities, threatened and/or endangered species, including resident and migratory animal populations while supporting the military mission.
- Goal 3:** Provide facilities and implement programs that encourage outdoor recreation and educational use of natural resources on NAS Key West, and improve the quality of life for user groups.
- Goal 4:** Protect and conserve the ecological value and diversity of natural resources by fostering knowledge of, and participation in, adaptive ecosystem management.

1.4 Implementation of the INRMP

The SAIA requires preparation and implementation of INRMPs at military Installations in the U.S. that contain significant natural resources. Implementation of the INRMP will follow an annual strategy that addresses legal requirements, funding, implementation responsibilities, technical assistance, labor resources, and technological enhancements. The Navy guidance for Installations determines the INRMP to be implemented if the Installation:

- 1) actively requests, receives, and uses funds for mandatory projects and activities;
- 2) Ensures that sufficient numbers of professionally trained natural resources management staff are available to perform the tasks required by the INRMP;
- 3) Coordinates annually with all cooperating offices; and
- 4) Documents specific INRMP action accomplishments undertaken each year.

1.4.1 Legal Requirements

Legal requirements are laws, executive orders, regulations, directives, and memoranda regarding the protection and management of natural resources. The most pertinent legislation and regulations are listed in Table 1-1. The INRMP will be updated as legal requirements change. Relevant legal requirements for natural resources management are presented throughout Section 4.

Table 1-1. Legal Drivers for Natural Resources Management

Name/Description	Citation
Anti-Deficiency Act	31 USC 1341
Bald and Golden Eagle Protection Act	16 USC 668
Clean Air Act	42 USC 7401
Clean Water Act	Public Law 95-217, 33 USC 1251
Coastal Zone Management Act	16 USC 1451
Cooperative Conservation	Executive Order 13352
Coral Reef Protection	Executive Order 13089
Endangered Species Act	16 USC 1531 & 1536
Environmental Readiness Program Manual	OPNAVINST 5090.1E
Environmental Conservation Program	DoD Instruction 4715.3
Erosion Protection Act	33 USC 426
Estuary Protection Act of 1968	16 USC 1221
Farm Land Protection Policy	7 CFR 658
Farmland Protection Policy Act of 1981	7 USC 4201
Federal Insecticide, Fungicide, and Rodenticide Act	7 USC 136
Federal Land Policy and Management Act of 1976	43 USC 1701
Federal Noxious Weed Act of 1974	7 USC 2801
Federal Pest Plant Act	7 USC 150
Fish and Wildlife Conservation Act	16 USC 2901
Fish and Wildlife Coordination Act, as amended	Public Law 85-624, 16 USC 661c
Floodplain Management	Executive Order 11988
Florida Keys National Marine Sanctuary and Protection Act	Public Law 101-605
Greening the Government through Environmental Management	Executive Order 13148
Invasive Species	Executive Order 13751
Magnuson-Stevens Fisheries Conservation and Management Act, as amended	Public Law 94-265, 16 USC 1801
Management of Undesirable Plants of Federal Lands	7 USC 2814
Marine Mammal Protection Act of 1972, as amended	16 USC 1361
Marine Mammal Protection Act Amendments of 1994	Public Law 103-238
Marine Protected Areas	Executive Order 13158
Migratory Bird Treaty Act	16 USC 703
Military Construction Authorization Act	Public Law 97-321 10 USC 2665
Military Reservations and Facilities – Hunting, Fishing, and Trapping	10 USC 2671
Multiple-Use Sustained Yield Act of 1960	16 USC 528
National Environmental Policy Act of 1969	42 USC 4321
National Marine Sanctuaries Act	16 USC 1431
Natural Resources Management Program	32 CFR 190
Natural Resources Management Program	DoD Directive 4700.4

Table 1-1, Continued

Name/Description	Citation
Outdoor Recreation – Federal/State Program Act	16 USC 460(L)
Protection and Enhancement of Environmental Quality	Executive Order 11514
Protection of Wetlands	Executive Order 11990
Recreational Fisheries	Executive Order 12962
Responsibilities of Federal Agencies to Protect Migratory Birds	Executive Order 13186
Rivers and Harbors Act of 1899	33 USC 401
Sikes Act Improvement Act of 1997	16 USC 670
Soil and Water Conservation Act of 1977	16 USC 2001
Soil Conservation Act	16 USC 5901
Use of Off-Road Vehicles on Public Lands	Executive Order 11989
Water Resources Planning Act	42 USC 1962
Watershed Protection and Flood Prevention Act	16 USC 1001, 33 USC 701

1.4.2 Project Classification and Funding

Funding for implementation of the INRMP will come from the Installation, Commander Navy Region Southeast (CNRSE), or other natural resources fund sources. The natural resources programs and projects described in this INRMP are classified as mandatory or stewardship to reflect implementation priorities. The mandatory projects and activities are required to meet recurring natural and cultural resources conservation requirements or current legal compliance needs, including Executive Orders (EO). The stewardship projects are discretionary actions that enhance an installation’s natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

The majority of the mandatory natural resource projects are funded with Operations and Maintenance, Navy (O&MN) environmental funds. These appropriated funds are the primary source of resources to support environmental compliance. Stewardship-type projects will often be funded through Conservation, Morale, Welfare, and Recreation (MWR), non-DoD funds, or other fund sources as funding and personnel resources become available.

1.4.3 Implementation Responsibilities

The NASKW Commanding Officer (CO) is responsible for managing all aspects of the Installation’s natural resources. The CO has delegated, to a NRM within the Public Works Department, Environmental Division, the authority to implement natural resources management activities. Other departments such as Operations, Weapons, Security, Housing, and Morale,

Welfare and Recreation (MWR) have functions that overlap with the natural resources program. These departments coordinate with the NAS Key West NRM on natural resources-related issues.

1.4.4 Technical Assistance

Technical assistance to NASKW may be provided from within the DoN or by outside agencies. Assistance from outside agencies is normally provided through individual agency requests and formal cooperative agreements, while assistance from within DoN is normally less formal. Section 103a(a) of the Sikes Act authorizes cooperative agreements to be used to accomplish work identified in the INRMP and may be entered into with states, local governments, non-governmental organizations, and individuals to provide for the maintenance and improvement of natural resources on or to benefit natural and historic research on military installations.

Technical assistance from organizations outside the DoN may include:

The Department of Interior, U.S. Fish and Wildlife Service (USFWS); Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) and Animal and Plant Health Inspection Service (APHIS) Wildlife Services; and National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Office of National Marine Sanctuaries (ONMS).

Florida Fish and Wildlife Conservation Commission (FWC) and Florida Department of Environmental Protection (FDEP).

The Nature Conservancy (TNC).

Texas A& M University.

Technical assistance from within The Navy will be provided by:

The NASKW Natural Resources and Environmental managers;

Conservation staff including fish and wildlife biologists, marine biologists and soil conservationists at Naval Facilities Engineering Command Southeast (NAVFAC SE); and

The NASKW Command; subject to funding, NASKW will hire additional staff to complete the continuous work necessary for successful implementation of the INRMP.

1.4.5 Labor Resources

Options for supplemental labor resources from outside the DoN for implementation of the INRMP include volunteers from local organizations and groups such as:

- Scout troops,
- Elementary, middle, or high school students,
- College students,
- Ecology clubs and conservation programs/groups (e.g., the Student Conservation Association),
- Businesses/Homeowners' associations,
- Retired military, and
- General public.

Options for supplemental labor resources from within the Installation include the Natural Resources Manager, and volunteer civilian and military personnel, and their dependents.

1.5 Approval, Function, Use, and Revision Process of the INRMP

1.5.1 Approval of the INRMP

The INRMP is required to be signature-endorsed by the subject installation's CO, the installation's Natural Resources Manager, the Natural Resources Manager at NAVFAC SE, and the Regional Environmental Coordinator at CNRSE. According to the SAIA, the INRMP must reflect mutual agreement with the USFWS, NOAA, and the FWC. Mutual agreement will concern conservation, protection, and management of fish and wildlife resources, and will be represented by the signing of the appropriate agency representatives.

1.5.2 Function and Use of the INRMP

The INRMP outline the management of the installation's natural resources. To accomplish this, the INRMP presents long-term management concepts that are consistent with the management of natural resources and fulfillment of the installation's military mission. The long-term management concepts do not represent any incremental or specific approach to management, but rather provide a philosophy and direction for the Natural Resources Manager and DoN decision-makers to ensure long-term sustainability of natural resources. It is not necessarily the function of the INRMP to define specific projects for specific locations nor to define specific practices or schedules for the individual components of natural resources management, which include land management, forestry, fish and wildlife, and outdoor recreation.

Specific practices and schedules are addressed in existing management plans and programs developed for the installation, including, but not limited to, grounds maintenance and stormwater pollution and prevention.

1.5.3 INRMP Reviews and Updates

An Installation that currently has an INRMP is not required to revise the document within a specific time interval. An installation is required to conduct informal INRMP reviews each year and formal INRMP reviews every five years with USFWS, NOAA, and State partners. During these reviews, it may be determined that an installation’s current INRMP is effective and is not in need of revision. With agreement from USFWS, NOAA, and State partners, thorough written documentation of the annual informal reviews may be used to substitute for the five-year formal review, thereby reducing the demands on Installation commanders. In addition, minor changes can be made to the INRMP following annual reviews that will prevent the need for a more costly and time-consuming revision following the five-year review. Therefore, it is the Navy’s intent that each installation fully document annual reviews and work with USFWS, NOAA, and State partners to utilize the annual review process to meet the five-year formal review requirement whenever possible.

On an annual basis, each Installation must complete an evaluation of the effectiveness of its INRMP. This evaluation is facilitated by the web-based Metrics Builder tool on the Natural Resources Data Call Station website (<https://eprweb.cnic.navy.mil/eprwebnet/web/logon.aspx>). The Metrics Builder provides the means to evaluate performance in seven areas:

- 1) INRMP Implementation,
- 2) Partnerships/Cooperation and Effectiveness,
- 3) Team Adequacy,
- 4) INRMP Impact on the Installation Mission,
- 5) Status of Federally Listed Species and Critical Habitat,
- 6) Ecosystem Integrity, and
- 7) Fish and Wildlife Management and Public Use.

Use of the Metrics Builder to accomplish the INRMP Annual Reviews will also generate Navy conservation program metrics to measure effects of the conservation program on the installation mission and the status of our relationship with the USFWS, NOAA, and State fish

and wildlife agencies. The annual evaluation must be completed in cooperation with the appropriate field-level offices of the USFWS, NOAA, and State fish and wildlife agencies. The cooperating partners will work together to measure both the successes and issues resulting from INRMP implementation.

HISTORY AND ORGANIZATION

2 HISTORY AND ORGANIZATION

2.1 Location, History, and Military Mission

NAS Key West is comprised of 6,433 acres of land distributed over twelve (12) properties, as defined in this INRMP, located in the Florida Keys, Monroe County, Florida (Figure 2-1). These properties are located in the Lower Florida Keys within a seven-mile radius from the primary Boca Chica Field, on Boca Chica Key approximately 6.8 miles northeast of downtown Key West. Boca Chica Field encompasses 3,912 acres and consists of an airfield, administrative and industrial facilities, and recreational areas. Location and mission/function information for each of the 12 properties of NASKW is included in Table 2-1.

The U.S. Navy has maintained a presence at the southernmost point of the continental United States (i.e., Key West, Florida) for more than 125 years. In 1823, the first naval base in Key West was established to combat piracy in South Florida. Expansion of the base occurred in stages, between 1823 to 1917, and coincided with periods of military activity during the Mexican War, the Spanish-American War, and World War I. The first recorded naval flight from Key West took place on 22 September 1917, and on 18 December 1917 Naval Air Base Key West was commissioned. Construction of a small coastal air patrol station began 13 July 1917 on Trumbo Point Annex. Seaplane training began for student flight officers on 8 January of the following year, therein, launching the station’s reputation as the premier training site for Naval aviators.

NAS Key West pilots developed naval aviation antisubmarine warfare technology. During World War I, the base was used primarily for antisubmarine patrol operations and as a flight training station. The base was decommissioned after the war and many of the buildings were destroyed, although the land holdings remained property of the U.S. government. At the onset of World War II, the base was re-opened to support Navy destroyers and PBV aircraft. Satellite facilities, including Meacham Field and a runway at Boca Chica were developed. On 15 December 1940, the seaplane base was designated a Naval Air Station. In May 1945, the satellite fields were disestablished and combined into one aviation facility, NASKW.

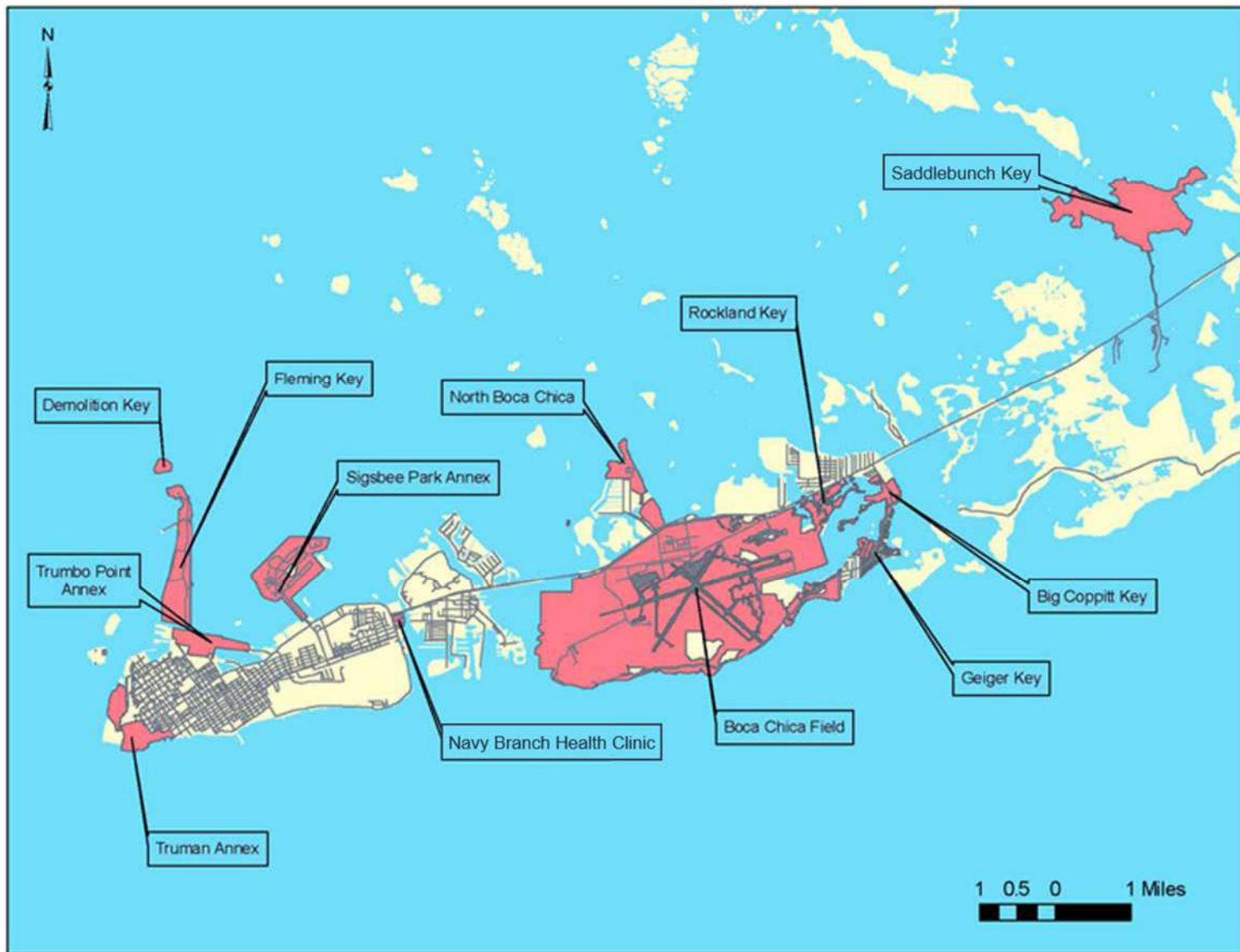


Figure 2-1. Location Map - NAS Key West, Florida

Table 2-1, Continued

Table 2-1. NAS Key West Property Location and Mission/Function

Property	Acreage	Location	Directions	Mission/Function
Demolition Key	24	North Fleming Key	2000 feet N of Fleming Key.	Both islands are used by the Navy as weapons areas for Special Operations ground training, historically using net explosive weight of ≤ 5 lbs.
Fleming Key	264	Fleming Key	2 mi. N of the Southernmost Point Monument.	Mixed Use area. Consists of Navy Research Laboratory, 200-acre weapons magazine, Special Forces and Special Operations Areas, two old landfills (IR Sites), and City of Key West wastewater treatment plant.
Truman Annex	157	Key West	East of the Southernmost Point Monument.	Mixed Use area. Consists of Port Operations, Joint Interagency Task Force (JIATF) South, BEQ housing and recreational areas.
Trumbo Point Annex	135	Key West	1.75 mi. NE of the Southernmost Point Monument.	Mixed Use area. U.S. Coast Guard utilizes port facilities. Consists of a small fuel farm, helicopter pad, C-1 Hangar, Navy housing, Visitors lodging with 300-500 rooms, water recreation park, and undesignated paved areas.
Sigsbee Park Annex	352	Key West	Dredgers Key, 1.25 mi. E of Fleming Key.	Residential area and facilities. Microwave Radio Tower at eastern tip of Key. Consists of Navy housing, Commissary, Exchange, MWR R/V campground, Child Development and Youth Centers, picnic sites, 3 boat ramps, fueling facilities, boat rentals, marina, playing fields, tennis courts.

Table 2-1, Continued

Property	Acreage	Location	Directions	Mission/Function
Navy Branch Health Clinic	15	Key West	SE of the intersection of US1 and South Roosevelt Boulevard, W of Cow Key Channel.	VA Outpatient Clinic, Naval Branch Health Clinic primarily for active duty members and civil service personnel.
Boca Chica Field	3958	Boca Chica Key	6.8 mi. NE of the Southernmost Point Monument.	To train Navy pilots and support for Naval aviation activities and units of the operating forces. Light industrial use and transient housing area. Consists of 3 runways, fuel farm, auto hobby shop, administrative facilities, playing fields, ball courts, bowling alley, fitness center, picnic areas, 83 to 103-slip marina, and 3 miles of oceanfront shoreline.
North Boca Chica	86	North Boca Chica Key	0.5 mi. NE of NAS Key West.	Mixed Use area. Small Arms Range, wastewater treatment plant, hazardous waste storage facility. Out of service weapons bunkers. NOAA Radar with several buildings from inactive missile site.
Geiger Key	164	Geiger Key	2.25 mi. SE of NAS Key West.	Air Installations Compatible Use Zones (AICUZ) buffer properties, multiple-use management for research, recreation, and wildlife habitat. There is also an inactive missile site.
Big Coppitt Key	48	Big Coppitt Key	1.25 mi. N of Geiger Key, 1.5 mi. NE of Rockland Key	AICUZ buffer properties. Former army antenna facility, service roads, weapons area.
Rockland Key	336	Rockland Key	1.5 mi. E of NAS Key West.	AICUZ with some residential use.

After WWII, NAS Key West was retained as a training facility. During the Cuban missile crisis, operational and reconnaissance flights were flown in support of the blockade around Cuba. In March 1979, a decision was made to keep NAS Key West as a fully operational Naval Air Station.

NAS Key West's present-day mission is to provide pilot training facilities and services, as well as access to superior airspace and training ranges for tactical aviation squadrons. It is one of the primary range complexes in which aircrews of the U.S. Atlantic Fleet train. The NAS Key West Range Complex consists of an at-sea Operating Area (OPAREA) that includes surface and subsurface waters; offshore special use airspace (warning areas); a submerged surface target; and other special-use airspace. The Key West Range Complex encompasses 25,498 square nautical miles of ocean within the OPAREA. The primary operation conducted at the Key West Range Complex is Anti-Air Warfare (AAW), specifically, Air Combat Maneuver (ACM). The range complex provides critical support for Navy operational readiness training.

In addition, the range includes a Tactical Combat Training System (TCTS) – one of only four located on the East Coast of the United States – that is used for air-to-air combat training. The TCTS range includes specialized equipment both within the range and at NAS Key West to assist pilots in performing and assessing various training scenarios. This is vital in the training process for pilots to assess and learn from practiced maneuvers. As such, NAS Key West serves as the Navy's premier East Coast pilot training facility for tactical aviation squadrons. The mild tropical-maritime climate of the Key West area makes this an ideal area for year-round pilot training activities. In fact, the weather is suitable for flying approximately 360 days per year or 99% of the time. This ensures that squadrons that make the commitment to deploy to this area for training can accomplish their requirements with little or no loss of opportunity and expense.

Ideal weather throughout the year allows the Navy to complete necessary readiness requirements during fixed training windows. In addition, because many aviation-related assets are already in place, NAS Key West serves as an ideal operating base for opposition and aggressor forces that conduct operations during readiness exercises. Designated airspace and a TCTS are heavily utilized in the Key West area by military assets in training evolutions.

Active and reserve Navy fighter/strike fighter communities, Chief of Naval Training (CNATRA) units, Fleet Replacement Squadrons (FRSs), Department of Homeland Security, foreign allies, and other military service users all come to NAS Key West to take advantage of the ideal

weather conditions and abundant training air space. The number of transient aircraft and personnel peak during the winter when weather is optimal for flying, and decrease during the summer months when temperatures are at the highest and storms are more prevalent. The most common transient aircraft to the installation is the F/A-18 Hornets, as well as other fighter jet aircraft. The transient squadrons come to NASKW to complete air-to-air combat training.

2.2 Organization and Structure

The functional organization of NASKW is shown in Figure 2-2. The most relevant departments in the context of the INRMP are Operations Department, Public Works Department (PWD), Fire Department, the Morale, Welfare & Recreation Department (MWR).

The Operations Department provides radar and airfield technical capabilities for NASKW. Three HM-60S search and rescue helicopters are maintained for readiness. It also monitors hazardous waste disposal sites maintained for fleet units at NASKW.

The Fire Department supports a Spill Response Team for containment services and a Crash and Fire Branch for fire-fighting capability and hazardous materials mitigation.

The PWD is the lead activity in planning, designing, constructing, maintaining and repairing Installation facilities.

The Environmental Division of the Public Works Department develops and implements the Natural Resources and the Environmental Protection Programs (Figure 2-3). The Natural Resources Program manages the natural resources at NASKW. All projects occurring within NASKW that potentially impact natural resources (i.e. wetlands, threatened and endangered species, water quality) must be evaluated by the Natural Resources Manager and/or Environmental Director prior to implementation. This will allow potential impacts to natural resources to be reviewed by appropriate personnel, and potential constraints to be identified.

The goal of the MWR Department is to provide a varied program of wholesome and constructive off-duty recreational activities that contribute to the mental, physical, social, and educational enrichment of military personnel and their families. In addition to indoor athletic facilities, community and child care centers, the MWR Department also has outdoor facilities, such as the Truman Annex beach patio recreation area and the Boca Chica and Sigsbee Marinas.

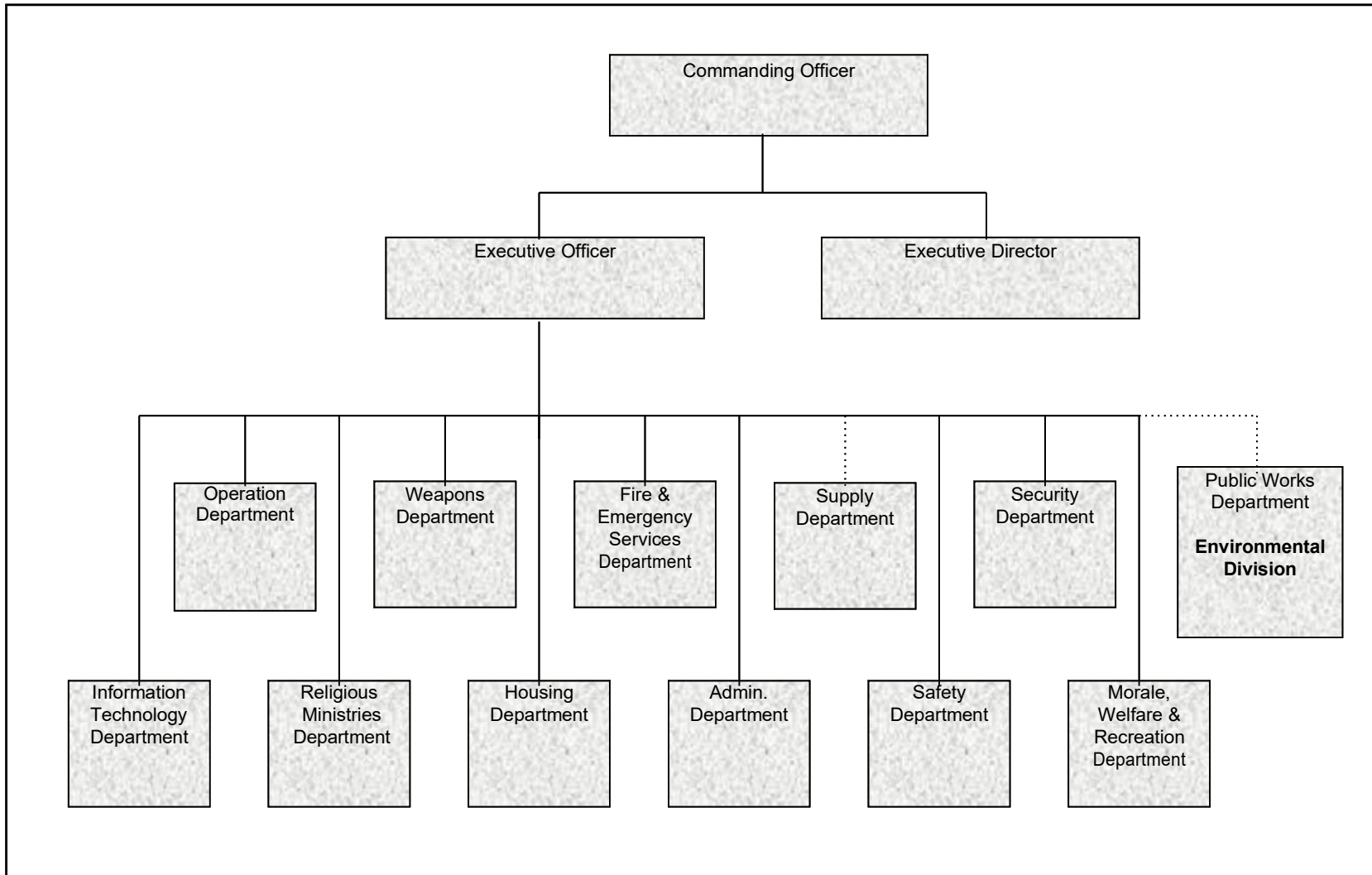


Figure 2-2. NAS Key West Organizational Chart

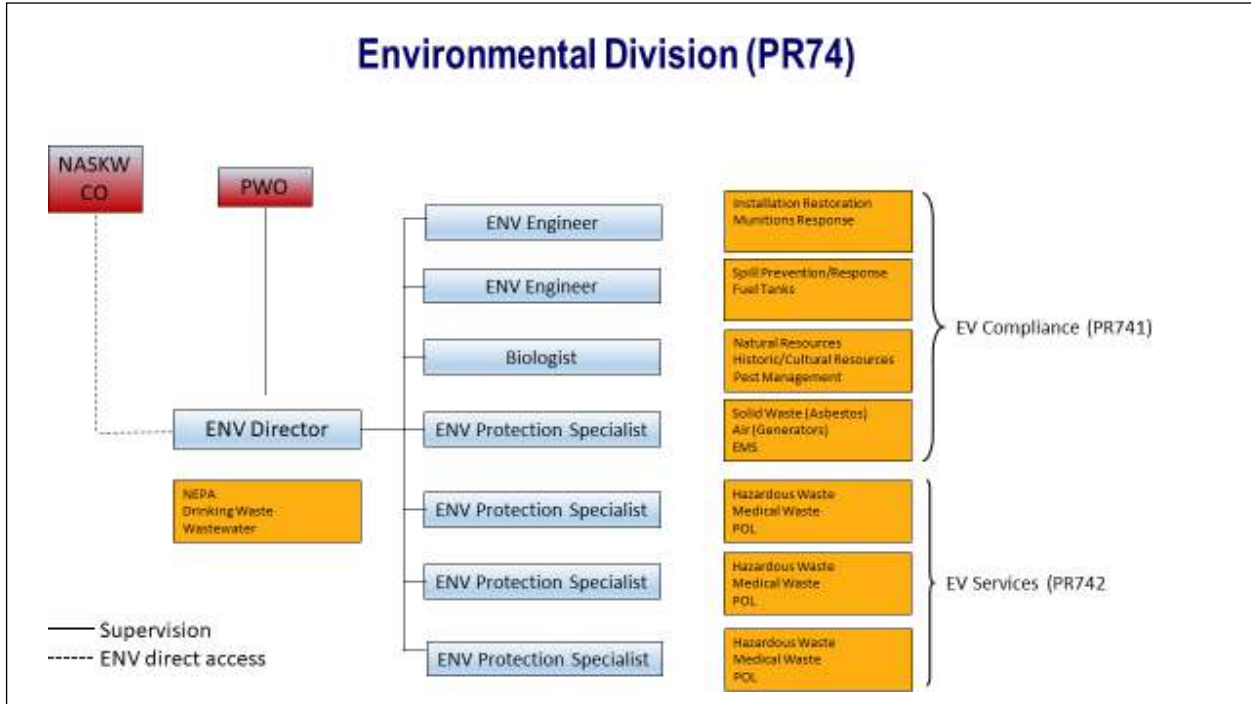


Figure 2-3. NAS Key West Environmental Division Organizational Chart

2.3 Overview of Natural Resources Management

With the passage of the Sikes Act (PL 86-797 as amended) and the DoD Appropriations Act of 1961 (10 USC Section 2665 as amended), additional sources of revenue stimulated the natural resources program throughout DoD. The Sikes Act provided for collection of user fees to support the fish and wildlife program. It also provided for the preparation of long range management plans and the initiation of cooperative agreements with the State and the US Fish and Wildlife Service for technical assistance in implementing the program. 10 USC 2665 made revenues from the sale of forest products available for support of a commercial forestry program.

NAS Key West began managing specifically for fish and wildlife resources in 1983, when the Installation’s first Bird/Animal Aircraft Strike Hazard (BASH) Assessment was completed by the Air Force BASH Team. In 1984, a Tripartite Fish and Wildlife Cooperative Agreement with the USFWS and the State of Florida was executed. The first Long Range Fish and Wildlife Management Plan for NASKW was approved in 1986. In 1989, the Navy, the National Park Service (NPS), and the Florida Division of Recreation and Parks signed a tripartite agreement to provide NASKW with professional and technical information and assistance necessary to coordinate actions pertaining to outdoor recreation. The Natural Resources

Management Plan was updated in 1992 and the National Park Service completed a Long Range Outdoor Recreation Plan in 1993. In 1996, the fish and wildlife management section of the Natural Resources Management Plan was updated. In 2001, as required by the amended Sikes Act, an INRMP was prepared to implement natural resources management program at NASKW. In coordination with the USFWS, NOAA, and the FWC, the Navy completes annual reviews of the INRMP. The INRMP is updated as needed – but at least every five years – to account for changing species statuses under the ESA, incorporate new information obtained from natural resources surveys, and add recommendations from USFWS, NOAA, and the FWC.

Over the years of military presence in the Keys, the physical environments at DOD properties have been altered to varying degrees, but natural communities remain, usually in better condition than in surrounding developed areas. These habitats support diverse populations of plants and animals, many of which are rare, threatened, and endangered species.

The Lower Keys marsh rabbit (LKMR), listed endangered by the USFWS in 1990, occupies habitats on NASKW properties including Boca Chica Key, East Rockland Key, Geiger Key and Saddlebunch Key. Distribution of the LKMR on NASKW was determined by Forsys (1994) with subsequent distribution being updated by Faulhaber (2002). It is estimated that approximately one-third of the occupied habitat for the LKMR occurs on Navy owned property. In 1992, NASKW consulted with the USFWS on impacts to the LKMR from operational activities. As a result, the USFWS issued a Biological Opinion (BO) in 1993 pursuant to Section 7 of the ESA on operational activities at NASKW, including those at Boca Chica Field, that may affect the federally-endangered LKMR. The BO considers motor vehicle usage (including off- road), habitat alteration (i.e., mowing of suitable and occupied areas), habitat degradation (invasive exotic plant species), feral and domestic cats, people, and raccoons as sources of potential impacts to LKMR on Navy lands. The BO identifies reasonable and prudent measures to be implemented by the Navy for compliance with an incidental take of this species, which is not to exceed two rabbits. This number was temporarily increased to six rabbits annually in accordance with a BO issued in 2007 for restoration of clear zones and stormwater drainage systems on Boca Chica Field, but is now two rabbits again. Terms and conditions of the incidental take statement required the Navy to institute a “no mowing program” in certain areas and actively manage several sites of known LKMR-occupied habitat. Mowing regimes are depicted in the Boca Chica Grounds Maintenance Mapbook, which is available upon request. In

1994, NASKW developed a Lower Keys Marsh Rabbit Management Plan, updated in 2016 (Appendix B), to outline measures to maintain rabbit populations at or above existing levels, to protect viable populations, and to promote the rabbit's recovery in ways and in areas that do not compromise the primary mission at NASKW.

The Florida Keys region is dominated by three marine habitat types: mangroves, seagrass and coral reef. The near-shore land/water interface is dominated by the mangrove community, seagrass is the principal marine benthic vegetation, and different forms of coral reef habitats are interspersed throughout the lower Keys. The species of mangroves present represent a major coastal wetland habitat and much of the mangrove habitat found at NASKW is *mangrove basin* type (SAFMC 1998). This habitat type is often dominated by black mangrove and water containing low dissolved oxygen and high levels of hydrogen sulfide (Odum et al. 1982). Seagrass habitat is found within many of the NASKW maritime areas, especially within several of the estuarine lagoons at Boca Chica Field. Seagrass habitats are ecologically important for many fish, sea turtle, and marine mammal species. Water quality and, in particular, water clarity is considered among the most critical factors in the maintenance of healthy seagrass habitats. The Florida coral reef tract is the most extensive living reef system in North America, and the third largest system in the world (FKNMS n.d.). The tract supports hundreds of species and helps protect the shoreline from destructive tropical storms and hurricanes. Various coral and hardbottom benthic habitats occur immediately adjacent to Boca Chica Field. Executive Order 13089 (*Coral Reef Protection of June 11, 1998*) provides Federal protection for coral reefs, and seven species of coral are listed as threatened under the Endangered Species Act: staghorn coral (*Acropora cervicornis*), elkhorn coral (*A. palmata*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), lobed star coral (*Orbicella annularis*), mountainous star coral (*O. faveolata*), and boulder star coral (*O. franksi*). Pursuant to the National Defense Authorization Act of 2004, Public Law 108 -136, the Navy deems that this INRMP provides a conservation benefit to federally-threatened coral species and has therefore determined that a critical habitat exclusion for these species is warranted for the nearshore environments owned and controlled by the Navy (Appendix C). A survey conducted in 2006 found three of the seven listed coral species attached to, or in the vicinity of, any NASKW-owned property. Corals are adversely affected by sedimentation, as are seagrasses. Erosion and runoff control are two key management strategies employed by NASKW that will benefit coral and seagrass communities.

The outbreak of stony coral tissue loss disease in the region is causing significant additional stress to corals (ONMS 2019). Additionally, Project 13 (Marine Resources Survey; Appendix A) involves recurring quantitative monitoring of seagrass and coral resources within NASKW properties.

Important animals that use the Lower Florida Keys oceanic and estuarine habitats include state and federally managed fish species, marine mammal species, migratory bird species, sea turtles, and the American crocodile. There are 88 species of fish that occur in the waters proximate to the NASKW that are federally managed. There are approximately 29 species of marine mammals (baleen whales, toothed whales, and manatees) found in the Gulf of Mexico, many of which are present within the Lower Keys region, and all are protected under the Marine Mammal Protection Act. The most recent survey of neotropical migratory birds took place in 2015 and documented 88 bird species on the installation (GSRC 2015). Five species of sea turtles are known to inhabit the waters of the Keys, and the loggerhead is the most common. Portions of the shoreline owned by the Navy on Boca Chica Field are considered sea turtle nesting habitat. More than 20 American crocodiles are known to occur on NASKW and suitable crocodile nesting sites have been located on southern Boca Chica Key and the southwest shore of Sigsbee Key (Mazzotti 2014; Metzger et al. 2016).

NAS Key West continues to be active in protecting and monitoring endangered species and improving their habitat when possible. Ecological surveys have been conducted to identify rare plant and animal species, natural communities and occurrences of invasive and exotic plants on all NASKW properties. Other important environmental concerns, such as wetlands and non-point source pollution, are always being addressed to ensure that the Installation is in compliance with Federal and State mandates. Efforts continue to be made to protect the diverse and abundant resources that create the aesthetic outdoor setting at NASKW and to develop outdoor recreation opportunities therefore improving the quality of life for military personnel, their dependents, and nearby civilian populations.

The NASKW Natural Resources Manager (NRM) operates under the direct supervision of the Environmental Director. Natural resources staffing at NASKW consists of the NRM. Technical assistance is provided by the natural resources staff at NAVFAC SE for developing and maintaining an effective conservation program. Installation personnel within Operations,

Public Works, Security, MWR, Housing, and Safety have various functions related to the natural resources program, and they coordinate with the NRM on all natural resource issues.

Law enforcement at NASKW, including the enforcement of local, state and federal laws and regulations pertaining to natural resources, is the responsibility of the NASKW Security Department. The NASKW Security Department coordinates with the NRM as needed. In addition, law enforcement officers of the USFWS and the State of Florida have access to NASKW for purposes of enforcing State and Federal fish and wildlife regulations, subject to the knowledge and consent of the Commanding Officer (CO).

2.4 Public Access

Public access to NASKW is limited to Installation personnel including active duty and reserve military personnel assigned to the Installation, their dependents and accompanied guests; federal civilian employees, their dependents and accompanied guests; and military retirees. Controlled public access is permitted for fishing and other recreational purposes when such access can be granted without impairment to the military mission. Manageable quotas will vary depending upon the amount of suitable land and water areas available. Public recreational use may be equitably distributed by impartial selection procedures. Public access for saltwater fishing is permitted on the Installation wherever the activity will not interfere with the mission or constitute a safety hazard. Due to the lack of suitable habitat, hunting and freshwater fishing is prohibited on the Installation. Off-road vehicles are prohibited due to the fragile nature of the environment at NASKW.

Access should also be considered in terms of accessibility of facilities and programs for the physically challenged. The Architectural Barriers Act of 1968 (Public Law 90-480) requires facilities to be accessible to the physically challenged. Section 504 of the Rehabilitation Act of 1973, as amended (Public Law 93-112), prohibits discrimination on the basis of handicap in program participation and in all facets of employment. The American with Disabilities Act (ADA) of 1990 (Public Law 101-336) provides standards for addressing discrimination against individuals with disabilities in employment, transportation, telecommunications, public accommodations, and services operated by private entities. Military Installations, including the dependents and civilians employed, are not exempt from these laws.

2.5 Stakeholders and Partnerships

Stakeholders are those individuals and organizations with a vested interest in the natural resources management on the Installation. Over the past several years, NASKW has developed partnerships and cooperative agreements for technical assistance with the stakeholders and other entities interested in participating in activities within NASKW. NAS Key West understands the importance of participating with the surrounding community and maintaining communication between the Installation, stakeholders, and other interested parties. These efforts complement its overall philosophy of active partnering with and sharing information and resources with internal stakeholders and other resources management agencies and organizations, including federal, state, and local governmental agencies, and other non-governmental organizations and groups. NAS Key West has a diversity of natural resources within its boundaries. Due to the need for a variety of expertise and assistance in developing and implementing sound management practices, the Installation has developed partnerships and cooperative agreements for technical assistance in managing its natural resources. The development of partnerships with state and federal natural resources agencies, local conservation groups, and academic institutions makes expertise available to natural resources managers, and fosters good community relationships.

2.6 Plans, Programs, and Studies

This section addresses existing plans and programs developed for NASKW outside the natural resources program. These plans adhere to federal and state regulatory requirements and will be utilized as tools for implementing this plan. These plans are dynamic, updated periodically, and will be inclusive of the goals and objectives identified in this INRMP.

Stormwater

Stormwater discharges have been increasingly identified as a significant source of water pollution in numerous nationwide studies on water quality. To address this problem, the Clean Water Act Amendments of 1987 required EPA to publish regulations to control storm water discharges under the National Pollutant Discharge Elimination System (NPDES) permit program. EPA regulations in 40 CFR 122 require that industrial and construction activities apply for a NPDES permit for storm water discharged to surface waters of the United States. Associated with the permitting is the need to characterize the storm drainage areas, monitor the

storm water quality and implement Best Management Practices (BMPs) to improve storm water quality (FDOT and FDEP 2007; FDEP 2008, NASKW 2016).

NAS Key West is regulated by EPA’s National Pollutant Discharge Elimination System (NPDES) and the Stormwater Multi Sector General Permit (MSGP) for use in the State of Florida. This permit requires the development of a Stormwater Pollution Prevention Plan (SWPPP). Stormwater is managed at NASKW according to the SWPPP, last updated in 2016 (NASKW 2016). The SWPPP is an engineering and management strategy designed to improve the quality of stormwater runoff, and thereby the quality of receiving waters. Industrial activities at NASKW have been reviewed in regard to the MSGP. The sectors that apply to NASKW are Sector K (hazardous waste treatment, storage or disposal facilities), Sector Q (water transportation facilities that have vehicle maintenance shops and equipment cleaning operations) and Sector S (air transportation facilities vehicle and equipment maintenance). These sectors are formally defined in the NPDES General Permit for Industrial Activities. A Stormwater Pollution Prevention Team (SWPPT) was formed to determine the adequacy of the SWPPP, ensure implementation of BMPs, perform inspections, perform required record keeping, and carry out the annual update and certification of the SWPPP. The three major components of the SWPPP are stormwater monitoring, BMP implementation, and site compliance evaluations. The SWPPP is discussed further in Section 4.1, Stormwater and Water Quality Control.

Hazardous Waste (HW)

NAS Key West operates under a Hazardous Waste Management Plan (HWMP) and Pollution Prevention (P2) Plan. The HWMP identifies and implements hazardous waste (HW) management actions required by state and federal law and provides the procedures and responsibilities for NAS Key West to properly manage that waste. HW is any solid waste (SW) that meets the definition found in 40 Code of Federal Regulations (CFR) 261.3. Navy policy is to minimize HW generation, not only for the protection of human health and the environment but also to reduce the regulatory burden and cost associated with HW management per Office of the Chief of Naval Operations (OPNAV) M-5090.1 Chapter 27-3.7. The procedures for waste minimization are presented via the Navy’s Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP). CHRIMP is a stand-alone program managed by Naval Supply Systems Command (NAVSUP) Fleet Logistics Center (FLC). CHRIMP details the

methods for minimization of hazardous material (HM) at NAS Key West and describes the means to measure the success of the program.

NAS Key West has a permit for the operation of a Hazardous Waste Container Storage Unit under the Florida Department of Environmental Protection, issued in 2019.

The NAS Key West P2 Plan, last revised in August 2013 (and currently undergoing new revisions), was developed in accordance with the Pollution Prevention Act of 1990, EO 12856, and OPNAVINST 5090.1E. The purpose of the plan is to manage P2 efforts and comply with federal, state, and local environmental regulations, thereby minimizing potential adverse impacts on human health and the environment, reducing liability, and decreasing costs associated with HW disposal. The plan applies to all activities, tenant commands, and on-site contractors. The plan sets specific goals for reducing the quantity of HW generated at the Installation.

Oil Pollution Prevention

NAS Key West operates under a Facility Response Plan and a Spill Prevention, Control, and Countermeasure (SPCC) Plan. The Facilities Response Plan, revised in August 2016, was developed in accordance with OPNAVINST 5090.1E, Environmental Readiness Program Manual. The purpose of the Facility Response Plan is to provide a contingency plan that establishes policy, responsibilities and procedures for the control and cleanup of oil spills within NASKW jurisdiction. The plan is applicable to spills into air, water, or land, originating from any NASKW department, tenant activity, or other organization or private contractor working within NASKW property boundaries. The NAS Key West CO is the Facility Incident Commander.

In order to decrease the potential for oil spills and comply with 40 CFR 112 and OPNAVINST 5090.1E, a SPCC Plan was developed for NASKW (Navy 2000a). The Plan, updated in 2018, is required at NASKW because the Installation possesses facilities and conducts operational activities related to storage and transfer of oil in support of aircraft flight training. The SPCC plan addresses both federal and state spill prevention requirements.

Installation Restoration

Federal Facilities were required to comply with the Comprehensive Environmental Response, Compensation Liability Act of 1980 (CERCLA) and as a result developed the Defense Environmental Restoration Program (DERP) in 1984, which initiated the current Installation

Restoration Program (IRP). CERCLA was further amended in 1986 under Superfund Amendments and Reauthorization Act. This amendment predominantly requires all federal facilities to fully meet the cleanup and reporting criteria. Under the auspices of these legal mandates, this program is conducted to address the environmental conditions created by the release of chemicals, petroleum products and contaminants from past spills or disposal practices. In accordance with the provisions of CERCLA, the U.S. Navy at NASKW is currently investigating and performing remediation at various sites to fully remove known contaminants. Additionally, at NASKW, some site investigations are also conducted in accordance with the provisions of the Resource Conservation and Recovery Act (RCRA); which addresses areas where formerly stored or used hazardous substances were released into the environment. Fuel and petroleum related contaminated sites are regulated under Chapter 62-770 Florida Administrative Code (FAC) which addresses contamination impacting soils and groundwater.

In cases where contaminants have been found to pose a potential threat to human health or the environment, immediate cleanup measures were initiated to remove the source of the threat. These measures are known as Interim Remedial Actions (IRAs). To date, ten IRAs have been completed or are planned at NASKW. However, these IRAs are not permanent remedies and work continues on developing final cleanup plans for these sites.

In addition to the IR site investigations, underground/aboveground storage tank (UST/AST) sites are also evaluated. These sites are addressed under a separate storage tank management program administered by the FDEP. The program is designed to provide a practical and timely plan to determine contamination that may have resulted from storage tank operations, remove unneeded tanks, and perform any necessary remediation.

Because Natural Resources management activities have the potential to involve Installation Restoration sites, especially those in the more remote locations of the Installation, activity personnel executing INRMP functions should ensure the areas they are working in are not specifically identified as IR sites.

Pest Management

Pest Management is provided through implementation of the Integrated Pest Management Plan (IPMP). The IPMP provides a comprehensive, long-range document that captures all the pest management operations and pesticide-related activities conducted at Naval Air Station Key

West, including the control of feral cats. Pest control services are provided through a contracted pest control service. The contractor provides right-of-way weed, control pest control in industrial areas, and housing, and mosquito abatement. A pest management service provider (PMSP) conducts all outdoor turf and ornamental pest management. The Environmental Division conducts surveys and directs invasive weed control, and provides quality assurance for the PMSP management programs.

Grounds Maintenance

Grounds maintenance for NASKW is provided through a service contract. Landscaping and grounds maintenance is performed in accordance with the annual Grounds and Surfaced Area Maintenance Plan, which is prepared by the contractor and approved by the Public Works Department. The plan includes a map or maps of all improved and semi-improved areas maintenance schedule, annual fertilization and lime application program with location and type of treatment required.

Integrated Cultural Resources Management Plan (ICRMP)

In compliance with the requirements of Sections 106 and 110 of the National Historic Preservation Act of 1966, OPNAVINST 5090.1E, and SECNAVINST 4000.35, an ICRMP was developed in 2003 for the Installation. A major update was completed in 2012 and the last annual update occurred in 2019. The ICRMP identifies and addresses cultural and archaeological resources located within the Installation, including the main facility, Naval Air Station and it’s non-contiguous sites.

Because Natural Resources management activities have the potential to involve invasive soils work and potential damage to physical structures, especially those in the more remote locations of the Installation, activity personnel executing INRMP functions should ensure the areas they are working in are not specifically identified as being of historic and/or archaeological value.

The ICRMP provides an inventory of known Cultural Resources and provides a Management Plan. The Management Plan addresses Commander’s Responsibilities, Review Monitoring and Reporting as well as Standard Operating Procedures for Inadvertent Discovery of Archaeological Deposits. The entire Key West area has a potential to encounter previously unidentified cultural and archaeological resources. Installation personnel executing INRMP

functions should be aware of the ICRMP recommendations in the event of inadvertent discovery of human remains and/or archeological artifacts. Coordination of issues related to cultural resources should involve the Installation cultural resources management staff and/or technical support from NAVFAC SE.

3 EXISTING ENVIRONMENT

3.1 Climate and Climate Change

3.1.1 Key West Climate

The Florida Keys climate is classified as subtropical marine, characterized by mild winters with hot, humid, but breezy summers. Key West has a year round average temperature of approximately 77 degrees Fahrenheit (° F) and receives an average of approximately 40 inches of rainfall per year (Table 3-1). The temperature difference between summer and winter is only 15° F. The nearness of the Gulf Stream, combined with the effects of the Gulf of Mexico, tend to mitigate advancing cold fronts. Easterly tradewinds and sea breezes suppress the summer heat. January is typically the coldest month of the year, with an average low temperature of 64.4° F. August is typically the hottest month of the year with an average high temperature of 88.7° F.

Table 3-1. Average Temperature and Rainfall in the Key West Vicinity (2007-2019)

Month	Average Low Temp (°F)	Average High Temp (°F)	Average Rainfall (inches)
January	64	74	2.04
February	66	76	1.49
March	68	78	2.05
April	72	81	2.05
May	76	85	3.00
June	79	88	4.11
July	80	89	3.55
August	80	89	5.38
September	78	88	6.71
October	76	85	4.93
November	72	80	2.30
December	67	76	2.22
Average/Total	73	82	39.83

Source: usclimatedata.com

Key: Temp. = Temperature °F = degrees Fahrenheit

Hurricane season in Florida extends from June through November; however, the frequency of hurricanes in the Gulf of Mexico is greatest during the months of August, September, and October. The majority of hurricanes approach Key West from the south and east, with their effects felt on the south, east, and west sides of the island; however severe hurricanes have struck Key West from all directions. An estimated 75 percent (%) of all damage

from annual hurricanes is due to tidal flooding. The probability that a hurricane (winds exceeding 73 miles per hour) or a great hurricane (winds exceeding 125 miles per hour) will occur in a 50-mile segment of the U.S. coastline near Key West is 13% and 4%, respectively.

3.1.2 Climate Change

Over the coming decades, DoD installations will experience significant risks from climate-driven changes in the environment, which could compromise the capacity of these lands and waters to support the military mission. Threats such as rising global temperatures, changing precipitation patterns, increasing frequency and intensity of extreme weather events, and rising sea levels and associated storm surge are already impacting Navy installations across the country. There is an operational need to ensure that current and future climatic changes do not compromise the ability of NASKW to serve its essential operational, training, and testing functions. To this end, adapting to a changing climate is essential and requires an assertive level of planning.

Climate adaptation planning can be viewed as a process of iterative risk management consisting of four major components:

- Assess climate risks,
- Develop adaptation responses,
- Implement adaptation actions, and
- Monitor and adjust actions as needed.

Adaptation should be viewed as an ongoing process rather than as a “one-and-done” product or action. Such an iterative process, with opportunities for periodic review, evaluation, and adjustment, builds on and is consistent with DoD’s longstanding commitment to adaptive management. Because climatic changes are underway and continuing to intensify, installation managers should also shift management strategies to help create habitats that will be resilient to future environmental challenges rather than always aiming to restore or maintain the status quo (Stein et al. 2019).

3.2 Air Quality

The Clean Air Act (CAA) is the primary federal statute governing the control of air pollution. The Clean Air Act (CAA) designates six pollutants as criteria pollutants for which National Ambient Air Quality Standards (NAAQSs) have been declared to protect public health

and welfare: particulate matter (PM₁₀ and PM_{2.5}), carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, and ozone. Areas that do not meet NAAQSs are designated as “nonattainment” for those criteria pollutants exceeding their respective NAAQS. Nonattainment status is further classified by the extent to which the standard is exceeded.

The CAA, as amended, requires Federal actions to conform to an approved State Implementation Plan (SIP). The SIP is designed to achieve or maintain an attainment designation for air pollutants as defined by the NAAQSs. The General Conformity Rule (40 CFR Parts 51 and 93) implements these requirements for Federal actions occurring in air quality nonattainment areas.

NAS Key West is located in Monroe County, which is not in violation of any of the six criteria air pollutants of the NAAQS as established by the CAA (EPA 2005). Because of the excellent air dispersion characteristics and non-industrialized nature of Monroe County, most pollutants are not routinely measured. The closest monitoring stations are in Miami-Dade County, and these stations have documented attainment status for particulate matter and ozone (FDEP 2005).

Air quality is regulated nationally by the EPA, the standards of which have been documented in Title 40 Part 50 (Subchapter C-Air Programs) of the CFR. On the State level, FDEP has authority to regulate air quality in the State of Florida.

Currently, air pollutant emissions at NASKW are generated from stationary and mobile sources. Stationary sources include surface coating, fuel storage and handling, fire-fighting training facilities, and miscellaneous small stationary combustion sources. Mobile sources include aircraft, motor vehicles, and ground support equipment. Military aircraft operations are the most significant source of air pollutant emissions at NASKW.

3.3 Land Use

NAS Key West has a number of noncontiguous properties located in Key West, Boca Chica Key, Big Coppitt Key, Rockland Key, Geiger Key, Demolition Key, Dredgers Key, Fleming Key, and Saddlebunch Key. These properties include Boca Chica Field, Sigsbee Park, Trumbo Point Annex, Truman Annex, and others totaling approximately 6,433 acres of land.

Land use among the Installations that make up NASKW is based on the operational needs and military mission requirements. Land use at NASKW ranges from “high intensity,” well-

developed areas used for operational functions, to “low intensity” areas that serve as buffers from surrounding non-military lands. Airfields, administrative and training facilities, public works, housing, medical facilities, and other mission operations occur within the high intensity areas at each Installation, while the low intensity land use areas include natural resources such as forests, ponds, wetlands, and other unique habitats. The following is a brief description of the major NASKW facilities.

Demolition Key (24 acres). This land is a Navy-owned island located immediately north of Fleming Key, and historically used for demolition of explosives. It consists of two undeveloped spoil islands. The southern key consists primarily of red mangrove and saltwort within the interior. The northern key consists of a dense fringe of red and black mangrove with an almost pure stand of Australian pine and some Brazilian pepper in the interior. There is a bunker used for weapons observation and ordnance training. The natural communities in this area support important bird rookeries. Nearshore waters support seagrass and hard-bottom communities.

Fleming Key (323 acres). This Navy-owned island is located immediately north of Trumbo Point Annex. The north area contains a 200-acre weapons magazine and a Special Forces area. The central portion consists of two old landfills (Installation Restoration Sites), Navy Research Laboratory, Special Operations area, and vacant parcels of land. The south end is a leased area which consists of the City of Key West Wastewater Treatment Plant. The shoreline of the Gulf of Mexico on the western side of Fleming Key consists mainly of mangroves with a mix of some Brazilian pepper and Australian pine. The F-26 Bunker is located on the north end and is considered a significant cultural resource. Nearshore waters support seagrass and hard-bottom communities.

Truman Annex (157 acres). This annex is bound on the south by the Atlantic Ocean; to the north-northeast by residences and commercial, warehouse and light industrial buildings; and to the west-northwest by Fort Zachary Taylor State Historic Site. The property includes bachelors enlisted quarters (BEQ) housing, visitors quarters (VQ) lodging, a beach, and numerous recreational areas (e.g., playing field, etc.). The property contains building rooftops that support identified least or roseate tern nesting colonies. This property also contains historic sites. Nearshore waters support seagrass and hard-bottom communities.

Trumbo Point Annex (135 acres). This annex is bound on the north by the Gulf of Mexico; to the south by residences and commercial, warehouse and light industrial buildings; to the west by Key West Bight; and to the east by Garrison Bight. This property includes military housing, VQ lodging, and recreational areas (e.g. ball courts, water park, tennis courts, etc.). In addition, the United States Coast Guard (USCG) Sector Key West, USCG Station Key West, and the City of Key West Port Authority Maintenance Facility are located on this annex. The only area consisting of native vegetation is a mangrove fringe along the Garrison Bight shoreline. This property also contains historic sites. Nearshore waters support seagrass and hard-bottom communities.

Sigsbee Park Annex (352 acres). This facility is located on Dredgers Key, which is surrounded by the Gulf of Mexico to the north, east, and west, and the Salt Pond Keys to the south. It is connected to Key West with a manmade causeway. Sigsbee Park houses MWR facilities, marina, family housing, and community support services, including the Navy Exchange, a commissary, and the Sigsbee Charter School. The western 40 acres of the site are tidal wetlands, consisting predominantly of red mangrove, with black and white mangroves. The property contains building rooftops that support identified least tern nesting habitat. Nearshore waters support seagrass and hard-bottom communities.

Navy Branch Health Clinic (15 acres). This property is located on the east end of the City of Key West. It is bound by Navy housing to the north, private residential housing to the south, Cow Key Channel to the east, and South Roosevelt Boulevard to the west. The property contains a naval branch health clinic primarily for active duty members and civil service personnel and a Veterans Administration Outpatient Clinic. This property also contains historic sites. Nearshore waters support seagrass and hard-bottom communities.

Boca Chica Key (3,958 acres). This property is the site of Boca Chica Field. The primary land use is an airfield with three runways and the associated safety clear zones that include large expanses of mowed apron areas, open water lagoons and wetland habitats; some which support endangered species (e.g., Lower Key marsh rabbit). Mowing contractors at Boca Chica abide by a grounds maintenance mapbook, which is available upon request. The area located to the north of the runway includes air operations buildings, transient housing, administrative buildings and recreational facilities. In addition to airfield operations, Boca Chica

contains a weapons area to the west-southwest of the airfield. This area contains a few buildings but is primarily undeveloped because it is encumbered by safety requirements during explosive ordinance handling activities (i.e., Explosive Safety Quantity Distance arcs). The Boca Chica Marina is located on the western side of the Key and includes a recreational beach, boat slips and a mooring area. The natural communities on Boca Chica Key include more than 2,000 undeveloped acres consisting of tidal mangroves, transitional wetlands, hardwood hammocks, and coastal zones. Nearshore waters support seagrass, hard-bottom, and patch reef communities.

North Boca Chica (86 acres). This site is located on the north end of Boca Chica Key, northeast of the airfield and is bordered to the south by U.S. Highway 1 and to the north, east, and west by mangrove fringe and the Gulf of Mexico. A privately owned parcel is located on the northwest side of the site and United States Department of Interior property is located on the west and east sides of the site. This area consists of a hazardous waste storage facility, a publicly owned wastewater treatment facility, a supply building, out-of-service weapons bunkers, small arms and rifle ranges, a NOAA radar site and several buildings associated with an abandoned missile site. The natural communities within this area include mangrove areas, transitional areas, and coastal zones providing habitat for the endangered marsh rabbit. Nearshore waters support seagrass and hard-bottom communities.

Geiger Key (164 acres). This property is located southeast of Boca Chica Field and contains an inactive missile site. The property north of the residential community consists primarily of higher areas are developed for residential purposes. The property south of the residential community consist of wetlands which include mangrove areas, coastal zones, and transitional areas. These areas contain habitat for the endangered marsh rabbit. Nearshore waters support seagrass and hard-bottom communities.

Big Coppitt Key (48 acres). This property is located north of Geiger Key and is bordered by residential homes and businesses to the north, by the oceanfront to the east and west, and by oceanfront and wetlands to the south. A two acre site on the northwest corner of the property contains a former army antenna facility and a few associated buildings. A canal runs through the center of the property east of Geiger road and fill road accesses a borrow pit and fill pad on the western side. The natural areas surrounding these disturbed areas consist of mangroves, transitional areas and coastal zones. These areas contain habitat for the endangered

marsh rabbit. Least terns have been observed nesting on the fill pad on the western side of the property. Nearshore waters support seagrass and hard-bottom communities.

Rockland Key (336 acres). This property located east of Boca Chica Field and is bound by the coast and some undeveloped land areas. The natural area is comprised of 75% tidal swamp, 15% coastal rock barren, and 10% lowland hammock. These areas contain habitat for the endangered marsh rabbit. Nearshore waters support seagrass and hard-bottom communities.

Saddlebunch Key (615 acres). This property is located approximately seven miles east of Boca Chica Field. Except for the narrow fill pad for the access road and relatively small areas associated with buildings and antenna pads, this key is in natural condition. The natural areas consist of extensive tidal swamp, the Five Mile Creek, limited areas of hammock, and saltmarsh that supports the federally endangered silver rice rat and Lower Keys marsh rabbit. Nearshore waters support seagrass and hard-bottom communities.

3.4 Physiography, Geology, and Topography

The Florida Keys are a series of low limestone islands that extend 140 mi southwest of the mainland. Elevations in the islands rarely exceed 5 ft above sea level. A narrow shelf is present along the Atlantic Coast, where the seafloor drops sharply into the Straits of Florida. The Atlantic Coast is bathed in the clear, tropical waters of the Florida Current which is favorable to the development of coral reefs several miles offshore of the keys.

The Florida Keys are assigned to the Gold Coast-Florida Bay District where Pleistocene limestone and limestone cap rocks are prevalent. This province has also been referred to as the southern zone of the coastal lowlands, the Florida Plateau. This eustatically formed archipelago is then subdivided into three island groups of limestone or carbonate sand and mud: 1) Coral Reef Keys, the northern linear island chain of coral rock with a living coral reef offshore; 2) Oolitic Keys or “western keys,” the southern chain of east-west aligned keys (including the Key West area) of oolitic limestone with Pleistocene and Holocene coral reef tracts to the southeast and south; and 3) Dry Tortugas, shoals, and islands of bioclastic carbonate sand and mud.

All of the Lower Keys are composed of Miami oolite. These formations are soft, white to yellow, stratified to massive, cross-bedded and are constituted of pure calcium carbonate which may contain shell fragments and minor quartz sand. Its major constituents are tiny oolids, which are spherical calcareous grains with concentric structure and cemented to form oolitic rock.

Key Largo Limestone underlies the Miami Oolite on all of the Lower Keys. Its major constituents are the cemented remains of ancient coral reefs and a subsidiary amount of fossils or coral, shell algae and echinids. Unconsolidated to consolidated Miocene sediments of the Tamiami, Hawthorn, and Tampa formations, Oligocene Suwannee Limestone, and Eocene Avon Park Formation underlie recent and Pleistocene deposits. The Pleistocene Miami Limestone is about 100,000 years old. The oolitic facies of this formation overlie the Key Largo Limestone Formation. This formation probably originated as an east-west mound of unstable oolite in a high-energy environment at the shelf margin where sediments were stirred up and deposited over the southern portion of the active reef.

The topography at NASKW is flat with elevations averaging 4 to 5 feet above mean sea level (MSL). The airfield elevation (highest point of the runway system) at Boca Chica is 6 feet above MSL. Large interior areas at Boca Chica range from 0 to 2 feet below sea level. The elevation on Truman Annex ranges between 5 and 10 feet above MSL.

3.5 Soils

The soils in the Key West area belong to the Rock Island or Urban Land Association (USDA 1995). These soils have been created as a result of dredge and fill activities or have accumulated as a result of the physical and chemical weathering of the parent oolitic limestone. The soils consist of sand, shell, and limestone fragments mixed with small amounts of marine sediments. These unconsolidated soils are very permeable and, therefore, despite the flat topography, drainage is good. The original soils in the Key West area are mostly entisols, dominated by level, very poorly drained organic soils underlain by limestone. Soils found at the NASKW are described in Table 3-2.

Table 3-2. Soils of NAS Key West

Map Unit	Soil	Hydric Soils	Series Description
Demolition Key			
7	Udorthents, Urban land complex.	----	No description
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock

Map Unit	Soil	Hydric Soils	Series Description
Fleming Key			
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Tropoapristis. Very poorly drained soil, moderately deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	-----	No description.
Truman Annex			
11	Urban Land	-----	No description.
Trumbo Point Annex			
11	Urban Land	-----	No description.
Sigsbee Park Annex			
11	Urban Land	-----	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock
Naval Branch Health Clinic			
11	Urban Land	-----	No description.
Boca Chica Field			
3	Matecumbe muck, occasionally flooded, 0-1% slopes	-----	Euic, isohyperthermic Lithic Tropofolists. Moderately well drained soils, very shallow to rippable coral or oolitic limestone bedrock
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Tropoapristis. Very poorly drained soils, moderately deep to rippable coral or oolitic limestone bedrock
6	Key Largo muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Typic Tropoapristis. Very poorly drained soils, deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	-----	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock
19	Saddlebunch marl, occasionally flooded, 0-1% slopes	-----	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Somewhat poorly drained soils, shallow to rippable coral or oolitic limestone bedrock.

Table 3-2, Continued

Map Unit	Soil	Hydric Soils	Series Description
North Boca Chica			
7	Udorthents, Urban land complex.	-----	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock
Geiger Key			
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Tropoapristis. Very poorly drained soils, moderately deep to rippable coral or oolitic limestone bedrock
6	Key Largo muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Typic Tropoapristis. Very poorly drained soils, deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	-----	No description.
8	Rock outcrop-Cudjoe complex, tidal	Hydric	No description
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock
Big Coppitt Key			
3	Matecumbe muck, occasionally flooded, 0-1% slopes	-----	Euic, isohyperthermic Lithic Tropofolists. Moderately well drained soils, very shallow to rippable coral or oolitic limestone bedrock
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Tropoapristis. Very poorly drained soils, moderately deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	-----	No description.
12	Rock oucrop-Cudjoe complex, frequently flooded	Hydric	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock

Table 3-2, Continued

Map Unit	Soil	Hydric Soils	Series Description
Rockland Key			
3	Matecumbe muck, occasionally flooded, 0-1% slopes	----	Euic, isohyperthermic Lithic Tropofolists. Moderately well drained soils, very shallow to rippable coral or oolitic limestone bedrock
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Troposaprists. Very poorly drained soils, moderately deep to rippable coral or oolitic limestone bedrock
6	Key Largo muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Typic Troposaprists. Very poorly drained soils, deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	----	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock
Saddlebunch Key			
5	Islamorada muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Lithic Troposaprists. Very poorly drained soils, moderately deep to rippable coral or oolitic limestone bedrock
6	Key Largo muck, tidal, <1% slopes	Hydric	Euic, isohyperthermic Typic Troposaprists. Very poorly drained soils, deep to rippable coral or oolitic limestone bedrock
7	Udorthents, Urban land complex.	----	No description.
15	Cudjoe marl, tidal, 0-1% slopes	Hydric	Loamy, carbonatic, isohyperthermic, shallow Tropic Fluvaquents. Poorly drained soil, shallow to rippable coral or oolitic limestone bedrock

Source: USDA 1995

3.6 Hydrology

3.6.1 Watersheds and Hydrology

Monroe County is located within the Florida Bay-Florida Keys Watershed, which encompasses approximately 2043 square miles. The bulk of the annual rainfall, approximately 53%, falls in the period of June through October. Rainfall runoff from Key West is carried to the

tidal waters by overland flow or storm drains that cover approximately 50% of the island; however, much of the rainfall percolates directly into the porous limestone.

The Lower Florida Keys are subject to mixed semidiurnal tides (i.e., generally two high and two low tides per day) with a mean range of 1.3 feet (0.4 meters) and spring tide range of 1.8 feet (0.5 meters). During flood tide, the tidal current flows toward the Gulf of Mexico, and during ebb tide, the current direction is toward the Atlantic Ocean. Tidal flats occur at approximately sea level and are subject to daily tidal inundation. Portions of this area are inundated most of the time. Some of the areas are covered with mangroves. The mangrove swamps are either flooded with each tide, or if cut off from tidal action, remain permanently wet. There are also some narrow strips of beach and adjacent coastal dunes.

3.6.2 Water Quality

The waters surrounding the Florida Keys are designated by the State of Florida as Class III, Outstanding Florida Waters (OFW; Chapter 62-302, Florida Administrative Code [FAC]). This water classification essentially prohibits any significant decrease in ambient water quality. OFW's are designated to ensure greater protection with the intent of maintaining existing good water quality. Waters that are not in a federally or state-managed area may be designated as "special water" OFW's if certain requirements are met, including a public process of designation. The designation of "special water" may be made by the Environmental Regulation Commission if the waters are of exceptional recreational or ecological significance and if the environmental, social, and economic benefits of the action outweigh the environmental, social, and economic costs. The Florida Keys National Marine Sanctuary (FKNMS) is designated by Congress as a "special water" OFW and contains approximately 3,800 square miles (9,840 km²) of water and submerged lands (Florida Marine Research Institute [FMRI] 2000; FDEP 2005; ONMS 2019). Because of the OFW designation, direct surface water discharges of pollutants have either been eliminated or are being phased out.

The degradation of water quality over the past two decades has been a major concern for the residents of the Florida Keys. Primary pollutants include pollution from stormwater runoff, improper wastewater treatment, marinas that improperly dispose of boater waste, landfill sites, hazardous material spills, pesticides and herbicides, and external influences. In response, Congress directed the EPA, in conjunction with the Department of Commerce, to develop a

Water Quality Protection Program (WQPP). The WQPP for the Florida Keys consists of four interrelated components: corrective actions, monitoring, research/special studies, and public education and outreach.

3.6.3 Estuarine and Marine Waters

NAS Key West property accounts for approximately 27 miles of shoreline that lies adjacent to the FKNMS. Marine waters in close proximity to NASKW include Hawk Channel, Boca Chica Channel, Garrison Bight Channel, Man of War Harbor, Northwest Channel, Florida Bay, and the Gulf of Mexico. Tidal ranges in the Keys are low; the mean tidal range is 1.3 feet with a spring tide range of 1.6 feet. The tidal current is toward the Gulf of Mexico during flood and toward the Atlantic Ocean during ebb. Low elevations in the Keys make it necessary to consider tidal surge in site design and construction. Hurricane tidal surges for a 100-year storm and a 500-year storm are estimated at 8 feet MSL and 12 feet MSL, respectively.

The four main types of benthic habitat found within the Florida Keys, and in the vicinity of NASKW, are corals, seagrasses, hard bottom, and bare substrate. Benthic habitats in the Lower Keys as determined by aerial photography are dominated by seagrasses, and to a lesser extent by hard bottom, corals, and bare substrate (FMRI 2000). Benthic habitats in the waters surrounding Key West, Fleming Key, Dredgers Key, Boca Chica Key, North Boca Chica Key, Rockland Key, Big Coppitt Key, Geiger Key, and Saddlebunch Key consist of moderate to dense continuous seagrass beds, interspersed with hard bottom areas containing a perceptible coverage of seagrass (Figures 3-1, 3-2, 3-3). Waters and habitats within the FKNMS support the largest documented contiguous seagrass community in the Northern Hemisphere and extensive coral reef habitat (ONMS 2019). Areas of sparse, continuous seagrass beds and dense seagrass patches are scattered throughout water bodies in the vicinity of Boca Chica Key, Stock Island, and Key West. The lagoons located directly south of the Boca Chica Field, north of Old Boca Chica Road, contain a predominantly macroalgae cover with scattered seagrass patches. Several individual patch reefs are located south of Geiger Key and Boca Chica Key, and some aggregated patch reefs are located directly south of the Old Boca Chica Road.

Waters of the Florida Keys are utilized for several recreational activities including boating, diving, sport fishing, and recreational fishing in addition to commercial fishing. Between 20% and 30% of Keys visitors, scuba dive or snorkel at one of several dive spots

including the Key Largo Management Area, John Pennekamp Coral Reef State Park, and Looe Key Management Area. Recreational fishing in the Keys contributes approximately \$500 million annually to the local economy. The “marine life” fishery generates \$30 million annually, and supplies small fishes and invertebrates to aquaria. Commercial fishing is the fourth largest industry in the region, and the Keys provide habitat for approximately 90% of the region’s commercially important species during at least one stage of their life history. Shrimp, stone crab, spiny lobster, snapper, grouper, king mackerels, and Spanish mackerels dominate commercial landings.

NAS Key West submerged properties serve as *de facto* Marine Protected Areas (MPAs) from the stressors described above. Additional stressors, such as anchor damage, grounding of personal watercraft, improper disposal of plastics and refuse, and overfishing, are also either absent or occur at far lower levels than in public coastal zones. The Navy’s Boca Chica property is adjacent to Western Sambo Ecological Reserve within the FKNMS. NAS Key West is able to enforce natural resources management policies on its properties better than can typically be accomplished in MPAs. These policies are ecosystem-based and include managing the degree of access to submerged natural resources, controlling soil erosion, and controlling upland development outside of the DoD facility through efforts to reduce encroachment. The minimally-impaired condition of the coastal marine ecosystem at NAS Key West reflects the benefit of DoD ecosystem-based environmental stewardship and compliance with applicable regulations.



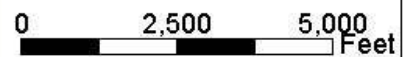
Benthic Habitats

Navy Branch Health Clinic,
Sigsbee, Trumbo Point,
Fleming Key, Truman
Annex

NAS Key West, Florida

Legend

- Patch Reefs - Individual
- Patch Reefs - Aggregated
- Continuous Seagrass - Moderate to Dense
- Continuous Seagrass - Sparse
- Continuous Seagrass - Dense Patches in a Matrix of Sparse Seagrass (<50%)
- Patchy Seagrass - Moderate to Dense with Blowouts
- Patchy Seagrass - Dense Patches in a Matrix of Hardbottom
- Patchy Seagrass - Predominantly Sand and/or Mud with Small, Scattered Seagrass Patches (<50%)
- Patchy Seagrass - Predominantly Macroalgae Cover with Scattered Seagrass Patches
- Hardbottom - Soft Corals, Sponges, Algae
- Hardbottom - Perceptible Seagrass (<50%)
- Bare Substrate - Carbonate Sand
- Bare Substrate - Carbonate Mud
- Bare Substrate - Organic Mud
- Inland Water
- Unknown Bottom





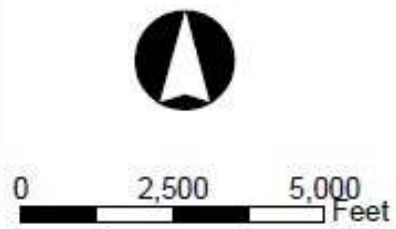
Benthic Habitats

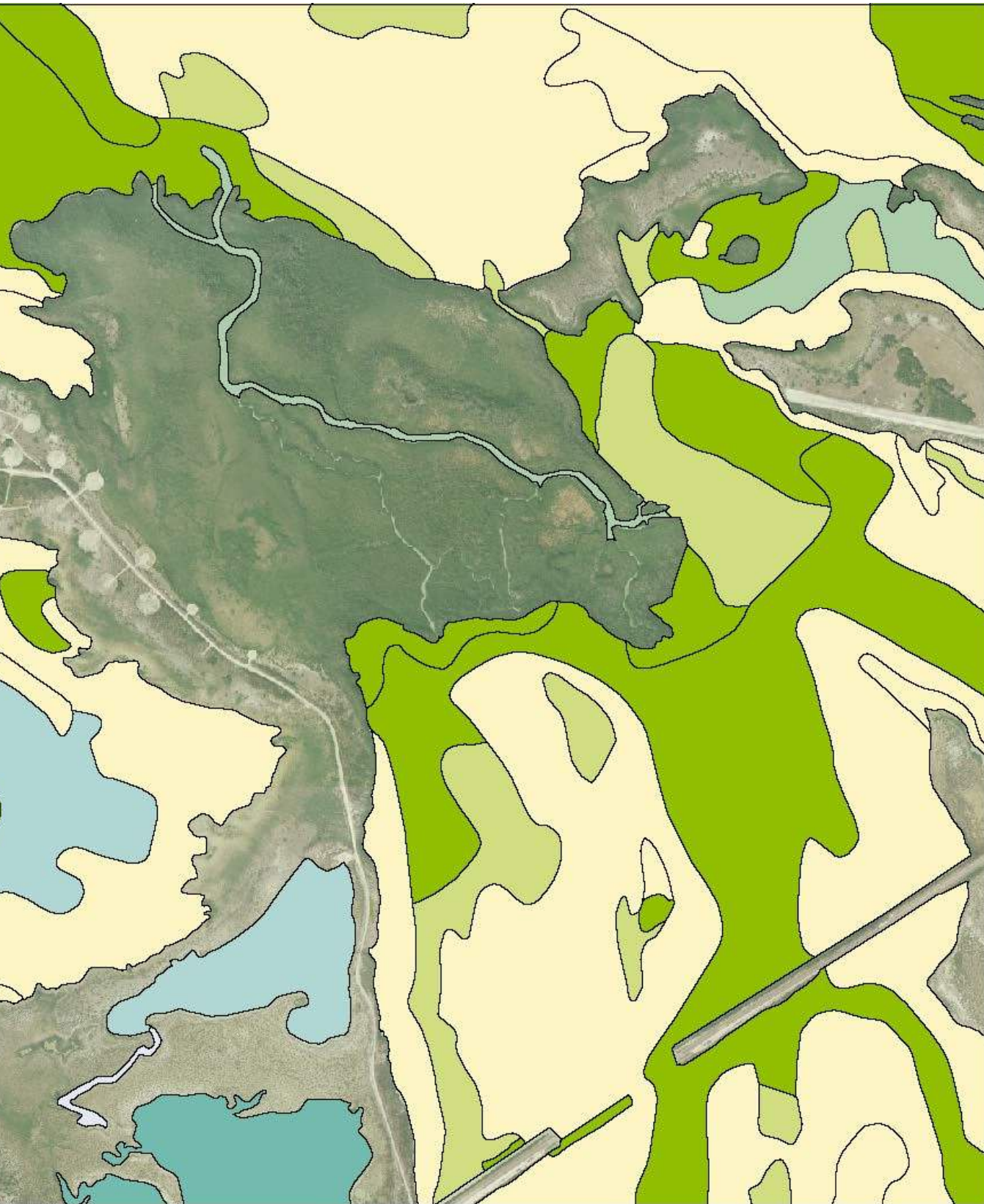
Boca Chica, Rockland,
Big Coppitt and Geiger
Keys

NAS Key West, Florida

Legend

- Patch Reefs - Individual
- Patch Reefs - Aggregated
- Continuous Seagrass - Moderate to Dense
- Continuous Seagrass - Sparse
- Continuous Seagrass - Dense Patches in a Matrix of Sparse Seagrass (<50%)
- Patchy Seagrass - Moderate to Dense with Blowouts
- Patchy Seagrass - Dense Patches in a Matrix of Hardbottom
- Patchy Seagrass - Predominantly Sand and/or Mud with Small, Scattered Seagrass Patches (<50%)
- Patchy Seagrass - Predominantly Macroalgae Cover with Scattered Seagrass Patches
- Hardbottom - Soft Corals, Sponges, Algae
- Hardbottom - Perceptible Seagrass (<50%)
- Bare Substrate - Carbonate Sand
- Bare Substrate - Carbonate Mud
- Bare Substrate - Organic Mud
- Inland Water
- Unknown Bottom
- West Sambo Ecological Reserve





Benthic Habitats

Saddlebunch Key

NAS Key West, Florida

Legend

- Patch Reefs - Individual
- Patch Reefs - Aggregated
- Continuous Seagrass - Moderate to Dense
- Continuous Seagrass - Sparse
- Continuous Seagrass - Dense Patches in a Matrix of Sparse Seagrass (<50%)
- Patchy Seagrass - Moderate to Dense with Blowouts
- Patchy Seagrass - Dense Patches in a Matrix of Hardbottom
- Patchy Seagrass - Predominantly Sand and/or Mud with Small, Scattered Seagrass Patches (<50%)
- Patchy Seagrass - Predominantly Macroalgae Cover with Scattered Seagrass Patches
- Hardbottom - Soft Corals, Sponges, Algae
- Hardbottom - Perceptible Seagrass (<50%)
- Bare Substrate - Carbonate Sand
- Bare Substrate - Carbonate Mud
- Bare Substrate - Organic Mud
- Inland Water
- Unknown Bottom



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3.6.4 Clean Marina

NAS Key West’s Boca Chica Marina has been designated as a member of the Clean Marina Program (CMP) since 2001. Members of the CMP implement a set of BMPs that help protect coastal waterways and pledge to take a proactive approach to environmental stewardship. Membership must be maintained annually to ensure adherence to the BMPs. The BMPs include a variety of measures that ensure good water quality, such as proper use of fertilizers and pesticides, proper storage and disposal of oils, fuels, solvents, and soiled rags, proper use and disposal of cleaning supplies, adequate and well-managed trash receptacles, convenient recycling of batteries, refrigerants, and fluorescent bulbs, zero discharge of raw sewage, written plans for hurricane preparedness, and possession of a National Pollution Discharge Elimination System (NPDES) stormwater permit and a SWPPP (FDOT and FDEP 2007, FDEP 2008, NASKW 2016).

3.6.5 Wetlands

Wetlands are generally considered to be transitional zones between the terrestrial and aquatic environment. These areas are characterized by physical, chemical and biological features indicative of hydrological conditions. Currently, wetlands are regulated at the federal level by the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA) of 1977. Wetlands are defined by the USACE as “...*those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.*”

Jurisdictional wetland boundaries on NASKW are delineated as needed, using the USACE 1989 Wetland Delineation Manual, in the specific locales of planned construction projects. Currently, the best source of data for identifying potential wetland communities across the entirety of NASKW and in the Florida Keys is the National Wetlands Inventory and Wetlands Mapper (<https://www.fws.gov/wetlands/>). The exact boundaries and condition of wetlands indicated by the Wetlands Mapper would need to be validated in the field in cooperation with the USACE and Florida Department of Environmental Protection (FDEP) before construction activities could begin in those areas.

Wetland Permits

NAS Key West occasionally undertakes activities to maintain or renovate existing facilities, such as the Restoration of Clear Zones and Stormwater Drainage Systems at Boca Chica Field. These activities may require state and/or federal permits, such as FDEP Environmental Resource Permits (Chapter 62-340 F.A.C.) and USACE permits (CWA Section 404/Rivers and Harbors Act Section 10). The FDEP and the South Florida Water Management District (SFWMD) have an Interagency Operating Agreement that divides responsibilities for processing environmental resource permit applications in accordance with the type of activity involved. Each project must be reviewed in accordance with this operating agreement to determine the correct permitting agency. The Florida environmental resource permit program administered by the FDEP/SFWMD regulates any dredging, filling, or construction in, on, or over waters and wetlands. Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits the obstruction or alteration of navigable waters of the United States without a permit from the USACE. Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344) prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE. If it is determined that wetland impacts are unavoidable, mitigation in the form of the creation of wetlands, or the restoration or enhancement of previously degraded ones, may be required under state and federal permits.

3.6.6 Groundwater

The Biscayne Aquifer (commonly referred to as the Surficial Aquifer), and the Floridan Aquifer (a confined artesian aquifer), are the two main aquifers that underlie the Florida Keys. The Biscayne Aquifer is the primary system, and is considered one of the most productive and permeable in the world. However, because of its excessive chloride content in the Florida Keys, the Biscayne Aquifer is a nonpotable water source, although water from the aquifer is used for numerous other nonpotable water uses. The freshwater lens averages 5 feet (1.5 meters) below the center western half of Key West. The lens contains 20 to 30 million gallons (75.7 to 113.5 million liters) of freshwater depending on the season. The layer of freshwater beneath Key West is subject to salt water intrusion through the porous Key Largo limestone formation underlying the less porous Miami oolite limestone formation which forms the Key West Island. The fresh

water is also exposed to pollution from exfiltrating sewer lines leading from the sewer system to Hawk Channel. No known source of potable artesian water exists in Key West.

3.7 Coastal and Marine Resources

3.7.1 Flora

Near Shore Habitats

The Florida Keys region is dominated by three coastal marine habitats: mangroves, sea grass, and coral reef. The near-shore land/water interface is dominated by the mangrove community (mangrove forest, scrub mangrove, and buttonwood). Seagrass is the principal marine benthic vegetation in the Florida Keys region and is present in various levels of cover. Approximately 70% of the FKNMS consists of seagrass. Coral is present in different forms throughout the Lower Keys. There are patch reefs, coral reefs, and hardbottom coral communities throughout the FKNMS. These habitats cover approximately 27% of the benthos in the FKNMS (Florida International University, 2002).

Mangrove Community Habitat

Mangroves represent a major coastal wetland habitat in the Florida Keys region. Collectively, four species comprise the mangrove forest: the red (*Rhizophora mangle* L.), black (*Avicennia germinans*), and white (*Laguncularia racemosa*) mangroves, and the buttonwood tree (*Conocarpus erectus* L.). These species singularly or in combinations occupy wide ranges in the coastal zone from regularly flooded tidal regimes to higher elevations that may receive tidal waters only several times per year or during storm events. The growth of mangroves appears to be limited to estuarine systems and more inland areas that are subject to saline intrusions. A classification system for mangrove types based on gross differences in topography, surface hydrology, and salinity exists. A brief description of the mangrove types as summarized from Gilmore and Snedaker (1993) follows. This description is provided because the different forest types have somewhat different functional roles and fauna that utilize them.

Mangrove fringe forests occur along sheltered coastlines with exposure to open water of lagoons and bays. The tree canopy foliage forms a vertical wall and these forests are almost exclusively dominated by red mangroves. The characteristics of this mangrove habitat type are related to the patterns of tidal inundation through which detrital materials and propagules (any

portion of a plant, such as a bud or other offshoot, that aid in dispersal of the species and from which a new individual may develop) are exported from the system during ebb tides. These fringe forests commonly have a shoreline berm or an interior wrack line (i.e., build up of detritus). This is an important habitat type for fishery organisms because abundant food and refuge are provided by the mangrove prop-roots (Thayer and Sheridan 1999).

Overwash mangrove islands are ecologically similar to fringe forests because of their high frequency of tidal inundation, but here the entire area is completely covered by tidal waters on almost every tidal cycle. Because of the overwash phenomenon, there is an infrequent build up of a detrital berm or the development of a shoreline berm. Gilmore and Snedaker (1993) indicate that there is a high incidence of bird rookeries on overwash islands, presumably due to the limited habitat for predators and scavengers.

Riverine mangrove forests occur in riverine areas that have estuarine water exchange and are considered to be the most productive forest type of the five described. This high productivity is attributed to the reduced salinity and the fact that freshwater runoff from land provides mineral nutrients required for growth. This high production provides organic detrital material to the adjoining low-salinity system, and also is an important habitat for fishery organisms (Ley 1992).

Basin mangrove forests exist in inland topographic depressions that are not flushed by all high tides. This habitat type may experience seasonal periods of hypersaline soil water which can limit mangrove growth and induce mortality. These habitat types are normally dominated by black mangroves, but invasion by Australian pine (*Casuarina equisetifolia*) and Brazilian pepper (*Schinus terebinthifolius*) is very common. Odum *et al.* (1982) notes that this habitat type provides an extreme habitat in which few aquatic species can live because of the commonly low oxygen levels and presence of generally high levels of hydrogen sulfide. However, Gilmore and Snedaker (1993) suggest that because of the large aerial extent of the basin mangrove habitat type, they probably contribute the largest absolute quantity of organic detritus to Florida's nearshore waters, and that this export occurs on a highly seasonal basis.

Dwarf mangrove forests occur in areas where nutrients, freshwater inflow, and tidal activity limit the growth of the plant. All of the species can exist in a dwarf form. These marginal habitats have received little attention relative to their role as fishery habitat.

Threats to Mangrove Ecosystems

While much of the total U.S. mangrove forest area is protected under the jurisdictions of parks, sanctuaries, and refuges, this coastal habitat and resource is being progressively diminished by a variety of natural and anthropogenic (human-caused) actions such as removal for coastal development, deprivation of freshwater from upland watersheds, severe freezes, clearing for charcoal production, oil spills and water pollution, competitive exclusion by exotic tree species (e.g., Australian pine, Brazilian pepper), illegal cutting or removal, coastal erosion, and mosquito control activities.

Mangroves are considered resilient and display characteristics of some “pioneer species” in that they have broad tolerances to environmental factors, rapid growth and maturity, continuous or almost continuous flowering and propagule production, high propagule outputs in a wide range of environmental conditions, and adaptations for short and long distance dispersal by tides (Cintron-Molero 1992). Even with these characteristics, mangroves are both sensitive and vulnerable to disturbance. Odum *et al.* (1982) point out, however, that one of the adaptations of mangroves, the aerial root system, is also one of the plant’s most vulnerable components because of their susceptibility to clogging, prolonged flooding, and boring damage from invertebrates. They note that any process that coats the aerial roots with fine sediments or covers them with water for long periods has the potential of being a destructive agent. Diking, impounding, and long-term flooding, as has occurred in mosquito control situations, has caused considerable damage, as have spraying of herbicides and inundation by oil spills.

Ecological Roles and Function

The relatively high primary productivity of mangrove ecosystems and the associated biological processes provide many goods and services that are of direct or indirect benefit to the public and to the urban and industrial environment. In Asia and South America, mangroves have been managed for lumber, firewood, and charcoal. Mangrove habitats, particularly riverine, overwash and fringe forests, provide shelter for larval, juvenile, and adult fish and invertebrates and dissolved and particulate organic detritus to estuarine food webs. Because of this linkage, both as habitat and as food resources, mangroves are important exporters of material to coastal systems as well as to terrestrial systems (e.g., through bird use as a rookery and feeding on fish). They help shape local geomorphic processes and are important in the diversity of landforms that

provide shelter, foraging grounds, and nursery areas for terrestrial organisms. The root system binds sediments, thereby contributing to sedimentation and sediment stabilization. Much of the mangrove habitat found at NASKW can be considered as *mangrove basin* type.

Seagrass Habitat

Seagrass habitat is found within many of the NASKW maritime areas, especially within several of the estuarine lagoons at Boca Chica Field. The east and west lagoons contain seagrass ranging from sparse to moderate cover. A recent assessment of seagrass coverage across the entire Florida Keys can be found in the Seagrass Integrated Mapping and Monitoring Program Mapping and Monitoring Report (FWC 2016). Surveys specific to NASKW properties included seagrass surveys off Boca Chica, Fleming Key, Truman Harbor, and Trumbo Point in 2006 (CSA International 2007b) and Boca Chica, Fleming Island, Truman Harbor, Sigsbee Marina, and Demolition Key in 2013 (HDR 2013). Additionally, the Florida Department of Transportation (FDOT) partnered with the Navy, beginning in 2008, to restore tidal flow in Boca Chica Lagoon on NASKW. This has resulted in the natural recruitment of more than 23 acres of seagrass in the lagoon (the amount was more than 40 acres prior to Hurricane Irma in 2017), which had no seagrass in 2008 (MEI 2018). Project 13 (Marine Resources Survey; Appendix A) involves the quantitative mapping of seagrass and coral resources within NASKW maritime facilities approximately every five years.

The Florida Keys ecosystem includes one of the world's largest seagrass beds. Seagrass occurs throughout the soft-bottom, shallow-water areas of the Keys wherever water quality allows adequate light penetration to enable photosynthesis. Seagrass present within the study area include turtle grass (*Thalassia testudinum*), the dominant seagrass community; shoal grass (*Halodule wrightii*); and manatee grass (*Syringodium filiforme*), with *Halophila* spp. found in some deeper seagrass habitats (FWC 2016; ONMS 2019). Seagrass communities provide a range of ecosystem services, including stabilizing the bottom through their dense roots and rhizomes, and helping to maintain water clarity by trapping fine sediments and other particles in their leaves and root systems. Seagrass beds are integrally linked to reef environments, mangrove communities, and hardbottom habitats, both spatially and in terms of food webs (Valentine et al. 2008). Seagrass beds provide critical settlement and nursery habitat for juvenile life stages of many fishes and invertebrates, including crustaceans (e.g., lobster and shrimp) and molluscs

(e.g., queen conch), as well as recreationally and commercially important fish species. Seagrass beds also provide foraging area for herbivores including turtles and West Indian manatees, and refuge from predation for numerous invertebrates and fishes (Rudnick et al. 2005; Acosta et al. 2007; ONMS 2019).

Threats to Seagrass Systems

Like all other organisms and habitats in estuarine-near shore environments, seagrasses occur at the end of all watershed inputs: the juncture between riverine inflow and oceanic inputs as well as the interface between land and sea. This situation makes them extremely susceptible to perturbations by natural processes as well as being susceptible to damage by human activities. In the south Atlantic region, seagrasses experience natural disturbances such as bioturbation (stingray foraging), storm or wave-related scour (tropical storms and surges), and disease or disease-associated perturbations (*Labyrinthula*), as well as man-related impacts (Short and Wyllie-Echeverria 1996). Especially problematic are excessive epiphytic loads and smothering by transient macroalgae, both of which are often associated with nutrient enrichment. Excessive nutrient discharges and suspended sediments can also disrupt seagrass systems by causing water column algal blooms that diminish the amount of light available for bottom-dwelling seagrasses (Dennison et al. 1993). Often, nutrient enrichment will have detrimental effects that cascade up and down the food webs of seagrass meadows by diminishing the dissolved oxygen concentrations, forming toxic concentrations of hydrogen sulfide and diminishing the ability of a meadow to filter and stabilize sediments, thus altering the water column environment for filter feeders and primary producers. Increased sea surface temperatures, reduced freshwater inputs and elevated salinity, and increased nutrients can contribute to episodic die-offs of seagrasses and shifts from seagrass dominance to macroalgae. A seagrass die-off occurred in Florida Bay in 1987 impacting 9,884 acres of seagrass (Hall et al. 2016). Florida Bay experienced another large-scale seagrass die-off in 2015 due to increased water temperatures, salinity, a stratified water column, and bottom water anoxia (Hall et al. 2016). Other well-known impacts such as dredge and fill operations are no longer a primary cause of major losses of seagrass habitat due to the recognition of their ecological role and vigilance of State and Federal regulatory activities relative to permits. This human-related impact, although still present, is now being replaced by that associated with propeller scouring (Sargent et al. 1995) and some fishing gear-related

impacts (Fonseca et al. 1984). This physical damage is long-lasting and often results in sediment destabilization and continued habitat loss.

The increasing number of small boats traversing estuarine and coastal waters has made the prop-scarring impacts more widespread, and there has been a recognized need in some regions for both enhanced management of these systems and increased awareness by the boating public. A mapping project conducted in 1995 and replicated in 2015 documented visible scarring and grounding impacts in shallow seagrass habitats from the FKNMS northern boundary north of Ocean Reef to the west of Key West in the Marquesas Keys. Within these habitats, there was a 285% increase in severely impacted acres between 1995 to 2015, increasing from 5,060 acres to 19,462 acres (Kruer 2017). Water quality and, in particular, water clarity are now considered among the most critical factors in the maintenance of healthy SAV habitats. It has long been evident that, with few exceptions, seagrasses generally require light intensities reaching the leaves of 15 to 25% of the surface incident light (Kenworthy and Fonseca 1996, Gallegos and Kenworthy 1996, Onuf 1996). However, water transparency standards historically have been based on light requirements of phytoplankton which typically require only 1% of surface light (Kenworthy and Haurert 1991). Many factors act to reduce water column transparency, with excess suspended solids and nutrients being considered to be among the most important and most controllable through watershed management practices. The loss of seagrasses, regardless of the cause, leads to several undesirable, and often difficult to reverse, situations that reflect on aquatic vascular plant ecological values. Losses can and have led to reduced sediment binding and water motion baffling capability of the habitat allowing sediments to be more readily resuspended and moved (Fonseca 1996). The physical ramification includes increased shoreline erosion (e.g., as occurred in some areas after the seagrass die-off in the 1930's) and water column turbidity.

3.7.2 Fauna

Several marine species regularly utilize lower Florida Keys oceanic and estuarine habitats. Among these are federally managed fish species, marine mammal species, and sea turtles. Sea turtles and federally listed coral are also listed in the Section 3.8 (Threatened & Endangered Species).

Sea Turtles

Five species of sea turtles are known to inhabit the waters in Monroe County and throughout the State of Florida. The loggerhead sea turtle (*Caretta caretta*) is the most common sea turtle in South Florida. Habitat for this reptile is relatively uncertain, as they seem to occupy and utilize a variety of marine habitats; consequently, no critical habitat has been designated for this species (USFWS 1999). Nesting season in the Florida Keys begins on April 15 and ends on October 31 (Save A Turtle, Inc. 2004). Loggerhead sea turtles are migratory animals, and breeding females may migrate hundreds of miles to the ideal beaches of Florida in order to nest (USFWS 1999). Approximately 80% of all loggerhead sea turtle nesting sites occur on the east coast of Florida in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and USFWS 1991).

Save-a-Turtle has surveyed beaches in the Truman Annex since 2005 and Boca Chica since 2016. Table 3-3 provides data on sea turtle nesting for the two beaches.

Table 3-3. Loggerhead Sea Turtle Nesting Data at the Truman Annex and Boca Chica Beaches on NAS Key West, Florida

Year	Truman Annex Beach		Boca Chica Beach	
	Nests	False Crawls	Nests	False Crawls
2005	1	0	-	-
2006	0	0	-	-
2007	3	0	-	-
2008	0	0	-	-
2009	0	0	-	-
2010	6	1	-	-
2011	0	0	-	-
2012	5	1	-	-
2013	3	11	-	-
2014	1	4	-	-
2015	1	3	-	-
2016	2	0	0	4
2017	2	5	1	4
2018	2	2	1	5
2019	4	5	3	0

American Crocodile

The American Crocodile (*Crocodylus acutus*) is a coastal crocodylian that occurs primarily in extreme southern mainland Florida and northern Florida Keys (Mazzotti 1999). Habitat loss due to rapidly-growing populations in coastal areas of Palm Beach, Broward, Miami-Dade, and Monroe counties has been the primary threat to this species (Mazzotti 1999, Mazzotti et al. 2007). The American Crocodile is typically found in freshwater or brackish coastal habitats. Mangrove-lined estuaries with access to inland water sources like artificial impoundments, non-vegetated wetlands, and salt marshes provide the most ideal habitat at NASKW. Suitable nesting sites at the installation have been located on southern Boca Chica Key and the southwest shore of Sigsbee Key (Mazzotti 2014; Metzger et al. 2016).

Coral Reefs

The Florida Reef Tract is the most extensive living coral reef ecosystem in North American waters. It extends from the Dry Tortugas in the west to St. Lucie inlet off the southeast coast of peninsular Florida. The reef tract consists of a near-continuous offshore bank-barrier reef system, mid-channel patch reefs, and an inner reef system that begins 0.5 to three miles (0.8-4.8 km) off the coastline. (ONMS 2019). All but the northernmost extent of this reef tract lies within the boundaries of the FKNMS, which also includes Boca Chica Key. Hundreds of marine species are found within the Florida Reef Tract, including sponges, jellyfish, firecorals, anemones, false corals, stony corals, and octocorals (NOAA 1996). The rigidity of coral reefs helps protect the shoreline from destructive tropical storm waves. Reefs provide habitats for hundreds of species of marine organisms, including commercially important finfish and shellfish.

Various coral and hardbottom benthic habitats occur immediately adjacent to Boca Chica Field. The predominant community found in the waters adjacent to the airfield is considered hardbottom. In relation to Boca Chica Field, this hardbottom community is found all along the southern edge of the Field in open water, as well as adjacent to Runway 25. Farther away from the airfield, it occurs from the northwest to the northeast, along with various seagrass communities. In the open water south of Boca Chica Field, both aggregated patch reefs and individual patch reefs occur. Patch reefs are discrete coral communities that are typically dome-shaped and circular, although they may form a line. They may range in size from tens to thousands of square meters and occur in depths of 3.3 feet to 65.6 feet (1 to 20 m; USACE

2003). Aggregated patch reefs are clustered patch reefs that individually are too close together to map separately, and individual patch reefs are distinctive single patch reefs. These patch reef habitats are found between 1,476 and 2,132 feet (450 and 650 meters) offshore of Boca Chica Field.

Acropora cervicornis, *A. palmata*, *Dendrogyra cylindricus*, *Mycetophyllia ferox*, *Orbicella annularis*, *O. faveolata*, and *O. franksi* have been listed as threatened under the ESA. Critical habitat has been designated for *A. cervicornis*, *A. palmata* (73 FR 72210). Pursuant to the National Defense Authorization Act of 2004, Public Law 108 -136, this INRMP provides a conservation benefit to corals and NOAA NMFS therefore determined that a critical habitat exclusion is warranted for the nearshore environments owned and controlled by the Navy (73 FR 72210; Appendix C). Critical habitat for the other five corals has not been proposed, but the Navy shall continue to provide a conservation benefit to all coral species adjacent to NASKW through the implementation of this INRMP. Corals are particularly vulnerable to oceanic perturbations, and if any are found to exist adjacent to NASKW maritime facilities, they must be protected.

The Navy conducted comprehensive benthic marine surveys for several NASKW maritime areas in 2006 and 2013 to assess benthic habitat and federally-protected marine biota present in the nearshore marine waters of NASKW to provide data that could be used during interagency consultations. Three of the listed coral species were identified. Assets surveyed are summarized in Table 3-4 (CSA 2007; HDR 2013).

Table 3-4. Summary of the 2006 and 2013 Benthic Surveys at NAS Key West, Florida.

Asset:	Vegetation	Corals	Fishes
Demolition Key 2013	Mature mangroves with dense prop roots. High seagrass cover, averaging 52.5%.	Very few stony corals.	24 taxa, including three SAFMC-managed species.
Fleming Key Army Special Ops Area 2006 & 2013	Seagrass beds occurred across “two-thirds” of basin. Average cover was 21%.	8 stony coral taxa ¹ .	Not assessed.
Fleming Key Bay 2006 & 2013	High seagrass cover (45%) in shallow areas, decreasing with depth.	21 stony coral taxa. Three listed species: <i>O. faveolata</i> <i>O. annularis</i>	48 taxa. No listed species observed.

Table 3-4, continued.

Asset:	Vegetation	Corals	Fishes
Trumbo Point 2006	High seagrass cover, averaging 43%, extending north from seawall.	14 stony coral taxa. 2 octocoral taxa. Two listed corals: <i>O. faveolata</i>	Not assessed.
Mole Pier and Truman Harbor 2006 & 2013	Mostly silty-mud bottom. Two small patches of paddle grass (<i>H. decipiens</i>) in SW corner of area.	27 stony coral taxa. 8 octocoral taxa. Three listed corals: <i>O. annularis</i> <i>O. faveolata</i> <i>O. franksii</i> ²	51 taxa, including 10 SAFMC-managed species.
Sigsbee Marina and Basin 2013	Mature mangroves with dense prop roots. High seagrass cover (40-50%).	The only stony corals observed were two small colonies of <i>S. radians</i> .	24 taxa, including seven SAFMC-managed species, and state-protected goliath grouper.
Boca Chica Marina and Entrance Channel 2006 & 2013	Mangroves surrounding area. Seagrass cover averaged 42.5% in center of marina and 37.5% adjacent of channel.	Two listed corals: <i>O. faveolata</i>	79 taxa, including 11 SAFMC-managed species. Snook, tarpon, and redfish also noted.

Sources: CSA 2007, HDR 2013, and GSRC 2014.

SAFMC = South Atlantic Fisheries Management Council

1 - Six stony coral taxa were identified in 2006 and two more in 2013, but survey boundaries were different.

2 - The sighting of *O. franksii* at the Mole Pier was recorded only in 2006 and denoted with a “?”.

Reef-building corals are sensitive to sudden and prolonged changes in sea water temperatures, including elevated summer temperatures and colder than normal winter temperatures. These temperature fluctuations are a major contributing factor to coral bleaching and may increase susceptibility to disease (ONMS 2019). The most severe cold water event since the 1970s impacted nearshore and mid-shelf reefs in the winter of 2010, and this was followed by the first multi-year bleaching event, which impacted reefs throughout the FKNMS in 2014 – 2016 (Eakin et al. 2018). Other issues have also impacted corals in the Florida Keys, including diseases and predation (Williams and Miller 2012, Williams et al. 2017), and a recent hurricane (Hurricane Irma, September 2017). Updated coral surveys, including quantitative mapping and monitoring, are a component of the Marine Resources Survey project (see Project 13 in Appendix A). Future surveys under this project will include assessments of hurricanes impacts and the status of Stony Coral Tissue Loss Disease (SCTLD) in the region.

SCTLD emerged near Miami in 2014 and spread throughout the Keys, reaching reefs off Key West in January 2019. SCTLD affects 22 species of stony coral, including five species listed as threatened under the ESA (Precht et al. 2016, Walton et al. 2018), and it has caused

widespread declines to these corals. Even before the emergence of SCTLD, there had been a transition from stony coral dominance to benthic communities dominated by octocorals, colonial anemones, and other non-reef-building species (Ruzicka et al. 2013). SCTLD is the most severe and long lasting disease event ever reported to affect a coral reef, with 60 to 100 percent of corals dying over a few months to a year on affected reefs (FDEP 2019).

Fish & Essential Fish Habitat

Fishes (including crustaceans and shellfish) that occur in the waters proximate to NASKW are managed by the FWC. In addition, the South Atlantic Fisheries Management Council (SAFMC) has developed management plans for more than 85 species of commercially- and recreationally-valuable marine fishes, which are enforced by NOAA NMFS. Several of the SAFMC managed species have Essential Fish Habitat (EFH) listed for them, and future projects that may adversely affect any of these species would require consultation with FWC and NOAA NMFS. The Magnuson-Stevens Fishery Conservation and Management Act of 1996 (MSA) requires that NMFS, the regional fishery management councils, and the Secretary of Commerce to describe and identify essential fish habitat (EFH) for important marine and anadromous fish habitat for species listed in federal Fishery Management Plans. EFH includes all waters and substrate necessary to fish for spawning, breeding feeding, or growth to maturity and extends from offshore habitats to inland areas to where the salt-water influence subsides. The EFH Final Rule defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The following definitions apply for interpreting the definition of the EFH rule:

- “Waters” include aquatic areas and their physical, chemical, and biological properties that are used by fish and invertebrates and, where appropriate, may include areas historically used by fish and invertebrates;
- “Substrate” includes sediment, hard bottom, structures underlying the waters, and biological communities;
- “Necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and
- “Spawning, breeding, feeding, or growth to maturity” covers species’ full life cycle.

Fish habitat is the geographic area where the species occurs at any time during its life. This area can be described by ecological characteristics, location, and time. EFH includes waters and substrate that focus on distribution (e.g., coral reefs, marshes, or submerged aquatic vegetation [SAV]), and other characteristics that are less distinct, such as turbidity zones, water quality, and salinity gradients. Habitat use may change or shift over time due to climatic change, human activities and impacts, and/or other factors such as change with life history stage, species abundance, competition from other species, and environmental variability in time and space. The type of habitat available, its attributes, and its functions are important to species productivity, diversity, health, and survival.

The MSA requires federal agencies to consult with NMFS when any activity proposed to be permitted, funded, or undertaken by a federal agency may adversely affect EFH. Affects to EFH were considered when preparing this INRMP, and no projects considered within are expected to adversely affect EFH. Moreover, implementation of the INRMP would be expected to improve water quality and estuarine and marine habitats.

Marine Mammals

All of the marine mammals that may potentially occur within the NASKW area are federally protected under the Marine Mammal Protection Act (MMPA). The MMPA protects marine mammals within the territorial waters of the US, on the US Exclusive Economic Zone and on the high seas. The act prohibits marine mammal takes unless a permit is secured from NMFS.

Approximately 29 species (Table 3-5) of marine mammals (baleen whales, toothed whales, and manatees) are found within the Gulf of Mexico. Many of these species are present within the Lower Keys region. For a current list and information on marine mammals that utilize the Key West area, please consult the Navy Marine Resource Assessment for the Gulf of Mexico (Navy 2007b).

Marine mammals, including the ubiquitous bottlenose dolphin (*Tursiops truncatus*), are protected under the Marine Mammal Protection Act (MMPA). There are two levels of “take” under the MMPA: Level A take encompasses injury or death of the animal. Level B take includes many form of harassment, which has been interpreted to include sound-in-the-water from activities such as pile driving. NOAA Fisheries has provided criteria for mathematically

Table 3-5. Marine Mammal Species in the Gulf of Mexico

Common Name	Scientific Name	Status	Occurrence ¹
Order Cetacea			
Suborder Mysticeti (baleen whales)			
Family Balaenidae (right whales)			
North Atlantic right whale	<i>Eubalaena glacialis</i>	Endangered	Extralimital
Family Balaenopteridae (rorquals)			
Humpback whale	<i>Megaptera novaeangliae</i>	Endangered	Extralimital
Minke whale	<i>Balaenoptera acutorostrata</i>	MMPA Only	Rare
Bryde's whale	<i>Balaenoptera edeni</i>	Endangered	Regular
Sei whale	<i>Balaenoptera borealis</i>	Endangered	Extralimital
Fin whale	<i>Balaenoptera physalus</i>	Endangered	Rare
Blue whale	<i>Balaenoptera musculus</i>	Endangered	Extralimital
Suborder Odontoceti (toothed whales)			
Family Physeteridae (sperm whale)			
Sperm whale	<i>Physeter macrocephalus</i>	Endangered	Regular
Family Kogiidae (pygmy sperm whales)			
Pygmy sperm whale	<i>Kogia breviceps</i>	MMPA Only	Regular
Dwarf sperm whale	<i>Kogia sima</i>	MMPA Only	Regular
Family Ziphiidae (beaked whales)			
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	MMPA Only	Regular
Gervais' beaked whale	<i>Mesoplodon europaeus</i>	MMPA Only	Rare
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	MMPA Only	Extralimital
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	MMPA Only	Regular
Family Delphinidae (dolphins)			
Rough-toothed dolphin	<i>Steno bredanensis</i>	MMPA Only	Regular
Bottlenose dolphin	<i>Tursiops truncatus</i>	MMPA Only	Regular
Pantropical spotted dolphin	<i>Stenella attenuata</i>	MMPA Only	Regular
Atlantic spotted dolphin	<i>Stenella frontalis</i>	MMPA Only	Regular
Spinner dolphin	<i>Stenella longirostris</i>	MMPA Only	Regular
Clymene dolphin	<i>Stenella clymene</i>	MMPA Only	Regular
Striped dolphin	<i>Stenella coeruleoalba</i>	MMPA Only	Regular
Fraser's dolphin	<i>Lagenodelphis hosei</i>	MMPA Only	Regular
Risso's dolphin	<i>Grampus griseus</i>	MMPA Only	Regular
Melon-headed whale	<i>Peponocephala electra</i>	MMPA Only	Regular
Pygmy killer whale	<i>Feresa attenuata</i>	MMPA Only	Regular
False killer whale	<i>Pseudorca crassidens</i>	MMPA Only	Regular
Killer whale	<i>Orcinus orca</i>	MMPA Only	Regular
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	MMPA Only	Regular
Order Sirenia			
Family Trichechidae (manatees)			
West Indian manatee	<i>Trichechus manatus</i>	Endangered	Extralimital*

Source: Navy2007b

¹ Regular = A species that occurs as a regular or normal part of the fauna of an area regardless of its abundance

Rare = A species that only occurs in an area sporadically

Extralimital = A species that does not normally occur in an area and occurrence is considered to be beyond the normal range of the species even though one or more occurrence records exist

* The extralimital designation for this species specifically applies to the offshore area formally considered as the GOMEX MRA study area

determining the maximum distance to which sound-in-the-water may travel and constitute a Level B take. Installations may be able to mitigate these takes to zero by implementing a marine mammal observer plan that ensures a shut-down of relevant activities if a marine mammal comes within that distance. Alternatively, the action proponent may pursue an incidental harassment authorization (IHA) for the required number of Level B takes, but an IHA cannot be issued unless an Environmental Assessment (EA) is prepared.

3.8 Terrestrial Resources

3.8.1 Flora

Vegetative Communities

Prior to colonization and development, the biological environment of NASKW was considerably different than it is today. Historically, the Keys were dominated by subtropical vegetative communities that are typical of the South Florida environment. Today, these communities are found only scattered throughout NASKW. Terrestrial vegetative communities that characterize the Florida Keys and the majority of vegetative communities at NASKW include tropical hardwood hammocks, grasslands, buttonwoods, salt marsh, freshwater marsh, and mangrove forests.

Several spatial databases mapping terrestrial habitats are available for the Florida Keys. The Advanced Identification of Wetlands GIS layer is currently the source of spatial terrestrial habitat data used by NASKW which classifies land cover in the Florida Keys into 15 types (Figures 3-4 and 3-5).



Vegetative Communities

Boca Chica, Rockland,
Big Coppitt and Geiger
Keys

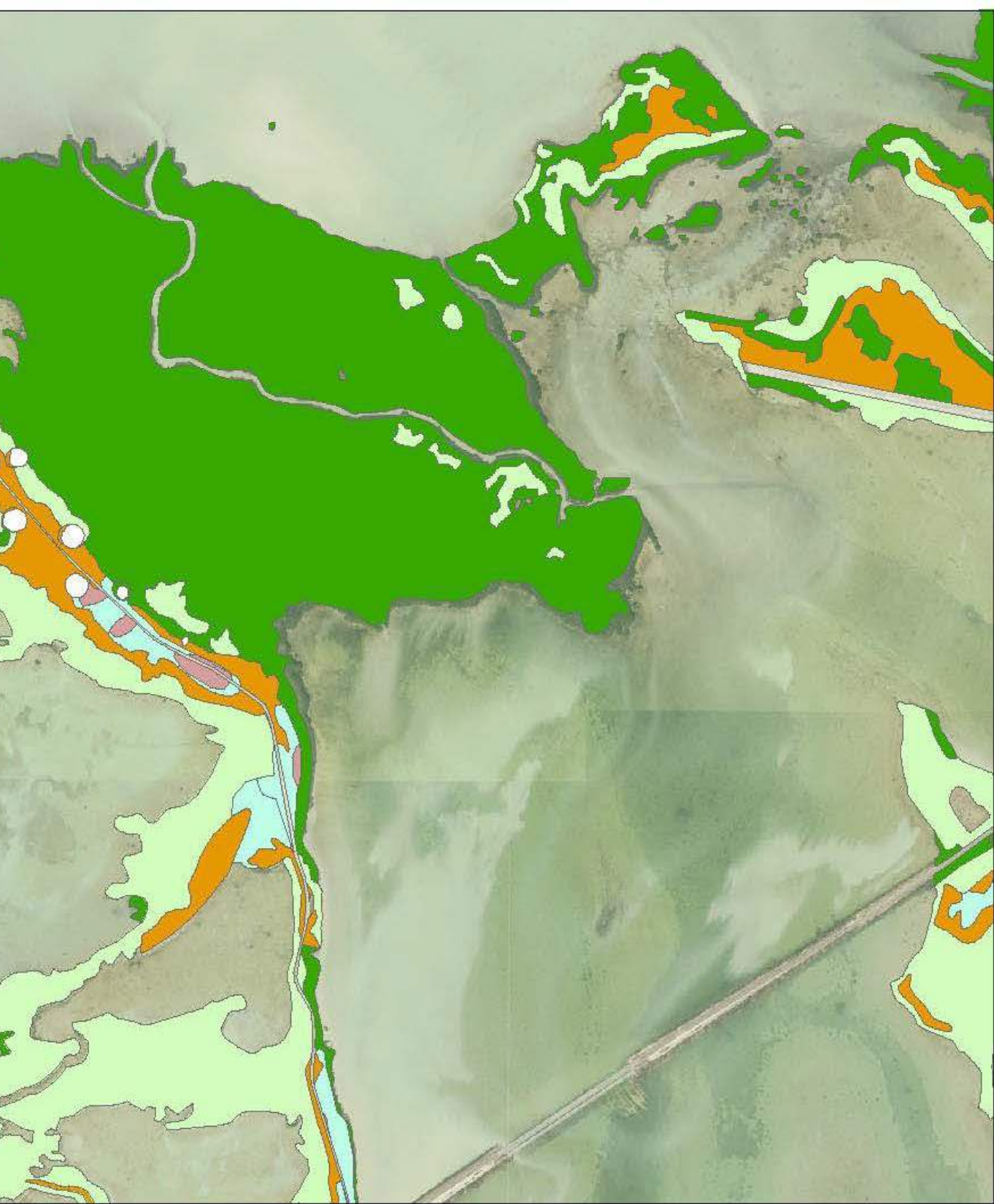
NAS Key West, Florida

Legend

- Buttonwoods
- Exotics
- Freshwater Hardwoods
- Freshwater Marsh
- Grassland
- Hammocks
- Low Saltmarsh
- Mangrove
- Mowed vegetation
- Ridge/Hammock
- Saltmarsh
- Scarified
- Scrub Mangrove



Big Coppitt, and Geiger Keys



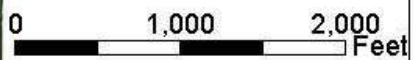
Vegetative Communities

Saddlebunch Key

NAS Key West, Florida

Legend

-  Buttonwoods
-  Exotics
-  Freshwater Hardwoods
-  Freshwater Marsh
-  Grassland
-  Hammocks
-  Low Saltmarsh
-  Mangrove
-  Mowed vegetation
-  Ridge/Hammock
-  Saltmarsh
-  Scarified
-  Scrub Mangrove



Natural Communities

Florida Natural Areas Inventory (FNAI) performed ecological surveys including a natural areas survey on the properties of Naval Air Station Key West in 2004-05 and 2010-11, and the Institute for Regional Conservation performed a survey in 2016-17 (Henize and Hipes 2005; Gulledge et al. 2011; van der Heiden et al. 2017). The natural communities surveyed were classified as described in the Guide to the Natural Communities of Florida developed by the FNAI and identified as collectively constituting the original, natural biological associations of Florida. A Natural Community (NC) is defined as a distinct and reoccurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment. Natural Communities are characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire. They are named for their most characteristic biological or physical feature. Seventy five occurrences of five natural community types were identified on the properties at NASKW. Site specific descriptions of these natural communities are provided below.

Tidal swamp. On NASKW, tidal swamp covers the greatest area, by far. These tidal areas have relatively low plant species diversity and are dominated by three mangrove species, red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*). The relative abundance of these species, their density, average height, degree of canopy closure and the diversity of associated herbaceous species varies from site to site. Buttonwood (*Conocarpus erectus*) may infrequently be included with the mangroves, but they tend toward a more scrub-like growth habit, occurring more frequently as a transition species as the tidal swamp grades into adjacent communities. The herbaceous species commonly found in Lower Keys tidal swamps are saltwort (*Batis maritima*), moonvines (*Ipomoea alba*), perennial glasswort (*Sarcocornia perennis*), key grass (*Monanthochloe littoralis*), Carolina sealavender (*Limonium carolinianum*), and sea oxeye daisy (*Borrchia frutescens*). In general, the herbaceous plants gradually increase in frequency as the community transitions into adjacent communities such as coastal rock barren, salt marsh or rockland hammock. Inclusions of saltmarsh are present within some of the mapped tidal swamp areas.

Tidal swamp communities are highly variable depending on the extent of tidal influence, salinity and substrate. Zones of vegetation typically develop along these environmental

gradients. Red mangrove dominates the lowest or deep water zone, black mangrove the intermediate zone, and white mangrove and buttonwood the highest least tidally influenced zone. These typical zones are obvious at only a few sites on NASKW property; most of the tidal swamps in study area are composed of a mosaic of mangrove species. Additional site specific tidal swamp descriptions are provided for each of the NASKW properties that support this community in the 2004-05 FNAI report (Henize and Hipes 2005).

Coastal Rock Barren. Coastal rock barren is an ecotonal community between tidal swamp and inland communities occurring along rocky coastlines in the Florida Keys. They are generally characterized as flat rocklands with much exposed and eroded limestone and are sparsely vegetated with stunted, xeric and halophytic shrubs, cacti, algae, and herbs. Coastal rock barrens are among the most endangered natural communities in Florida. Though they cover far less area of Navy land than the tidal swamps, the coastal rock barrens exhibit more variation than do the tidal swamp communities. The structure and composition vary with soils/substrates, salinity, and topography and range from sparsely vegetated rocky or marl flats to moderately dense shrub thickets on shallow organic soil.

Buttonwood is the dominant plant found in coastal rock barren. It varies from stunted sprawling multi-stemmed shrubs to 30 ft tall trees. Other typical species are saffron plum (*Sideroxylon celastrinum*), blackbead (*Pithecellobium keyense*), black torch (*Erithalis fruticosa*), bay cedar (*Suriana maritima*), randia (*Randia aculeata*), wild dilly (*Manilkara jaimiqui*), poisonwood (*Metopium toxiferum*), sea grape (*Coccoloba uvifera*), joewood (*Jacquinia keyensis*), rhacoma (*Crossopetalum rhacoma*), Spanish stopper (*Eugenia foetida*), Christmas berry (*Lycium carolinianum*), oxeye daisy species (*Borrchia frutescens* and *B. arborescens*), annual and perennial glassworts (*Salicornia bigelovii* and *Sarcocornia perennis*), key grass, saltgrass (*Distichlis spicata*), seashore dropseed (*Sporobolus virginicus*), cordgrass and saltmarsh fringe rush (*Fimbristylis spadicea*). Two rare plants are predominately found in coastal rock barren: manchineel (*Hippomane mancinella*) and Porter's broom spurge (*Chamaesyce porteriana* var. *scoparia*).

Coastal rock barrens also may be referred to as salt marshes, cactus barrens, or buttonwood perimeter zones. A marsh-like structure is often present where the surface rock/substrate has been disturbed. These areas often support gulf cordgrass (*Spartina spartinae*)

and seashore dropseed, but are rarely inundated. Examples of this altered community are present around the Boca Chica Field.

Beach Dune. Beach dune is characterized as a wind-deposited, foredune and wave-deposited upper beach that are sparsely to densely vegetated with pioneer species, especially sea oats (*Uniola paniculata*). Very little of this community type naturally occurs in the Keys and even less on NASKW property; there are only two small areas, both on Boca Chica off the Old Boca Chica Road Coast. Both of these areas have some ruderal components, but nevertheless are important natural areas. The threats to this community are storm damage, borrow and fill, clearing, vegetation trampling, and outright development.

Coastal Berm. Coastal berm applies to a variety of plant associations that develop on ridges of storm deposited sand, shells, and debris. These associations include dense thickets of large shrubs and small trees, hammocks, or sparse shrubby vegetation with spiny xerophytic plants. In the Lower Keys and on NASKW the coastal beach berm occurs occasionally in two general forms. One type of berm may be characterized as rather ephemeral, consisting of loosely deposited shell and marl sands forming small, low (a foot high, more or less) ridges which will partly define salt ponds or flats in a lagoon setting, or will occur along outer edges of scrub mangroves or the rock barrens of these lagoons. In this form they will generally support scrub buttonwood and black or white mangroves, Christmas berry, sea purslane (*Sesuvium* sp.), key grass and saltgrass and/or seashore dropseed, sea oxeye, and bay cedar or sea grape or even 7- year apple (*Genipa clusiifolia*) and joewood. The second general form has a broader mound to several feet high made up of long-term deep storm deposits of shell/marl sands and detritus over rocky substrate adjacent to the rock barren or within or behind the mangrove communities. These soft ridges support large, old, diverse and xeric populations of buttonwood, saffron plum, prickly pear (*Opuntia* sp.), sea grape, cordgrass, poisonwood, Jamaican caper (*Capparis cynophallophora*), blackbead, and other woody and/or thorny shrubs and trees.

Rockland Hammock. Rockland hammock is a hardwood forest on upland sites where limestone is very near the surface and is often exposed. Vegetation can be similar to that of the coastal berms, but is typically more diverse and has a more developed canopy. Rockland hammock is the climax community and the most tree rich community in the Keys. Canopy species on NASKW include Jamaican dogwood (*Piscidia piscipula*), gumbo limbo (*Bursera simaruba*), poisonwood, buttonwood, sea grape, blolly (*Guapira discolor*), pigeon plum

(*Coccoloba diversifolia*), black ironwood (*Krugiodendron ferreum*), inkwood (*Exothea paniculata*), willow bustic (*Sideroxylon salicifolium*), Spanish stopper, white stopper (*Eugenia axillaris*), darling plum (*Reynosa septentrionalis*), Keys thatch palm (*Thrinax morrisii*), Florida thatch palm (*Thrinax radiata*), wild dilly, black torch, blackbead, locustberry (*Byrsonima lucida*), rhacoma, and torchwood (*Amyris elemifera*). Most of these species also make up the continuous understory, shrub and groundcover layers, with the addition of randia, saffron plum, and lancewood (*Ocotea coriacea*).

The Navy's rockland hammocks are found on Big Coppitt, Rockland Key, Boca Chica Field, Saddlebunch Key, and north Boca Chica.

Invasive and Exotic Plants

FNAI completed field surveys in 2004 to identify invasive and exotic plant species on properties at NASKW. More than 2,350 occurrences of 47 invasive exotic species were documented (Figures 3-6 to 3-8). Twenty two of those species are ranked as Category I by FLEPPC, twenty are ranked as Category II, and six are not currently ranked, but may be considered for ranking and merited recording (Table 3-6). Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*), latherleaf (*Colubrina asiatica*), Lead tree (*Leucaena leucocephala*), sisal hemp (*Agave sisalana*) and melaleuca (*Melaleuca quinquenervia*) were deemed to pose the greatest threat to natural areas and other vegetated areas on NASKW (FNAI 2005).

As a member of the Florida Keys Exotic Invasive Task Force, NASKW has, since the early 2000s, annually submitted proposals to the FWC Upland Invasive Exotic Control Program to treat invasive plants on the installation. These proposals are funded every year. Between 2016 and 2019, more than 167 acres were treated under this program.

Additionally, over the past decade, NASKW has invested money annually in the eradication of invasive plant species across the installation. These efforts have included the eradication of 66 acres of invasive exotic plants in 2012, 47 acres of various invasives (but principally Brazilian pepper, leadtree, and Australian pine) at Boca Chica Airfield and Fleming Key in 2013, the clearing of 3 acres in 2014 as part of a shoreline stabilization project, and the regular eradication and control of invasive hardwoods on the Boca Chica airfield since 2015.

Table 3-6. Invasive and Exotic Plants Documented on Navy Properties in the Florida Keys

Species	Common Name	Occurrences	EPPC Rank
<i>Acacia auriculiformis</i>	Earleaf acacia	2	Category I
<i>Agave sisalana</i>	Sisal hemp	8	Category II
<i>Agave sp.</i>	Agave	9	Category II
<i>Albizia lebeck</i>	Woman's tongue	30	Category I
<i>Bauhinia variegata</i>	Orchid tree	6	Category I
<i>Calophyllum antillanum</i>	Santa Maria	9	Category I
<i>Casuarina equisetifolia</i>	Australian pine	362	Category I
<i>Colubrina asiatica</i>	Latherleaf	33	Category I
<i>Cryptostegia madagascariensis</i>	Madagascar rubbervine	4	Category II
<i>Eugenia uniflora</i>	Surinam cherry	1	Category I
<i>Ficus microcarpa</i>	Laurel fig	54	Category I
<i>Flacourtia indica</i>	Governor's plum	4	Category II
<i>Hibiscus tiliaceus</i>	Mahoe	5	Category II
<i>Hylocereus undatus</i>	Night-blooming cereus	4	N*
<i>Jacquinia arborea</i>	Braceletwood	3	N*
<i>Jasminum fluminense</i>	Brazilian jasmine	15	Category I
<i>Kalanchoe pinnata</i>	Life plant	77	Category II
<i>Lantana camara</i>	Lantana	5	Category I
<i>Leucaena leucocephala</i>	Lead tree	152	Category II
<i>Manilkara zapota</i>	Sapodilla	10	Category I
<i>Melaleuca quinquenervia</i>	Melaleuca	38	Category I
<i>Melia azederach</i>	Chinaberry	1	Category I
<i>Neyraudia reynaudiana</i>	Burma reed	2	Category I
<i>Panicum maximum</i>	Guinea grass	2	Category II
<i>Pennisetum purpureum</i>	Napier grass	3	Category I
<i>Pennisetum setaceum</i>	Green fountaingrass	1	Category II
<i>Phoenix dactylifera</i>	Date palm	1	Category II
<i>Phoenix reclinata</i>	Senegal date palm	1	Category II
<i>Phoenix sp.</i>	Date palm	57	Category II
<i>Pteris vittata</i>	Chinese brake fern	4	Category II
<i>Ptychosperma elegans</i>	Solitaire palm	1	Category II
<i>Ricinus communis</i>	Castor bean	3	Category II
<i>Sansevieria hyacinthoides</i>	Bowstring hemp	57	Category II
<i>Scaevola sericea</i>	Beach naupaka	50	Category I
<i>Schefflera actinophylla</i>	Umbrella tree	151	Category I
<i>Schinus terebinthifolius</i>	Brazilian pepper	703	Category I
<i>Sesbania sericea</i>	Sesban	56	N*
<i>Syngonium podophyllum</i>	Arrowhead vine	2	Category I
<i>Tabebuia heterophylla</i>	Trumpet tree	112	N*
<i>Tamarindus indica</i>	Edible tamarind	4	N*
<i>Terminalia catappa</i>	Tropical almond	56	Category II
<i>Thespesia populnea</i>	Seaside mahoe	113	Category I

Table 3-6, Continued

Species	Common Name	Occurrences	EPPC Rank
<i>Tradescantia fluminensis</i>	Wandering Jew	3	Category I
<i>Tradescantia spathacea</i>	Oyster plant	73	Category I
<i>Tribulus cistoides</i>	Puncturevine	2	Category II
<i>Washingtonia robusta</i>	Washington palm	62	N*
<i>Wedelia trilobata</i>	Wedelia	2	Category II

* The Florida Keys Invasive Exotic Task Force (FKIETF) lists *Hylocereus* as Category II and *Tabebuia* as Category III on the to-be-watched list. *Sesbania sericea* is likely to be listed soon by FLEPPC and FKIETF as a Category II invasive. *Washingtonia* has been listed by FKIETF in the past, but its current invasion into natural areas appears very slow and it is not listed. *Tamarindus* and *Jacquinia* are invading hammocks on NAS KeyWest; these species deserve monitoring at the least, but are currently not listed, nor are they likely to be listed anytime soon (*Tamarindus* has been found in Cudjoe hammock as well).

FLEPPC Category I - Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. *This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.*

FLEPPC Category II - Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. *These species may become ranked Category I, if ecological damage is demonstrated*




Invasive and Exotic Plants

Navy Branch Health Clinic,
Sigsbee, Trumbo Point,
Fleming Key, Truman
Annex

NAS Key West, Florida

Legend

 Invasive and Exotic Plants



0 1,800 3,600
Feet




Invasive and Exotic Plants

Boca Chica, Rockland,
Big Coppitt and Geiger
Keys

NAS Key West, Florida

Legend

 Invasive and Exotic Plants



0 2,000 4,000 Feet




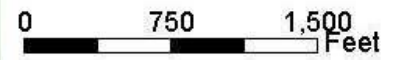
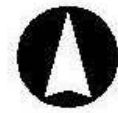
Invasive and Exotic Plants

Saddlebunch Key

NAS Key West, Florida

Legend

 Invasive and Exotic Plants



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3.8.2 Fauna

The unique natural communities on NASKW provide habitat for a variety of mammal, bird, reptile and invertebrate species. These communities provide important nesting and roosting areas and offer prime foraging habitat for many migratory and resident birds such as passerines, raptors, shorebirds and wading birds. These communities also provide habitats for the general spectrum of native frogs, snakes, and lizards, native tree snails, and most of the few native mammal species found in the Keys (raccoon, Lower Keys marsh rabbit, and Silver rice rat). Rare animal surveys were conducted on NASKW properties in 2004-05, 2010-11, and 2016-17 (Henize and Hipes 2005; Gullede et al. 2011; van der Heiden et al. 2017).

Neotropical Migratory Bird Surveys

Surveys for neotropical migratory birds at NASKW are completed approximately every five years. The last survey took place in 2015 and the results are presented in Table 3-7 on the following pages. Species denoted with a superscript “16” in Table 3-7 were observed during the 2016-17 survey of rare fauna and flora, but were not observed during the 2015 avian survey.

3.9 Threatened and Endangered Species

Table 3-8 provides a list of Federal- and State-listed species, including species of special concern and candidate, proposed, and petitioned species that occur or have the potential to occur on NASKW, including the 36 state and federal-listed plant species observed on NASKW during surveys in 2004, 2010-11, and 2016-17 surveys. Numerous other surveys, targeted at specific listed taxa, such as Lower Keys marsh rabbits, American crocodiles, and silver rice rats have also been conducted and are repeated regularly (generally, every one-to-five years). Separate key deer sightings occurred on Boca Chica Key in 2016 and 2018. The island has insufficient habitat to support a permanent key deer presence, so these observations likely indicated temporary transience (Parker et al. 2020). For this reason, NAS Key West does not manage habitat for key deer; sightings are reported to the USFWS Florida Keys National Wildlife Refuge Complex.

Occupied and potential habitats occurring on NASKW property for certain rare, threatened and endangered species are depicted in Figures 3-9 to 3-11. Section 4.3 (Threatened and Endangered Species) provides the current status, survey information, and habitat conditions for each of the threatened and endangered species that occur, is likely to occur, and/or is actively managed on NASKW.

Table 3-7. Migratory Birds Observed on NAS Key West During Seasonal Surveys in 2015, by Season and Property.

Species	Scientific name	Summer	Fall	Winter	Spring
American avocet ¹⁶	<i>Recurvirostra americana</i>				
American kestrel	<i>Falco sparverius</i>		TA,BC	TA,BC	
American redstart	<i>Setophaga ruticilla</i>		BC		
Antillean nighthawk	<i>Chordeiles gundlachii</i>	BC, BIG, SB			
Bald eagle	<i>Haliaeetus leucocephalus</i>		SB	BC,SB	
Baltimore oriole ¹⁶	<i>Icterus galbula</i>				
Barn swallow	<i>Hirundo rustica</i>		TA,BC,SB		BC,G
Belted kingfisher	<i>Megaceryle alcyon</i>		TA,BC,G,SB	BC,SB	
Black skimmer	<i>Rynchops niger</i>			TA	
Black-and-white warbler	<i>Mniotilta varia</i>			SB	
Black-bellied plover	<i>Pluvialis squatarola</i>	TA,SB	TA,BC	TA,BC,G	TA,BC
Black-necked stilt	<i>Himantopus mexicanus</i>				TA
Black-throated blue warbler ¹⁶	<i>Dendroica caerulescens</i>				
Black-whiskered vireo	<i>Vireo altiloquus</i>	BC,BIG, G,SB			BC
Blackburnian warbler ¹⁶	<i>Dendroica fusca</i>				
Blue grosbeak	<i>Passerina caerulea</i>		BC		
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>		TA,BC,R,BIG,G	BC,R,G,SB	
Blue-winged teal	<i>Anas discors</i>				BC
Blue-winged warbler ¹⁶	<i>Vermivora pinus</i>				
Bobolink	<i>Dolichonyx oryzivorus</i>		BC		
Broad-winged hawk	<i>Buteo platypterus</i>		BC,SB		
Brown pelican	<i>Pelecanus occidentalis</i>	TA	BC	TA,BC,R,G,SB	TA,SB
Brown-headed cowbird	<i>Molothrus ater</i>				BC
Cape may warbler ¹⁶	<i>Dendroica tigrina</i>				
Caspian tern ¹⁶	<i>Sterna caspia</i>				
Cattle egret	<i>Bubulcus ibis</i>	TA	TA		TA,BC
Chestnut-sided warbler ¹⁶	<i>Dendroica pensylvanica</i>				

Species	Scientific name	Summer	Fall	Winter	Spring
Clapper rail	<i>Rallus crepitans</i>	BC,R,BIG,G,SB	SB	SB	SB
Common grackle	<i>Quiscalus quiscula</i>	TA,BC,R,G,SB			
Common ground-dove	<i>Columbina passerina</i>	BC,R	BC,SB	BC,R	TA,BC,R,G,SB
Common yellowthroat	<i>Geothlypis trichas</i>		BC,R	R,SB	
Cooper's hawk	<i>Accipiter cooperii</i>		TA	TA,SB	
Double-crested cormorant	<i>Phalacrocorax auritus</i>	BC,SB	TA,BC,SB	TA,BC,SB	TA,BC,SB
Eastern kingbird	<i>Tyrannus tyrannus</i>				BC
Eastern wood-pewee ¹⁶	<i>Contopus virens</i>				
Eurasian collared dove	<i>Streptopelia decaocto</i>	TA,R,G	TA,R	BC,R	TA,R,G,SB
European starling	<i>Sturnus vulgaris</i>	TA			TA,G
Fish crow	<i>Corvus ossifragus</i>			TA	
Florida prairie warbler ¹⁶	<i>Dendroica discolor</i>	BC, BIG, SB			
Gray catbird	<i>Dumetella carolinensis</i>		BC		BC
Gray kingbird	<i>Tyrannus dominicensis</i>	BC,BIG,SB			BC,R,SB
Gray-cheeked thrush ¹⁶	<i>Catharus minimus</i>				
Great blue heron	<i>Ardea herodias</i>	TA,BC,G,SB	TA,BC,R,SB	BC,SB	TA,G,SB
Great egret	<i>Ardea alba</i>	BC	TA,BC,SB	TA,BC,SB	BC
Great white heron ¹⁶	<i>Ardea herodias</i>	BC, BIG, SB			
Great-crested flycatcher	<i>Myiarchus crinitus</i>	BC			BC,G
Greater yellowlegs	<i>Tringa melanoleuca</i>		BC		
Green heron	<i>Butorides virescens</i>	BC,R,SB	BC		
Herring gull	<i>Larus argentatus</i>	TA		TA,BC	TA
Hooded warbler ¹⁶	<i>Wilsonia citrina</i>				
Indigo bunting	<i>Passerina cyanea</i>				BC,G
Killdeer	<i>Charadrius vociferus</i>		BC	TA	
Laughing gull	<i>Leucophaeus atricilla</i>	TA,BC,R,G,SB	TA,G	TA,BC,SB	TA,BC,BIG,G,SB
Least sandpiper	<i>Calidris minutilla</i>		TA,BC	TA,BC	TA,BC
Least tern	<i>Sternula antillarum</i>	TA,BC,R,G			TA,BC,R
Lesser yellowlegs	<i>Tringa flavipes</i>				SB

Species	Scientific name	Summer	Fall	Winter	Spring
Little blue heron	<i>Egretta caerulea</i>	BC,SB	BC,SB	BC	BC,SB
Magnificent frigatebird	<i>Fregata magnificens</i>	TA,BC,G	TA,BC,SB	TA,BC,BIG,G	TA,BC
Magnolia warbler ¹⁶	<i>Dendroica magnolia</i>				
Mangrove cuckoo	<i>Coccyzus minor</i>	BC, SB			
Merlin ¹⁶	<i>Falco columbarius</i>				
Mississippi kite ¹⁶	<i>Ictinia mississippiensis</i>				
Mourning dove	<i>Zenaida macroura</i>	TA,BC,R,G,SB	TA,BC	BC	TA,BC,BIG,G
Northern cardinal	<i>Cardinalis cardinalis</i>	BC,R,BIG,G,SB	BC,BIG,G,SB	R,BIG,SB	BC,G,SB
Northern harrier	<i>Circus cyaneus</i>		TA,G		
Northern mockingbird	<i>Mimus polyglottos</i>	TA,G,SB	TA,BC,R,BIG	TA	TA,BC,R,G,SB
Northern parula	<i>Setophaga americana</i>				BC,R,SB
Northern rough-winged swallow ¹⁶	<i>Stelgidopteryx serripennis</i>				
Northern waterthrush	<i>Parkesia noveboracensis</i>		BC,G	BC,G,SB	
Osprey	<i>Pandion haliaetus</i>	TA,BC,SB	BC,R,G,SB	TA,BC,SB	TA,BC,SB
Ovenbird	<i>Seiurus aurocapilla</i>		BC		
Palm warbler	<i>Setophaga palmarum</i>		TA,BC,R,G,SB	TA,BC,R,SB	
Peregrine falcon	<i>Falco peregrinus</i>		TA,BC,SB	TA	
Pied-billed grebe	<i>Podilymbus podices</i>			BC	
Piping plover	<i>Charadrius melodus</i>				BC
Prairie warbler	<i>Setophaga pinus</i>	BC,G,SB	BC,BIG,SB	SB	BC,BIG,G,SB
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	TA,BC,G, SB	BC,BIG,G	BC,BIG,G,SB	BC,G,SB
Red-eyed vireo ¹⁶	<i>Vireo flavifrons</i>				
Red-winged blackbird	<i>Agelaius phoeniceus</i>	BC,R,G,SB	BC,R,G,SB	BC,BIG,G,SB	BC,R,G,SB
Reddish egret	<i>Egretta rufescens</i>	BC,R,G,SB	BC	R,SB	
Ring-billed gull	<i>Larus delawarensis</i>			TA,G,SB	
Rock pigeon	<i>Columba livia</i>	TA	TA	TA,SB	TA
Rose-breasted grosbeak ¹⁶	<i>Pheucticus ludovicianus</i>				
Roseate spoonbill ¹⁶	<i>Platalea ajaja</i>	BC			

Species	Scientific name	Summer	Fall	Winter	Spring
Roseate tern	<i>Sterna dougallii</i>	TA			TA
Royal tern	<i>Thalasseus maximus</i>	TA	TA	TA,SB	TA
Ruby-throated hummingbird ¹⁶	<i>Archilochus colubris</i>				
Ruddy turnstone	<i>Actitis macularius</i>	TA	TA,BC	BC	TA,BC
Sanderling	<i>Calidris alba</i>	BC	TA,BC	BC	BC
Sandwich tern	<i>Thalasseus sandvicensis</i>		TA		
Savannah sparrow	<i>Passerculus sandwichensis</i>			TA	
Scarlet tanager	<i>Piranga olivacea</i>				SB
Semipalmated plover	<i>Charadrius semipalmatus</i>	TA,BC	TA,BC		TA,BC
Sharp-shinned hawk	<i>Accipiter striatus</i>		BC,R,SB		
Short-billed dowitcher	<i>Limnodromus griseus</i>	BC	TA,BC,SB		TA,BC
Snowy egret	<i>Egretta thula</i>	TA,BC	TA,BC,BIG		
Spotted sandpiper	<i>Actitis macularius</i>		TA,BC,SB	TA,BC	TA,BC
Summer tanager ¹⁶	<i>Piranga rubra</i>				
Swainson's hawk ¹⁶	<i>Buteo swainsoni</i>				
Swainson's thrush	<i>Catharus ustulatus</i>		BC		
Swallow-tailed kite ¹⁶	<i>Elanoides forficatus</i>				
Tennessee warbler ¹⁶	<i>Vermivora peregrina</i>				
Tree swallow ¹⁶	<i>Tachycineta bicolor</i>				
Tricolored heron	<i>Egretta tricolor</i>	BC,R,SB	BC,R,G,SB	BC,R	BC,R,SB
Turkey vulture	<i>Cathartes aura</i>			TA,BC,G	TA,G
White ibis	<i>Eudocimus albus</i>	TA,BC,BIG,G,SB	TA,BC,R,BIG,G,SB	BC,R,BIG,SB	BC,G,SB
White-crowned pigeon	<i>Patagioenas leucocephala</i>	TA,BC,R,G,SB	BC		BC,BIG,G,SB
White-eyed vireo	<i>Vireo griseus</i>		BC		
White-winged dove	<i>Zenaida asiatica</i>		TA		
Willet	<i>Tringa semipalmata</i>	SB	TA,BC,SB	BC	TA,BC,SB
Wilson's plover	<i>Charadrius wilsonia</i>	BC, BIG,SB	TA,BC	BC	BC,SB
Yellow warbler	<i>Setophaga petechia</i>				G
Yellow-bellied sapsucker ¹⁶	<i>Sphyrapicus varius</i>				

Species	<i>Scientific name</i>	Summer	Fall	Winter	Spring
Yellow-crowned night heron	<i>Nyctanassa violacea</i>	BC	TA		BC
Yellow-throated vireo ¹⁶	<i>Vireo flavifrons</i>				
¹⁶ = The species was observed during a 2016 survey of rare fauna, but was not observed during the 2015 seasonal surveys (no location data). TA = Truman Annex, BC = Boca Chica Key, R = Rockland Key, BIG = Big Coppitt Key, G = Geiger Key, SB = Saddlebunch Keys					

Table 3-8. Federal and State Listed Candidate, Threatened, and Endangered Species that Occur or Potentially Occur on NAS Key West

SPECIES		STATUS		
Common Name	Scientific Name	USFWS/ NOAA	FWC	KNOWN TO OCCUR
Mammals				
Key Deer	<i>Odocoileus virginianus clavium</i>	E		✓
Lower Keys Marsh Rabbit	<i>Sylvilagus palustris hefneri</i>	E		✓
Silver Rice Rat	<i>Oryzomys palustris natator</i>	E		✓
West Indian Manatee	<i>Trichechus manatus</i>	T		✓
Birds				
American Kestrel	<i>Falco sparverius paulus</i>		T	✓
Black Skimmer	<i>Rhychops niger</i>		T	✓
Eastern Black Rail	<i>Laterallus jamaicensis</i>	PT		
Least Tern	<i>Sterna antillarum</i>		T	✓
Little Blue Heron	<i>Egretta caerulea</i>		T	✓
Osprey	<i>Pandion haliaetus</i>		D	✓
Piping Plover	<i>Charadrius melodus</i>	T		✓
Red Knot	<i>Calidris canutus ssp. rufa</i>	T		
Roseate Tern	<i>Sterna dougallii dougallii</i>	T		✓
Tri-colored Heron	<i>Egretta tricolor</i>		T	✓
White-crowned Pigeon	<i>Columba leucocephalus</i>		T	✓
Reptiles & Amphibians				
American Alligator	<i>Alligator mississippiensis</i>	T(S/A)		
American Crocodile	<i>Crocodylus Acutus</i>	T		✓
Green Sea Turtle	<i>Chelonia mydas</i>	T		
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>	E		
Kemps Ridley Sea Turtle	<i>Lepidochelys kempii</i>	E		
Key Ringneck Snake	<i>Diadophis punctatus acricus</i>	P	T	
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	E		
Loggerhead Sea Turtle	<i>Caretta caretta</i>	T		✓
Lower Keys Brown Snake	<i>Storeria dekayi victa</i>		T	
Rim Rock Crowned Snake	<i>Tantilla oolitica</i>	P	T	

SPECIES		STATUS		
Common Name	Scientific Name	USFWS/ NOAA	FWC	KNOWN TO OCCUR
Fish				
Dwarf Seahorse	<i>Hippocampus zosterae</i>	P		✓
Giant Manta Ray	<i>Manta birostris</i>	T		
Key Silverside	<i>Menidia conchorum</i>		T	✓
Mangrove Rivulus	<i>Rivulus marmoratus</i>		D	✓
Nassau Grouper	<i>Epinephelus striatus</i>	T		
Smalltooth Sawfish	<i>Pristis Pectinata</i>	E		✓
Invertebrates				
Boulder Star Coral	<i>Orbicella franksi</i>	T		✓
Elkhorn Coral	<i>Acropora palmata</i>	T		
Florida Tree Snail	<i>Liguus fasciatus</i>		D	
Lobed Star Coral	<i>Orbicella annularis</i>	T		✓
Monarch Butterfly	<i>Danaus plexippus</i>	P		✓
Mountainous Star Coral	<i>Orbicella faveolata</i>	T		✓
Pillar Coral	<i>Dendrogyra cylindricus</i>	T		
Rough Cactus Coral	<i>Mycetophyllia ferox</i>	T		
Staghorn Coral	<i>Acropora cervicornis</i>	T		
Plants				
Banded Wild Pine	<i>Tillandsia flexuosa</i>		T	✓
Barbed-Wire Cactus	<i>Acanthocereus tetragonus</i>		T	✓
Blacktorch	<i>Erithalis fruticosa</i>		T	✓
Blodgett's Silverbush	<i>Argythamnia blodgettii</i>	T	E	✓
Butterflybush	<i>Varronia globosa</i>		E	✓
Caribbean Princewood	<i>Exostema caribaeum</i>		E	✓
Darlingplum	<i>Reynosia septentrionalis</i>		T	✓
Florida Butterfly Orchid	<i>Encyclia tampensis</i>		X	✓
Florida Keys Blackbead	<i>Pithecellobium keyense</i>		T	✓
Florida Mayten	<i>Maytenus phyllanthoides</i>		T	✓
Florida Silverpalm	<i>Coccothrinax argentata</i>		T	✓
Garber's Spurge	<i>Euphorbia garberi</i>	E	E	✓
Giant Wild Pine	<i>Tillandsia utriculata</i>		E	✓
Green Thatch Palm	<i>Thrinax radiata</i>		E	✓

SPECIES		STATUS		
Common Name	Scientific Name	USFWS/ NOAA	FWC	KNOWN TO OCCUR
Joewood	<i>Jacquinia keyensis</i>		T	✓
Keys ageratum	<i>Ageratum littorale</i>			✓
Lignum-Vitae	<i>Guaiacum sanctum</i>		E	✓
Locustberry	<i>Byrsonima lucida</i>		T	✓
Long-Stalked Stopper	<i>Psidium longipes</i>		T	✓
Mahogany	<i>Swietenia mahagoni</i>		T	✓
Manchineel	<i>Hippomane mancinella</i>		E	✓
Mullein Nightshade	<i>Solanum donianum</i>			✓
Orange Geigertree	<i>Cordia sebestena</i>			✓
Pine Pink Orchid	<i>Bletia purpurea</i>		T	✓
Porter's Sandmat	<i>Euphorbia porteriana</i>		E	✓
Prickly Pear Cactus	<i>Opuntia stricta</i>		T	✓
Red Stopper	<i>Eugenia rhombea</i>		E	✓
Rhacoma, Maidenberry	<i>Crossopetalum rhacoma</i>		T	✓
Sea Lavender	<i>Argusia gnaphalodes</i>		E	✓
Silver Thatch Palm	<i>Thrinax morissii</i>		E	✓
Smooth Devil's Claw	<i>Pisonia rotundata</i>		E	✓
Smooth Strongback	<i>Bouyeria succulenta</i>			✓
West Indian False Boxwood	<i>Gyminda latifolia</i>			✓
Wild Cotton	<i>Gossypium hirsutum</i>		E	✓
Wild Dilly	<i>Manilkara jaimiqui</i>		T	✓

Status: C = Candidate, D = Delisted (State), E = Endangered, T = Threatened, T(S/A) = Threatened due to similarity of appearance, P = Petitioned, PE = Proposed Endangered; PT = Proposed Threatened, X = Commercially Exploited (State)

✓ denotes species are known to occur on NAS Key West Property-(all plants listed were observed during FNAI and IRC surveys)

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Rare,
Threatened and Endangered
Species Habitats

Navy Branch Health Clinic,
Sigsbee, Trumbo Point,
Fleming Key, Truman Annex

NAS Key West, Florida

Legend

-  Potential Tern Nesting Habitat
-  Potential Sea Turtle Nesting Habitat



0 1,800 3,600 Feet



Rare,
Threatened and Endangered
Species Habitats

Boca Chica, Rockland,
Big Coppitt and Geiger
Keys

NAS Key West, Florida

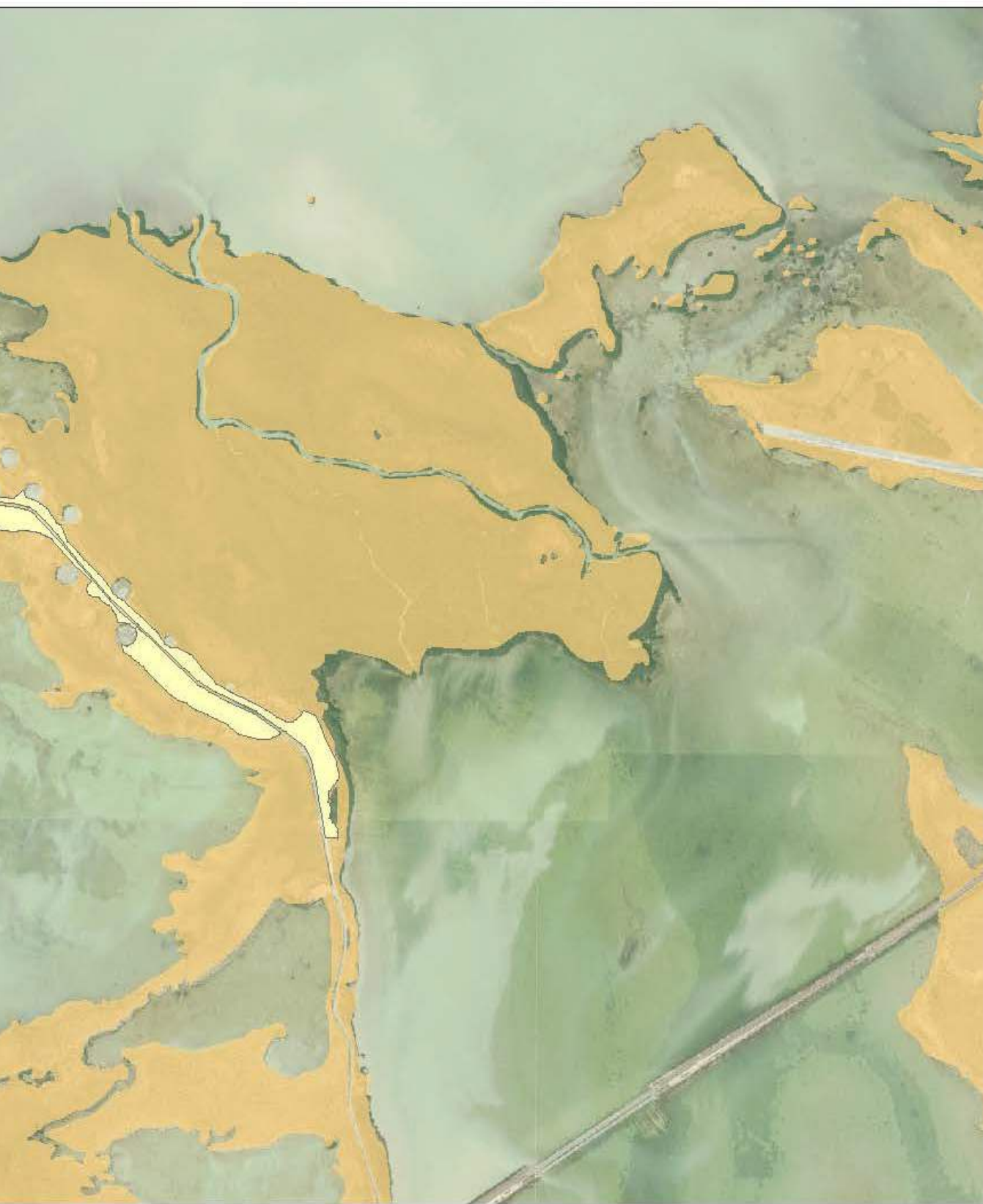
Legend

- Occupied LKMR habitat
- Potential LKMR habitat
- Potential tern nesting habitat
- Potential sea turtle nesting habitat
- Blodgett's silverbush
- Blodgett's silverbush
- Garber's spurge
- American crocodile



0 2,000 4,000 Feet

Nesting Activity



Rare,
Threatened and Endangered
Species Habitats

Saddlebunch Key

NAS Key West, Florida

Legend

Lower Keys Marsh Rabbit Habitat

Occupied

Potential

Silver Rice Rat Habitat



0 1,000 2,000 Feet

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Table 3-9 provides a list of Federally-listed threatened and endangered species that occur or have the potential to occur in Monroe County, Florida, but that do not occur on NASKW properties. These species were not observed during the 2004-05, 2010-11, and 2016-17 surveys, and have not been observed during any other surveys of the installation.

Table 3-9. Federally-listed Species with Ranges in Monroe County, Florida, but that are Not Found on NAS Key West Properties

SPECIES		
Common Name	STATUS	DISCUSSION
Scientific Name		
Butterflies		
Bartram’s Hairstreak Butterfly <i>Strymon acis bartrami</i>	FE	In the Florida Keys, the Bartram's hairstreak is restricted to Big Pine Key, as is its host plant, pineland croton. Surveys of relict pineland throughout the lower keys in 1999 failed to locate the host plant on any key other than Big Pine Key, and the host plant was not seen on NASKW in the 2016 survey.
Florida Leafwing Butterfly <i>Anaea troglodyta floralis</i>	FE	The species occurs only within pine rocklands that retain its hostplant, pineland croton. It previously occurred at Big Pine Key and Sugarloaf Key, but was not documented during surveys conducted in 2006, 2007, 2009, 2010, and 2016. It is therefore not expected that the species occurs at NASKW.
Miami Blue Butterfly <i>Cyclargus thomasi bethunebakeri</i>	FE	As of 2010, the species was determined to be limited to about 100 individuals in a colony in the Marquesas Keys. Its host plants, Florida Keys blackbead (<i>Pithecellobium keyense</i>) and Gray nicker-bean (<i>Caesalpinia bonduc</i>), were identified on the eastern end of Old Boca Chica Road in the 2016 survey.
Schaus’ Swallowtail Butterfly <i>Papilio aristodemus</i>	FE	Historically, this species occurred in tropical hardwood hammocks from Miami south to Lower Matecumbe Key. NASKW is therefore outside its range and it was not identified on the installation in the 2016 survey.
Other Invertebrates		
Stock Island Tree Snail <i>Orthalicus reses</i>	FT	The Stock Island tree snail has not been observed since 1992 in its original range on Stock Island and is considered locally extinct in the lower Keys. It was targeted during the 2010 and 2016 surveys at NASKW but was not found on the properties.
Mammals		
Florida Bonneted Bat <i>Eumops floridanus</i>	FC	This species occurs largely in the mainland portions of Monroe County, particularly in Everglades National Park and Big Cypress National Preserve. Its habitat includes forest and access to freshwater, which are lacking at NASKW.

SPECIES		
Common Name <i>Scientific Name</i>	STATUS	DISCUSSION
Key Largo Cotton Mouse <i>Peromyscus gossypinus allapaticola</i>	FE	The Key Largo Cotton Mouse resides in tropical hardwood hammocks on Key Largo. NASKW no longer owns property on Key Largo and has no management responsibilities there.
Key Largo Woodrat <i>Neotoma floridana smalli</i>	FE	The Key Largo woodrat resides in tropical hardwood hammocks on Key Largo. NASKW no longer owns property on Key Largo and has no management responsibilities there.
Reptiles & Amphibians		
Eastern Indigo Snake <i>Drymarchon coarais couperi</i>	FT	Herpetological surveys of Big Pine Key in 2006 led to the presumption that the species had been extirpated there, and it was not found during a 2016 herpetofauna survey of NASKW. NASKW and USFWS biologists have determined that it is extirpated from NASKW properties.
Plants		
Aboriginal Prickly-apple <i>Harrisia aboriginum</i>	FE	The historical and current ranges of this species are largely confined to the mainland of southwest Florida. It does not occur in the Florida Keys.
Big Pine Partridge Pea <i>Chamaecrista lineata keyensis</i>	FC	This species is currently known only from Big Pine Key. It occurs on the edges of rockland hammocks and pinelands in the pine rocklands there.
Cape Sable Thoroughwort <i>Chromolaena frustrata</i>	FE	According to 77 FR 61836, this species can be found on Big Pine Key and Boca Grande Key – east and west of NASKW – but has never been identified on Boca Chica Key and is extirpated from Key West.
Everglades Bully <i>Sideroxylon reclinatum</i> ssp. <i>austrofloridense</i>	FC	According to 69 FR 24881, this species is found only on Long Pine Key.
Florida Pineland Crabgrass <i>Digitaria pauciflora</i>	FC	This species is currently known only from the Everglades pinelands. It appears to be fire tolerant, existing in ecosystems that are known to have frequent fires.
Florida Prairie Clover <i>Dalea carthagenensis floridana</i>	FC	Florida prairie clover occurs in Big Cypress National Preserve and at six locations within Miami-Dade County, preferring the edges of rockland hammocks, coastal uplands, marl prairie. It does not occur in the Florida Keys.

SPECIES		
Common Name <i>Scientific Name</i>	STATUS	DISCUSSION
Florida semaphore cactus <i>Consolea corallicola</i>	FE	This species exists at two locations, one is an island in Biscayne Bay (Miami-Dade County) and the other is a small private island in the Florida Keys. Attempted reintroductions on other keys have been unsuccessful.
Key Tree Cactus <i>Pilosocereus robinii</i>	FE	Key tree cactus historically occurred throughout the Florida Keys. Its current range has been restricted to seven populations found on Key West, Boca Chica Key, Big Pine Key, Long Key, Lower Matecumbe Key, Upper Matecumbe Key, Upper Matecumbe Key, Windley Key, and Key Largo. The species is not known from NASKW.
Sand Flax <i>Linum arenicola</i>	FC	There are 12 known plots of sand flax in south Florida and the Florida Keys. Its closest approach to NASKW is Big Pine Key. Hurricane Wilma, in 2005, wiped out Big Pine's southern sand flax plots, but northern plots persist.
Wedge Spurge <i>Chamaesyce deltoidea serpyllum</i>	FC	Wedge spurge was historically, and remains, restricted to pine rocklands on Big Pine Key, mostly within the National Key Deer Refuge on the northern portion of the island.

FC = Federal Candidate; FE = Federally Endangered; FT = Federally Threatened.

3.10 Outdoor Recreation

Outdoor recreation is the public or military use of natural resources, including indoor interpretative centers. Outdoor recreation includes facilities such as nature trails, picnic and camping areas, beaches, swimming areas and other consumptive and non-consumptive uses of natural resources. The use of off-road vehicles, as well as highly developed outdoor uses such as golf courses and softball fields is not considered outdoor recreation in the context of this natural resources plan. The installation is an important occupier of federal lands and has adequate resources to support various programs for outdoor recreation.

Outdoor recreation opportunities can be classified as *dispersed* recreation opportunities or *concentrated* recreation opportunities. Concentrated recreation opportunities refer to those activities where recreationists concentrate in a specific area. Concentrated outdoors recreational opportunities include camping, picnicking, fitness trails, boating, recreational gardening, archery, and outdoor education/interpretation. Dispersed recreation opportunities refer to those activities where the recreationist moves about through an area. Dispersed opportunities include fresh

water and saltwater fishing, crabbing, shrimping, hiking, bird watching, nature study, bicycling, horseback riding, and canoeing.

The section on outdoor recreation inventories special interests areas, as well as identifies areas suitable for dispersed and concentrated outdoor recreation opportunities. These are for military and civilian personnel who live and/or work on the installation, military retirees, and the general public, to the extent access fits within the security needs and mission of the installation. The program develops strategies for managing the natural resources that meet outdoor recreation needs as an overall, compatible program as a part of the integrated plan.

The military and civilian personnel that are assigned to NASKW, military retirees and the general public, to the extent access fits within the security needs and mission of the Installation, are potential users of the outdoor recreation opportunities. The majority of the outdoor recreation opportunities for the Installation are located primarily on Boca Chica, Geiger and Dredger Keys (Sigsbee Park Annex).

Fishing

Freshwater fishing opportunities do not exist in the lower Florida Keys. However, saltwater fishing opportunities are unlimited on and off the Installation. Shore fishing sites are limited on the Installation. Fishing is permitted on the Installation whenever the activity will not interfere with the mission or constitute a safety hazard. Popular saltwater species are snapper, barracuda, tarpon, grouper, amberjack, wahoo, shark, shrimp, lobster, marlin, sailfish, dolphin, kingfish and tuna.

Hiking

There are no established hiking trails at the Installation due to a lack on contiguous undeveloped land. To the extent access fits within the security needs and mission of the Installation, an informal trail exists along Old Boca Chica Road which begins at the terminus of Geiger Key road and runs westward around the southern perimeter of Boca Chica Key. The trail courses along the old paved roadway and coastal berm, which has been partially eroded by storm events.

Canoeing and Kayaking

Canoeing, kayaking and sailing are popular year-round activities in the Florida Keys. The open water access and mangrove swamps around Boca Chica and Geiger Key are ideal for

canoeing and kayaking. Boca Chica Marina, on the west side of the Key, and Sigsbee Marina offer kayaks for rent. Mangrove swamps adjacent to Sigsbee Marina are limited for canoeing and kayaking.

Camping

NAS Key West operates a Recreational Vehicle (RV) campground at Sigsbee Park Annex. Sigsbee's RV Park is a favorite year-round camping destination. There are 93 full hook-up sites and over 300 dry camping areas. The RV park also features laundromats and shower facilities.

Picnicking

There are several existing picnic areas on NASKW property. On Boca Chica Key, Chickee shelters are located adjacent the swimming beach at Boca Chica Marina. Several other picnic sites are located in the vicinity of Sigsbee Marina. An area is provided at Patio Beach on Truman Annex with chickee huts and tables for picnicking.

Swimming

Due to the tropical climate, there is a long swimming season in the Florida Keys. There are a couple of locations on NASKW that are ideal for swimming. On Boca Chica Key, a sand/limerock beach was developed at Boca Chica marina which is ideal for swimming. The marina also provides bathroom facilities with showers. At Truman Annex, a typical limerock beach of the Lower Keys known as Patio Beach provides an area to swim. Adjacent to the beach on the west boundary is a public beach operated by Fort Zachary Taylor State Park.

Boating and Sailing

Boating is popular in the Florida Keys, not only because of the fishing opportunities but also because of the coral reefs which are popular destinations for snorkeling and scuba diving. Sailing is also popular year-round in this mild climate. The Boca Chica Marina provides a boat launch and deepwater access via the Boca Chica channel. The marina also provides slips and moorings for motorized boats and sail boats. The Sigsbee Marina is a full service marina that offers boat rentals, has a boat launch and sells everything from bait to gasoline.

Nature Study / Outdoor Education

Currently there is no formal program for nature study and outdoor education at NASKW, however there are some dispersed opportunities for nature study through canoeing, kayaking and hiking.

**NATURAL RESOURCE
MANAGEMENT**

4 NATURAL RESOURCE MANAGEMENT

This section discusses natural resource management at NASKW by dividing natural resources into focus units: land management, coastal and marine management, fish and wildlife, and outdoor recreation. These focus units are further divided into management actions; for example, the land management discussion addresses wetlands, soil conservation and erosion control, invasive and exotic species, and urban forestry. The objectives, long-term management, strategies, tasks and projects are discussed for each management action. Each action also identifies legal requirements, and sources for additional management information.

The management actions described in this INRMP benefit the plants, animals, and ecosystems occurring on this installation. Special attention is given to rare, threatened, and endangered (RTE) species, and their habitats, through actions referenced in Table 4-1. These management actions are long-term conservation measures that provide benefits for terrestrial and aquatic habitats on the installation. Management actions such as soil conservation and storm water management, for example, control sediment and pollutant runoff to protect nearshore water quality for species such as manatees, shorebirds, and corals. Actions such as invasive, exotic, and noxious species control help protect habitat and maintain resources for Lower Keys marsh rabbits, silver rice rats, and Blodgett's silverbush.

Table 4-1. Habitat Management Actions at NAS Key West

Habitat Management Actions	Section
Wetlands	4.1.1
Floodplain Management	4.1.2
Soil Conservation and Erosion Control	4.1.3
Stormwater and Water Quality Control	4.1.4
Grounds Maintenance and Landscaping	4.1.5
Invasive, Exotic, and Noxious Species	4.1.6
Coastal and Marine Management	4.2
Wildlife Management	4.3.1
Threatened and Endangered Species and Natural Communities	4.3.2
Essential Fish Habitat	4.3.3
Prevention and Control of Wildlife Damage and Disease	4.3.4

The “Threatened and Endangered Species and Natural Communities” section of this INRMP (Section 4.3.2) includes additional goals, objectives, strategies, and projects for the benefit and long-term conservation of RTE species found, or potentially found, on the installation. Animal and plant species explicitly accounted for in this INRMP are:

- American Crocodile
- Bald Eagle
- Blodgett’s Silverbush (plant)
- Corals
 - Boulder Star Coral
 - Elkhorn Coral
 - Lobed Star Coral
 - Mountainous Star Coral
 - Pillar Coral
 - Rough Cactus Coral
 - Staghorn Coral
- Dwarf Seahorse
- Eastern Black Rail
- Florida Tree Snail
- Garber’s Spurge (plant)
- Giant Manta Ray (fish)
- Key Ringneck Snake
- Least Tern (bird)
- Lower Keys Marsh Rabbit
- Lower Keys Brown Snake
- Monarch Butterfly
- Nassau Grouper (fish)
- Osprey (bird)
- Piping Plover (bird)
- Red Knot (bird)
- Rim Rock Crowned Snake
- Roseate Tern (bird)
- Sea Turtles
 - Green Sea Turtle
 - Hawksbill Sea Turtle
 - Kemp’s Ridley Sea Turtle
 - Leatherback Sea Turtle
 - Loggerhead Sea Turtle
- Silver Rice Rat
- Smalltooth Sawfish
- West Indian Manatee
- White-Crowned Pigeon

Section 4.5 discusses current natural resources staffing, training, and technology. It also presents objectives, long-term management, and identifies strategies, tasks and projects.

4.1 Land Management

This section addresses the land resources on the Installation that are managed as individual components and have independent management programs and techniques. The land management issues contained within this plan are not intended for directing land use activity (i.e. what buildings or activities should go where), and to provide managers and stakeholders with information and general guidance (e.g. regarding soil conservation, stormwater management) for making decisions to protect and enhance the natural resources, while sustaining the military mission of NASKW.

4.1.1 Wetlands

In general terms, wetlands are lands on which water covers the soil or is present either at or near the surface of the soil or within the root zone all year or for varying periods of time during the year, including during the growing season. The United States Army Corps of Engineers (USACE) (Federal Register, Section 328.3[b], 1991) and the Environmental Protection Agency (EPA) (Federal Register, Section 230.4[t], 1991) jointly define wetlands as “...those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (USACE 1982). The USACE definition relies on three key parameters – hydrology, soil, and vegetation – which must all occur and meet the defined characteristics in order for a location to be classified as a wetland.

Objectives

1. *Protection of wetlands and their natural functions while upholding Installation’s mission and facility development.*
2. *Continue existing and establish new procedures to monitor, maintain and enhance wetland resources.*

Long-Term Management

Wetlands management is an essential component of ecosystem management because proper management will preserve, enhance, and create habitat for a variety of wildlife species, while providing aesthetic and educational values. Changes to hydrology, geochemistry, substrate, or species composition may impair the ability of a wetland to function properly. Such alterations can affect the ability of the wetland to filter excess sedimentation and nutrients from surface water, which can result in deteriorated surface water quality and diminished flood control.

NAS Key West will continue to incorporate the DoN’s policy of no net loss of wetlands. Protective buffer strips or corridors of designated widths are recommended to be maintained and/or developed around wetlands and along water bodies. Vegetative buffers between wetland and upland vegetative communities will help maintain and improve water quality by filtering sediments and other pollutants from runoff prior to discharge into the wetland. Vegetative buffers also will provide habitat for a diversity of wetland and upland species. Width of the

buffers will be determined by the following: Best Management Practices, edaphic characteristics (topography and erodibility), sensitivity and uniqueness of wetland fauna and flora, and degree of disturbance. As a general guideline, a vegetated buffer should be left undisturbed adjacent to wetlands when possible. Restrictions within these buffers include activities such as heavy equipment operation, application of pesticides with acute toxicity to fauna and soil horizon disturbance. Other potential long-term management concepts for wetlands may include the creation and expansion of wetlands, wetland quality monitoring, and more extensive inventory of existing wetlands.

Wetland systems within the Installation provide valuable wildlife habitat, water quality protection, and flood protection. If site constraints and the need for future development of lands to enhance the military mission require wetlands incursions, NASKW would mitigate those actions with regulatory authorities. Proper management of wetland areas is necessary to support the military mission and to comply with federal laws and regulations.

Climate Change

According to the EPA, ocean levels in southern Florida are expected to rise 14-to-26 inches by 2060 and 31-to-61 inches by 2100 (SE Compact 2015). This would create a state of chronic saltwater intrusion into coastal wetlands, triggering a cascade of ecological change, most easily identified by the browning and death of surrounding trees and the upland migration of mangroves. Wetlands naturally increase their elevation by converting sediment and decomposing marsh plants into soil, but this adaptation may be outpaced by the current rate of sea level rise, especially if exacerbated by tropical storm flood events. Management actions that may buffer wetlands against saltwater intrusion include the enhancement of coastal vegetation to mitigate the impact of tropical storm wave action, the removal of aggressive salt-tolerant invasive plants, and the maintenance of natural conservation corridors to allow salt-intolerant animals to access wetlands at higher elevations.

Project Summaries (See Appendix A)

Project 1: Wetlands Protection and Shoreline Enhancement

Strategy: Develop and implement a plan to update wetlands and land cover maps on the properties of NASKW.

Tasks: (1) Consult with federal, state, and local biologists, and land managers on the appropriate methodology to be used in conducting wetlands and land cover mapping.

- (2) Map areas previously not surveyed and incorporate these new coverages with improved ADID coverages into a comprehensive wetlands and land cover map.
- (3) Produce a GIS layer for the wetland and land coverages.
- (4) Review Installation construction projects for impacts to wetland resources with emphasis on avoidance and minimization of impacts.

Project 2: Wetlands Restoration Mitigation Monitoring

Strategy: To implement wetlands restoration and enhancement projects on the properties of NASKW.

- Tasks:**
- (1) Identify and prioritize projects that provide the best ecological benefit for the cost.
 - (2) Consult with Navy engineers, planners, and biologist for assessing project feasibility and requirements.
 - (3) Develop a plan for implementing specific wetlands restoration and enhancement projects.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Wetlands

Federal Water Pollution Control Act, as amended by the Clean Water Act (CWA) of 1977, 33 United States Code (USC) 1251, prohibits the discharge of dredged or filled materials into waters of the United States, including wetlands, without first obtaining a permit from the USACE (Section 404 of the CWA).

Executive Order (EO) 11990, 24 May 1977, as amended, requires government agencies, in carrying out agency actions and programs affecting land use, to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Clean Water Act: Section 401 Water Quality Certification, 1986, 33 USC 1341, requires that states certify compliance with federal permits or licenses and with state water quality requirements and other applicable state laws. Under Section 401, states have the authority to review any federal permit or license that may result in a discharge to wetlands or other waters under the state's jurisdiction to ensure that the actions would be consistent with the state's water quality requirements.

EO 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems.

OPNAVINST 5090.1E, 12-3.8(c), discusses natural resources management relating to wetland management.

Additional Sources of Information

Telephone Contacts:

- USFWS, Regional Wetland Coordinator – (404) 679-7129
- FDEP, Monroe County, Florida, - (305) 289-7081
- USACE, Miami Regulatory Office, - (305) 526-7185
- The Center for Wetlands, University of Florida - (352) 392-2424
- South Florida Water Management District (SFWMD) – (561) 686-8800
- EPA, Regional Wetlands Coordinator – (404) 562-9408

Internet Addresses:

- FDEP Office of Submerged Lands and Environmental Resources:
<https://floridadep.gov/water/submerged-lands-environmental-resources-coordination/content/submitting-erp>
- Wetland Science Institute:
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/>
- University of Florida: Center for Aquatic and Invasive Plants: Institute of Food and Agricultural Sciences: <http://plants.ifas.ufl.edu/>
- EPA: Office of Water, Wetlands, Oceans and Watersheds:
<https://www.epa.gov/aboutepa/about-office-water#wetlands>
- South Florida Water Management District: <https://www.sfwmd.gov>
- U.S. Army Corps of Engineers Jacksonville District: <https://www.saj.usace.army.mil/>

4.1.2 Floodplain Management

The Federal Emergency Management Agency (FEMA) defines floodplains as areas subject to a 1% or greater chance of flooding in any given year. Floodplains are low, relatively flat areas adjoining inland and coastal waters. Boca Chica Field is within a floodplain and is susceptible to storm surge flooding (see Figure 3-11). The 100-year storm and 500-year storm tidal surges are estimated to be 8 feet (2.4 meters) MSL and 12 feet (3.7 meters) MSL, respectively. The potential for strong currents and wave action compounds the flood hazard. About 86% of the island is below 5 feet (1.5 meters) in elevation and is subject to flooding from lesser storm surges about once every 15 years.

Objectives

3. *Develop corrective and preventative measures to reduce the damage caused by flooding to Installation infrastructure and natural resources, including the maintenance and expansion of living shorelines.*

Long-Term Management

Floodplain management is the operation of an overall program of corrective and preventive measures for reducing flood damage. Floodplain management aims to achieve a reduction in the loss of life, disruption, and damage caused by floods, as well as the preservation and restoration of the natural resources and functions of floodplains. Floodplains perform important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and erosion prevention. Also, floodplains provide habitat for wildlife, recreational opportunities, aesthetic benefits, and areas of archaeological significance.

FEMA has various floodplain management publications and guidance for reducing flood damage in coastal areas. For all construction and development activities, alternatives and techniques will be evaluated for controlling and reducing the potential for flood damages. Consistent with the DoN's policy of no net loss of wetlands, NASKW will avoid construction in wetlands when possible. NAS Key West will protect natural areas (i.e. coastal berm and mangrove fringe) that provide storm surge protection. Furthermore, NASKW management will maintain and expand living shorelines, particularly in areas vulnerable to erosion.

Climate Change

Several recent rainfall events in southeastern states have been classified as having a 1-in-500 and even 1-in 1,000 chance of occurring in a given year. Hurricane Wilma in 2005 flooded the NASKW Airfield, spurring a multi-year airfield restoration project to ensure proper draining and uninterrupted airfield useage. Hurricane Irma in 2017 wobbled to avoid a direct impact to Key West but brought devastating flood waters to the middle-Keys. Such events may be expected to become even more frequent as global temperatures continue trending up since warmer air increases the evaporation rate of water. For every degree Celsius increase in temperature, a parcel of air can hold 7 percent more water. Average annual rainfall across the United States has gone up by 5 percent since 1990, with regional variation, according to the National Climate Assessment.

The position of NASKW on low land between Florida Bay and the Atlantic Ocean increases its susceptibility to storm surge but also helps facilitate drainage after a surge. The online NOAA Sea Level

Rise Viewer indicates that a surge of four feet would inundate practically the entire airfield at Boca Chica Key. Maintaining the natural wetlands drainage on the installation would help ensure that storm surge is dissipated as efficiently as possible.

Project Summaries

Project 1: Wetlands Protection and Shoreline Enhancement

Strategy: Review all proposed construction activities for potential damage from flooding.

Tasks:

- (1) Coordinate with facility and environmental personnel to ensure the siting, design and construction is consistent with the floodplain management strategy.
- (2) Incorporate corrective and preventive measures that may reduce the damage caused by floods.

Strategy: Preserve and restore the function of floodplains to reduce the damage caused by flooding.

Tasks:

- (1) Identify areas to protect and restore that provide important flood control functions.
- (2) Avoid manmade alterations to natural areas or wetlands that may increase the potential for flood damage.
- (3) Restore drainage conveyances on Boca Chica Key to improve drainage efficiency and reduce flooding on mission critical runways and within LKMR habitat.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Floodplains

EO 11988, Floodplain Management, May 24, 1977, requires federal service agencies to avoid construction or management practices that will adversely affect floodplains, unless it is found that: 1) there is no practical alternative, and 2) the proposed action has been designed to minimize harm to or within the floodplain.

OPNAVINST 5090.1E, 12-3.8(c), discusses natural resources management relating to floodplain management.

44 CFR Chapter 1 Subpart C Section 60.22, contains suggestions for improving floodplain management to reduce the possibility of flooding.

Additional Sources of Information

Internet Addresses:

FEMA's Floodplain Management Publications:
<https://www.fema.gov/floodplain-management-publications>

Monroe County Floodplain Management:
<https://www.monroecounty-fl.gov/173/Floodplain-Management>

4.1.3 Soil Conservation and Erosion Control

Soil conservation involves the identification (e.g., type, location, and amount) and appropriate use of soils in accordance within the limits of its physical characteristics while protecting it from uncontrolled storm events and stormwater runoff to prevent and control soil erosion. This information will be used to plan the use and management of soils for construction, recreation facilities, and wildlife habitat. More fragile soil types require modifications to the timing, intensity and frequency of management practices. Knowing where soil types are located on a particular tract, and understanding the capabilities and limitations of the soils are prerequisites to selecting the most appropriate natural resources improvement practices.

Areas on the Installation having poorly drained soils are susceptible to a high rate of runoff and significant soil erosion. Soil erosion contributes to water quality and conveyance problems, which may include: (1) elimination of habitat (terrestrial and aquatic), (2) reduction in reservoir capacity and stream flow, (3) increased flooding potential, (4) affected water quality, and (5) increased maintenance time and costs associated with stormwater facilities (i.e., culverts, ditches, and swales).

Water quality is affected by increased sedimentation. Sedimentation is particularly detrimental to benthic organisms and many fish species. Sedimentation can eliminate habitat by covering food sources and spawning sites and can smother bottom-dwelling organisms and periphyton. In addition, sedimentation increases turbidity, thereby limiting the depth to which light can penetrate and limiting aquatic vegetation photosynthesis. Reductions in photosynthesis can decrease dissolved oxygen levels below levels required to sustain aquatic vegetation, fish, and benthic invertebrates.

Actions contributing to soil erosion on the Installation include:

Human alterations to the natural vegetative cover and topography, including the channeling of water flow (e.g., ditches) which increases the quantity and rate of flow; the exposure of soils and increased soil slopes; and/or the creation of impervious surfaces.

Wave and wake action along the shoreline areas of the Installation.

Development in poor soil quality areas.

Improper mowing and maintenance of grassed areas.

Objectives

4. *Continue and establish new procedures as part of the natural resources program to control soil erosion and sedimentation.*

Long-Term Management

The long-term management concept for soil conservation is to identify and understand the suitability and sustainability of a soil unit for a proposed action. United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil surveys have been reviewed to determine constraints on soil management units, and may also be used to determine appropriate management practices. The USDA soil survey for Monroe County (1995), also provides information about potential erosion hazards; groundwater contamination; productivity of cultivated crops, trees, and grass; and the protection of water quality, wetlands, and wildlife habitat.

- Soil management strategies include:
 - Continued use of BMPs (FDOT and FDEP 2007; FDEP 2008, NASKW 2016) to control soil erosion for all natural resources operations. In addition, implement six principles for soil conservation and erosion management (Smoot and Smith, 1999).
 1. Minimizing areas of disturbance by leaving intact stream buffers, forest conservation areas, wetlands, highly erodible soils, steep slopes, environmental features, and stormwater filtration areas;
 2. Stabilizing and protecting disturbed areas that are highly susceptible to erosion as soon as practicable;
 3. Minimizing runoff velocities;
 4. Protecting waterways and stabilizing drainage ways that may be particularly susceptible to sedimentation;
 5. Retaining sediment within construction sites; and
 6. Reducing exposure time.
- Maintain SWPPP (NASKW 2016) to include control measures for shoreline areas.
- Reduced mowing and increase grass height and coverage, where practicable.
- Evaluate and map erosion control problem areas on the Installation.
- Control potential erosion problems by:
 1. Using vegetative and structural protective covers (e.g., permanent seeding, groundcover);
 2. Using sediment barriers (e.g., straw bales, silt fence, brush);

3. Creating sediment detention ponds and basins (e.g., sediment traps and basins);
4. Implementing pond and shore-bank protection (e.g., rip-rap);
5. Constructing pervious surface walkways in areas of high pedestrian traffic;
6. Constructing water conveyances (e.g., slope drains, check dam inlet and outlet protection);
7. Implementing temporary construction and road stabilization (e.g. placement of stone and geotextile fabrics [Smoot and Smith, 1999]); and
8. Repairing bare and slightly eroded areas quickly.

Climate Change

The rate and severity of soil erosion is affected by precipitation, temperature, runoff, and vegetative cover, all of which are susceptible to climate change. Increased and prolonged drought can result in the loss of vegetation that would otherwise stabilize embankments. Increased precipitation may exacerbate, these conditions by removing topsoil through runoff and thereby inhibiting vegetative re-establishment. In addition, tropical storm events can bring coastal flooding that dramatically erode dune systems and landscapes. Often, small-scale instances of soil erosion due to even minor changes in vegetation cover or surface runoff can persist and grow, so awareness combined with rapid recognition and response are all important to mitigate the impacts of soil erosion.

Project Summaries

Project 1: Wetlands Protection and Shoreline Enhancement

Strategy: Protect and maintain land and water resources through wetland restoration and enhancement while supporting the supporting the military mission.

- Tasks:**
- (1) Consult with soil conservation experts from NAVFAC SE, as well as with the USDA NRCS on specific methods that will be used implement erosion control projects.
 - (2) Establish and implement BMPs to prevent soil erosion during all operations at the Installation (FDOT and FDEP 2007; FDEP 2008, NASKW 2016).
 - (3) Train and educate all contract and department personnel on actions that may directly or indirectly contribute to soil erosion, and measures that can be employed to avoid or lessen these conditions.
 - (4) Establish practices to prevent further erosion and degradation of shorelines.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Soil Conservation

Soil Conservation Act, 16 USC 590a et seq., provides for soil conservation practices on federal lands.

Federal Water Pollution Control Act, as amended by the CWA of 1977, 33 USC 1251, regulates the dredging and filling of wetlands and establishes procedures for identifying and regulating nonpoint sources of polluted discharge, including turbidity, into waterways.

EOs 11989 and 12608 close areas to off-road vehicles where soil, wildlife, or other natural resources may be adversely affected.

EO 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems. Vegetative buffers and landscaping to control soil erosion must comply with this executive order.

OPNAVINST 5090.1E, 12-8(d) discusses natural resources management relating to soil conservation management.

Additional Sources of Information

Telephone Contacts:

USDA NRCS State Office: 352-338-9508

USDA NRCS, Monroe County: 786-742-3465

FDEP, Environmental Resources Permitting: 305-289-2310

Internet Addresses:

USDA NRCS: <https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/>

The National Erosion Research Laboratory: <https://www.ars.usda.gov/midwest-area/west-lafayette-in/national-soil-erosion-research/>

4.1.4 Stormwater and Water Quality Control

Stormwater runoff is precipitation that falls onto surfaces, such as roofs, streets, the ground, etc., and is not absorbed or retained by that surface, but flows off, collecting volume and energy. Stormwater runoff management addresses measures to reduce flow energy and pollutants in stormwater, and to control discharge from point and non-point sources. Non-point source pollution is pollution of surface-water and groundwater resources by diffuse sources. Point source pollution is pollution identified by a single, identifiable point source.

Stormwater discharges have been increasingly identified as a significant source of water pollution in numerous nationwide studies on water quality. As development increases at NASKW, the control of stormwater drainage is an increasingly important aspect of water quality control. More impermeable surface area, less land available for absorption and filtration, translates to faster runoff rates and increased pollution loads. More development means more land clearing and landscaping activities that require appropriate stormwater management practices. It is especially important to have effective stormwater management where developed areas are proximate to surface water bodies.

Objectives

5. *Protect water quality of wetlands and other water bodies from non-point source and point source pollution including erosion.*

Long-Term Management

NAS Key West natural resources program will be guided by the following management concepts for stormwater runoff and water quality control:

1. Continue to manage stormwater in natural areas consistent with BMPs (FDOT and FDEP 2007; FDEP 2008, NASKW 2016) to the extent practicable,
2. Update SWPPP (NASKW 2016) to include stormwater management practices for non-industrial areas such as forested and shoreline areas, and for non-industrial activities such as forest clearing,
3. Protective buffer strips or corridors of designated widths will be maintained and/or developed around wetlands and along shorelines. Allowances will be made for essential military mission requirements,
4. As part of the Oil and Hazardous Substance Spill Contingency Plan, implement the natural resource damage assessment program for assessing natural resource damages arising from the release of oil or hazardous substances that injure or threaten to injure natural resources of the United States. The program consists of criteria and procedures for collecting and evaluating the extent of damage to natural resources resulting from an incident and for determining restoration measures,
5. Manage stormwater runoff from new development in order to protect adjacent natural areas, and
6. Assess alternatives to existing pesticides, herbicides, and fertilizers with the intent of protecting water quality.

Climate Change

Water resources in the United States are affected by a number of climate stressors, including increasing temperatures, changing precipitation patterns, and extreme events. Elevated

water temperatures and increased sediment runoff are two of the most obvious impacts to water quality that result from climate change. Measures that can help to maintain good water quality and stormwater management in the face of a warming climate include:

- Planting trees to shade the ground and keep it cool, and reduce erosion;
- Controlling bank erosion to keep channels from getting wider and shallower, which would warm them more easily, and to reduce heat-trapping particles in water;
- Creating deep pools and artificial logjams to provide shade or deep water that limits direct heating from sunlight and creates biotic refugia and habitat;
- Removing unneeded channelization to restore natural groundwater exchange and connection to floodplains which promotes floodwater infiltration into aquifers;
- Constructing narrow streets for less heat-holding asphalt and to yield less runoff;
- Permeable paving to keep runoff from moving over heated roadways and promote infiltration during rain events;
- Building swales and rain gardens to get water underground and control runoff;
- Using rain barrels and cisterns to keep stormwater on a lot; and
- Installing green roofs to lower temperatures compared to conventional roofs, reduce energy use and wasted heat, and trap stormwater on site.

Project Summaries

Projects: None.

Strategy: Evaluate the stormwater management program and activities contributing to stormwater runoff and/or pollutant loading in stormwater runoff as it relates to the natural resources program.

- Tasks:**
- (1) Continue to implement BMPs to minimize stormwater runoff during natural resources management actions (FDOT and FDEP 2007; FDEP 2008, NASKW 2016).
 - (2) Natural resources personnel will review construction projects to evaluate stormwater discharge into wetlands and waterbodies and ensure that:
 - Stormwater runoff is subjected to BMPs prior to discharging into wetlands and waterbodies. BMPs shall prevent or reduce the amount of pollution in water to a level compatible with Florida Surface Water Quality Standards;
 - No site activities result in violation of state water quality standards associated with the siltation of wetlands, or reduction in the natural retention or filtering capability of wetlands;
 - Adequate soil erosion measures are implemented.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Stormwater

Federal Water Pollution Control Act, as amended by the CWA of 1977, 33 USC 1251, describes guidelines for the control of nonpoint source pollution.

Coastal Zone Management Act of 1972 (CZMA), 16 USC 1451 et seq., establishes authority (Section 6217) for states to administer coastal nonpoint pollution programs when approved by the National Oceanic and Atmospheric Administration (NOAA) and EPA.

EO 11990, 24 May 1977, as amended, directs the preservation and enhancement of wetlands.

Oil Pollution Act of 1990 (OPA 90), 33 USC 2701, requires planning for, rescue of, minimization of injury to, and assessment of damages or injury to fish and wildlife resources from the discharge of oil.

Comprehensive, Environmental Response, Compensation and Liability Act, 42 USC 9601, et seq., authorizes Natural Resource Trustees to recover damages for injury to, destruction of, or loss of natural resources resulting from the release of a hazardous substance.

OPNAVINST 5090.1E, 12-3.8 (f), discusses natural resources management relating to nonpoint source pollution.

OPNAVINST 5090.1E, Chapter 26, establishes requirements, guidelines, and standards for the assessment of damages arising from the release of oil or hazardous substances.

Florida Statutes, Chapter 373.403, Management and Storage of Surface Waters, regulates the management and storage of surface water and is implemented by the SFWMD through the environmental resources permitting process.

Florida Statutes, Chapter 376, Pollutant Discharge Prevention and Removal, prohibits the discharge of pollutants into coastal waters, estuaries, tidal flats, or beaches.

Florida Statutes, Chapter 380.012, The Florida Environmental Land and Water Management Act of 1972, is intended to: (1) ensure a water management system that reverses the deterioration of water quality and that provides optimum utilization of limited water resources; (2) facilitate orderly, well planned development; and 3) protect public health, welfare, safety, and quality of life for Florida residents

Florida Statutes, Chapter 403, Florida Air and Water Pollution Control Acts, conserves, protects, maintains, and improves the quality of the public water supply. Waste must not be discharged into any waters without prior approval from the State.

Florida Statutes, Chapter 582.05 Soil and Water Conservation, provides control and prevention of soil erosion, prevention of damage from floodwater and sediments, and conservation of soil and water resources.

Florida Coastal Management Program requires federal action in the coastal zone to be consistent with 23 Florida Statutes, which are administered by 11 state agencies and four of the five state water management districts. The coastal zone includes the area encompassed by the State’s 67 counties and its territorial seas. Therefore, federal actions that occur throughout the state are reviewed by the State for consistency with the FCMP. Consistency with the statutes constitutes consistency with the FCMP.

National Marine Sanctuary Act (16 U.S.C. §§ 1431 et seq.) protects significant marine habitats and special ocean areas like the Florida Keys. Under the Act, the Secretary of Commerce is authorized to designate and manage certain areas of the marine and Great Lakes environment that he or she considers to be nationally significant and that merit federal management.

Florida Keys National Marine Sanctuary and Protection Act (Pub. L. 101-605) designated the Florida Keys National Marine Sanctuary under Title III of the National Marine Sanctuary Act to protect and preserve living and other resources of the Florida Keys marine environment.

Additional Sources of Information

Telephone Contacts:

- EPA, Region 4, Stormwater Permitting: 404-562-9303
- FDEP, Stormwater Treatment, Monroe County: 305-289-7081
- SFWMD Florida Keys Service Center: 305-853-3219

Internet Addresses:

- Florida Keys Water Quality Protection Program:
<https://floridakeys.noaa.gov/wqpp/welcome.html>
- Managing Water Quality:
<https://waterknowledge.colostate.edu/hydrology/water-quality/>
- Environmental Law Institute: <https://www.eli.org/>
- USGS Water Resources Home Page:
<https://www.epa.gov/aboutepa/about-office-water>
- EPA Office of Water: <https://www.epa.gov/aboutepa/about-office-water#wetlands>

4.1.5 Grounds Maintenance and Landscaping

The majority of grounds maintenance and landscaping at NASKW is provided outside the natural resources program. Grounds maintenance is provided by contract through the Naval Facilities Engineering Command Southeast and is managed by NAS Key West’s Public Works Department. Grounds maintenance under this contract includes such services as grass cutting, edging, pruning, mulching, irrigation, and sodding. Although the grounds maintenance is outside the management scope for this INRMP, the natural resources program recommends implementing the following objectives and long-term management practices. Additionally, when mowing occurs in areas where federally-listed plants occur (see Figure 3-10 specific areas), the Environmental Division shall coordinate with USFWS and the grounds crew to develop mowing regimes that will support the protected plant populations on the installation. Mowing regimes on the airfield are depicted in the Boca Chica Grounds Maintenance Mapbook, which is available upon request.

Objectives

6. *Implement environmentally beneficial landscaping and grounds maintenance practices.*

Long-Term Management

Landscaping

NAS Key West’s natural resources personnel will recommend and incorporate the principles of xeriscaping into grounds maintenance and landscaping activities. Xeriscaping uses native plants and drought tolerant/non-invasive exotics, which are typically better adapted to local climatic conditions and variations; more resistant to drought, disease, and pests, and require less water than non-native species. Potential benefits of xeriscaping include reduced water use (typically 30 to 80 percent), decreased stormwater and irrigation runoff, fewer pesticide and fertilizer applications, less yard waste, increased habitat for native plants and animals, and lower labor and maintenance effort and thus costs. Xeriscaping will be utilized in all new construction activities and will be phased into existing landscape areas. Xeriscaping offers a viable alternative to the typically high-volume water requirements of other landscaping approaches by conserving water through creative landscaping.

Xeriscaping incorporates seven principles (Xeriscape Colorado Inc. 1999):

- Planning and design for water conservation and aesthetics,

- Creating practical turf areas using manageable sizes, shapes, and appropriate grass species,
- Selecting plants with low water requirements and grouping plants with similar water needs, then experimenting to determine how much and how often to water the plants,
- Using soil amenities, such as compost or manure, appropriate to site and plant needs,
- Using mulches such as wood chips to reduce evaporation and keep the soil cool,
- Irrigating efficiently with properly designed systems (including hose-end equipment) and by applying the right amount of water at the right time, and
- Maintaining the landscape by mowing, weeding, pruning, and fertilizing properly. Grass mowing should not be excessive and should be based on height rather than by arbitrarily specified time intervals.

To integrate the principles of xeriscaping into existing landscaped areas, the Installation should evaluate regional initiatives and current landscaping practices and sites and to predict the effectiveness of xeriscaping toward improving existing conditions. NAS Key West should evaluate whether the implementation of xeriscaping principles will: 1) provide sufficient benefits to justify any additional cost; 2) achieve the desired results; or 3) continue to achieve desired results. The success of integrating the xeriscaping principles into existing landscaped areas should be monitored and adjustments to management practices will be made, as necessary.

To maximize benefits for wildlife in urban areas, NASKW Natural Resources program will recommend and/or use the following guidelines when reviewing landscaping projects, as long as these benefits will not interfere with the military mission.

- Frame properties with a backdrop of native trees, which will simulate a forest canopy and provide nesting sites, protective cover, and food for small mammals and birds. Deciduous trees will be planted on the west side of buildings for summer shade.
- Create understories by planting smaller flowering or orchard trees in clusters near tall trees. The plants will be staggered at irregularly spaced intervals, avoiding, as much as possible, planting in lines or rows. When planting shrubbery borders, several varieties will be mixed to achieve varying shapes, heights, and densities. Shrubs that fruit at different times of the year will also be planted for a continuous food supply.
- Surround smaller trees with masses of shrubs, brambles, or ground covers. These will provide protective areas for ground-feeding birds and mammals.
- Plant shrubs and ground covers around building foundations.
- Frame lawns with above vegetation.

- Surround lawn areas with trees and shrubs. Plant small shrubs and ground covers around solitary trees. Irregular borders will be used to create more wildlife edge.
- Mulch trees and shrubs with leaf litter, lawn clippings, tree trimmings, or wood chips. Mulches are a rich food source for ground foragers like towhees and thrushes; provide cover for small mammals, reptiles, and amphibians; also enrich the soil.
- Replace exotic plant species with native species.
- Convert portions of lawns to “meadows,” which will be mowed only twice in the summer to control tree and shrub invasion. Wildflowers, butterflies, and bees can flourish in small meadows. Wildflower plantings provide many benefits, including reduced mowing efforts and expenses, increased wildlife potential, and improved aesthetics.
- Select a variety of shrub heights, but a minimum height of 3.5 to 8 feet will be maintained. The best hedges for bird cover and nesting are evergreens that have dense or thorny branches. Blackberries are also ideal. Remove large tree species that sprout and grow in the hedges.
- Birds prefer unclipped, informal hedges, so old growth will be selectively cut to assure that the plants do not overcrowd one another. Avoid pruning during the nesting season. Early flowering shrubs that bloom from buds formed during the previous summer will be selectively pruned or cut back only every few years.
- Orchard and flowering trees will be located to receive full sun. Avoid the use of toxic sprays. Instead, plant fruit varieties that thrive without pesticides.
- Control seedlings beneath large trees, but a few young replacements will be left. Allow one or two selected vines to climb each tree. Conserve standing dead trees and limbs that do not pose a safety hazard.
- Consider planting evergreens such as juniper (*Juniperus virginica* and *J. siliciola*), wax myrtle (*Myrica cerifera*), pines (*Pinus elliottii* and *P. taeda*), and hollies (*Ilex* spp) to provide sound barriers from roads and other land uses. In the planting of all tree and shrub species, consideration will be given to the ability of the species to provide food for wildlife and habitat for bird species.

Grounds Maintenance

The natural resources program at NASKW will recommend and/or implement of the following ground maintenance guidelines:

- Avoid excessive mowing. Grass mowing should be scheduled on the basis of height, rather than by arbitrarily specified time intervals, if practicable. Mowing regimes on the airfield are depicted in the Boca Chica Grounds Maintenance Mapbook, which is available upon request;
- Maintain good ground cover through proper fertilization to prevent erosion. If erosion occurs, the problem will be fixed as soon as possible;

- Natural resources personnel will review ground maintenance contracts prior to renewal.
- Mulch around trees and shrubs, where applicable, to avoid potential girdling from hand trimmers.
- Implement grounds maintenance activities in the vicinity of airfields to reduce BASH-related incidents.

Climate Change

Hotter, drier summers would necessitate the use drought-tolerant plants to maintain an aesthetic landscape. Increased native shade tree and shrub plantings would also help cool the ground and allow understory landscaping foliage to survive with minimal water. Planting native trees and tall shrubs where they can shade windows also helps to mitigate the cost of air conditioning. Permeable surfacing in parking lots would improve natural drainage, benefit the water table, and prevent flooding risks in maintained areas, especially when supplemented by “tree islands” placed throughout the lot. Additionally, permeable surfaces absorb less heat than traditional pavements. Tall grass provides shade on lawns to reduce evaporation from topsoil, so mowing grass to a taller height can help to maintain its health when the weather is dry and hot. Generous mulching also helps to reduce evaporation in garden beds and other vegetated plots.

Project Summaries

Project 4: Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitat.

Strategy: NAS Key West’s natural resources program will implement grounds maintenance and landscaping practices consistent with the concepts presented in this INRMP.

- Tasks:**
- (1) Educate Installation and contractor personnel on the principles of grounds maintenance and landscaping discussed in this INRMP.
 - (2) Continue efforts to reduce BASH incidents at the Boca Chica Field to include:
 - Manage airfield mowing to maintain grass height between seven and fourteen inches (7"-14") to discourage birds that prefer shorter grass without attracting large numbers of rodents and birds that prefer taller grasses;
 - Control broad-leaf weeds, the seeds of which are a food source for birds and rodents;
 - Plant bare, unvegetated areas using low maintenance, non-bird attracting ground cover; and
 - Remove dead vegetation, perches or other high spots, edge effects and trees or other plants with berries.

- (3) Develop procedure for all new landscaping projects and grounds maintenance contracts to be reviewed by natural resources personnel.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Landscaping

The President’s April 16, 1994, Memorandum on Environmentally Beneficial Landscaping, requires implementing landscaping practices that are intended to benefit the environment and generate long-term cost savings.

Executive Order 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems.

Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. 136, governs the use and application of pesticides in natural resources management programs.

Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, 33 U.S.C. 1251, prohibits the discharge of dredged or filled materials into waters of the United States, including wetlands, without first obtaining a permit from USACE (Section 404 of the CWA).

OPNAVINST 5090.1E, 12-3.8(e), discusses natural resources management relating to environmentally and economically beneficial landscaping.

Additional Sources of Information

Telephone Contacts:

Monroe County Extension Office: 305-292-4501

Internet Addresses:

Waterwise Florida Landscape:

<https://www.sfwmd.gov/document/waterwise-south-florida-landscapes-plant-guide>

Florida Association of Native Nurseries: <https://www.afnn.org/>

Landscaping for Wildlife: https://edis.ifas.ufl.edu/topic_landscaping_for_wildlife

Florida Keys Friendly Landscaping: <https://konklife.com/uf-ifas-extension-hosting-florida-friendly-landscaping-trainings/>

4.1.6 Invasive, Exotic, and Noxious Species

Species can be categorized as invasive, exotic, and native, and/or native and invasive. Invasive species are alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. In natural areas, the definition of invasive species is expanded to include aggressive plants that produce a significant change in terms of

composition, structure, or ecosystem functions (Cronk and Fuller 1995). Executive Order 13112, Invasive Species, of February 3, 1999 requires executive agents to restrict the introduction of exotic organisms into natural ecosystems. An exotic species is defined as a non-indigenous (non-native) species that was either purposefully or accidentally introduced into an area outside its natural range.

The Federal Noxious Weed Act of 1974 (7 U.S.C. 2801-2814) provides for the control and eradication of noxious weeds and their regulation in interstate and foreign commerce. It defines noxious weeds as “any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation, or the fish and wildlife resources of the United States or the public health, and includes kudzu (*Pueraria lobata* Dc)” (7 U.S.C. 2802 (c)).

Objectives

7. *Control and eradicate invasive and exotic species.*

Long-Term Management

During the 2004-05 survey completed by FNAI, 2,353 occurrences of 47 exotic and invasive plant species were identified on NASKW. A description, area of occurrence, treatment and management recommendation is given for each species within the final report (FNAI 2005). Invasive and exotic species are managed through the removal of the species and restrictions on the introduction of the species to the Installation in accordance with Executive Order 13112.

Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*), latherleaf (*Colubrina asiatica*), Lead tree (*Leucaena leucocephala*), sisal hemp (*Agave sisalana*) and melaleuca (*Melaleuca quinquenervia*) pose the greatest threat to natural areas and other vegetated areas on NASKW property. Eradication and control of these 6 species are a priority and has been ongoing.

A second level of invasive and exotic species infestations worthy of noting include: Phoenix palms, seaside mahoe (*Thespesia populnea*), beach naupaka (*Scaevola sericea*), trumpet tree (*Tabebuia heterophylla*), umbrella tree (*Schefflera actinophylla*), bowstring hemp (*Sansevieria hyacinthoides*), life plant (*Kalanchoe pinnata*), sapodilla (*Manilkara zapota*), and the oyster plant (*Tradescantia spathacea*). Though not found in large quantity yet, these species

are spreading and beginning to affect natural systems; they will be much more difficult to eradicate if continued spread is allowed. As part of the exotics eradication process, careful monitoring is required, with follow-up treatments where necessary.

Prior to the use of a Federal Insecticide, Fungicide, and Rodenticide Act- (FIFRA-) regulated pesticide at NASKW, the Installation's NRM will contact the Applied Biology Department of NAVFAC Atlantic for information regarding approved pesticides, including the location of use, amount, and concentrations, as well as treatment methods (e.g. basal-bark, cut-stump, cut-surface, foliar). The applicability of burning or hand clearing in combination with pesticides will also be considered, as well as other non-pesticide removal methods.

The use of pesticides for removal of invasive and exotic species and pests will be conducted in accordance with federal and state laws regulating the use of pesticides. According to the EPA, a "pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses; the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests". Under the FIFRA, 7 U.S.C. 136, pesticides are registered at the federal level and by individual states. Therefore, a particular pesticide product that is federally registered by the EPA is not legal for use until it is also registered by the individual state. FIFRA allows individual state registrations to be more restrictive than federal registrations, but not less so.

To ensure that the application of pesticides does not contaminate surface waters and/or inadvertently affect flora or fauna, pesticides shall be applied by skilled DoD or state-certified workers and according to label instructions. Careful prescription of the type and amount of chemical to be applied and the use of buffer areas around surface waters will also help prevent misdirected application or deposition. Pesticides with lower toxicity shall be used and applied at rates below those specified on the label, when it is believed that such modifications can adequately address the problem. The Installation will evaluate the effectiveness of the lower rates and toxicity, and shall apply pesticides in accordance with label instructions if the lower rate applications are not adequately controlling the problem. The Installation shall also consider the applicability of non-pesticide removal methods.

Climate Change

Climate change will likely bring about more rapid introduction and proliferation of exotics species. Effective tools, such as prescribed fire, are difficult to implement at NASKW, but would help give native plant species a competitive advantage over exotic species. Coordinated regional fire management efforts emphasizing frequent, low intensity fire regimes in wetland systems would maximize habitat quality and resilience to change while preventing fuel load build up that could lead to unplanned fires.

Regional cooperation among land management entities will become more essential since invasive seeds can be easily broadcast across installation boundaries, as is apparent with the grove of Australian pines adjacent to Truman Annex. Coordinated regional invasive exotic species prevention and control efforts also facilitate early detection and rapid response to nascent invasions.

Living shorelines composed of native marsh grasses and mangroves would preclude the establishment of invasive seedlings along the coast while also buffering the coastline from storm surge and erosion.

Project Summaries

Project 11: Habitat Management and Restoration (Invasive and Exotic Vegetation Control).

Strategy: Continue to eradicate/control invasive and exotic plant species, which are altering natural areas and endangered species habitats by displacing native species.

Tasks: (1) Develop an invasive and exotic species management strategy from the invasive species survey of the Installation to determine: areas of priority for exotic and invasive species removal; removal methods, including time of year for removal and, if appropriate, pesticide application rates.

Consult with the Applied Biology Department at NAVFAC Atlantic for information on approved pesticides, treatment methods and application rates. Consider non-pesticide removal methods and removal using pesticides with lower toxicity and applied at reduced rates.

Consult with biologists from DoN, as well as with federal, state, and county biologists, and land managers, for identification of invasive and exotic species, and for appropriate, effective measures to protect fish and wildlife.

(2) Identify groups and/or programs that could contribute to the removal effort.

- Natural resources staff members,
- Contractor and Installation personnel,
- Volunteer groups (e.g. Scout troops, SCA), and

- Special Interest Groups (e.g. TNC).
- (3) Ensure adequate training of removal teams.
 - (4) Maintain a program for the eradication and control of invasive and exotic species and prohibit the planting of such species as part of NAS Key West's grounds maintenance contract. Develop a monitoring and re-removal program for problem areas.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Invasive Species

Federal Noxious Weed Act of 1974, 7 U.S.C. 2801 et. seq., provides for the control and eradication of noxious weeds and their regulation in interstate and foreign commerce.

Executive Order 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems.

Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 136, requires that all pesticides, whether for commercial or private use, be applied in accordance with product labeling and that containers are properly disposed of. EPA is responsible under FIFRA for the registration of all pesticide active ingredients used in the United States.

OPNAVINST 6240.4B, 27 August 1998, DoD Pest Management Program, provides the DoN with policies for implementing pest management programs directed against pests that conflict with or adversely affect the mission of the DoD; affect the health and well-being of the DoN personnel and their dependants; attach or damage real property, supplies, or equipment; adversely affect the environment; or are otherwise undesirable.

Federal Plant Pest Act, 7 U.S.C. 150a et seq., regulates the importation and interstate movement of plant pests and authorizes the Secretary of Agriculture to take emergency measures to destroy infected plants or materials.

OPNAVINST 5090.1E, 12-3.10(a), discusses natural resources management relating to the control of noxious weeds.

Florida Statutes, Chapter 370.072, Florida Endangered and Threatened Species Act, is to conserve, protect, and manage the threatened and endangered species and their habitats.

Florida Statutes, Chapter 487, the Florida Pesticide Law, regulates the distribution and use of pesticides.

Florida Statutes, Chapter 482, Structural Pest Control Act, requires using pesticides for their intended purpose in accordance with the registered labels or as directed by the EPA.

Florida Statutes, Chapter 369.2, Florida Aquatic Weed Control Act, regulates noxious aquatic weeds on public lands.

Florida Statutes, Chapter 369.252, Invasive Exotic Plant Control, requires a program be established to eradicate or maintain control of the species detrimental to the State’s natural environment.

Additional Sources of Information

Telephone Contacts:

NAVFAC LANT Applied Biology Dept: Sabra Scheffel, 757-322-4320

FDACS, Pesticide Division: 800-435-7352

Internet Addresses:

DoD Invasive Species Management: <http://www.dodinvasives.org/>

Florida Exotic Pest Plant Council: <https://www.fleppc.org/>

University of Florida, Center for Aquatic and Invasive Plants: <http://plants.ifas.ufl.edu/>

FDEP Invasive Plant Management:
<https://floridadep.gov/rcp/coral/documents/fact-sheet-invasive-species>

FNAI: <https://www.fnai.org/>

4.2 Coastal and Marine Management

Objectives

- 9. *To protect and conserve maritime and near-shore estuarine habitats.*

Long-Term Management

The Coastal Zone Management Act of 1972 (16 U.S. Code [USC] 1451 et seq.), as amended, encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. NAS Key West will ensure that any of its activities that would directly affect or that would be conducted in the coastal zone are carried out in a manner that is, to the maximum extent practicable, consistent with approved coastal zone management programs.

The management of erosion to reduce or eliminate sediment influx into the near shore environment is a crucial management component for marine resources and essential fish habitat (EFH). Seagrass, mangrove stands, and near shore coral reefs are all EFH and are susceptible to rapid decline when exposed to persistent sedimentation. Seagrasses are affected by direct

sedimentation and light attenuation and are a very important species for many near shore fauna including the endangered West Indian Manatee. Coral reef systems are not easily adaptable to increased sediment loading and light attenuation caused by turbid waters. Perhaps the most important management control that NASKW can employ is the use of BMPs for any base development project to ensure that turbidity is not created within the near shore Florida Marine Sanctuary waters (FDOT and FDEP 2007; FDEP 2008, NASKW 2016).

- Utilize best management practices in the design of storm water drainage systems at NASKW.
- Utilize best management practices during earthwork and construction at NASKW to control sedimentation into the near shore waters and lagoons.
- Retain mangrove stands where possible for sedimentation control into near shore waters.

Climate Change

Increased precipitation could exasperate coastal erosion and nearshore sedimentation and harmful algal blooms, hindering estuarine production and seagrass growth. Much of the excess heat energy produced by global warming has been captured by the world’s oceans, leading to numerous changes in ocean conditions. Surface waters have also increased in acidity (lowered pH) by as much as 30 percent over the past 150 years, as oceans have absorbed large quantities of atmospheric carbon dioxide (Feely et al. 2004). Warming ocean waters and increased acidity are leading to rapid shifts in the distribution of marine organisms, and appear to be contributing to the emergence and spread of bleaching and diseases in corals (Hoegh-Guldberg and Bruno 2010). The loss of healthy coral reefs threaten marine ecosystems and could place Navy coastal assets at increased risk from storm events since compromised reefs are less effective at buffering waves and storm surge.

Coastal and marine management priorities to consider include:

- The extent to which ocean warming, ocean acidification, and sea-level rise are already affecting natural resources and operations,
- The potential implications of a range of scenarios for future reef loss and storm surge on habitats, infrastructure, and mission requirements, and
- Available options to sustain or restore coastal habitats providing protective benefits to installation facilities and other military assets.

Project Summaries

Project 13: Marine Resources Survey

Strategy: Protect and manage the marine resources while supporting the military, commercial and municipal uses (i.e. marinas, large vessel docking, and harbor operations).

Tasks:

- (1) Prioritize areas that require baseline surveys and continued monitoring.
- (2) Staff from NOAA FKNMS and FWC Aquatic Habitat Conservation and Restoration Section shall be afforded an opportunity to comment and make recommendations on survey methods.

Strategy: Conduct quantitative surveys to map near-shore marine resources, develop a comprehensive baseline, and track changes in order to effectively monitor and address issues in the marine ecosystem.

Tasks:

- (1) Updating near-shore marine benthic surveys every five years. Increasing quantitative depth of current surveys in subsequent years.
- (2) Survey the NASKW lagoons (East and West) to assess sea grass cover and species type and health.
- (3) Create a quantitative analysis of coral habitat at NASKW maritime facilities, specifically coral that is adhered to vertical surfaces. Assess the health of these species every five years.

Project 14: Smalltooth Sawfish Survey

Strategy: NAS Key West will conduct a shore based survey for the smalltooth sawfish along red mangrove open water habitat. The smalltooth sawfish is an endangered species that may utilize open water mangrove habitat for avoiding predation.

Tasks:

- (1) Conduct in-house surveys for the smalltooth sawfish on an annual basis - methodology to be determined.

Project 15: Sea Turtle Protection Lighting

Strategy: NAS Key West will reduce the emission of light that may disorient nesting sea turtles and hatchlings.

Tasks:

- (1) Replace lights with "turtle friendly" lighting that meets Florida Fish and Wildlife Conservation Commission (FWC) Guidelines.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Coastal and Marine Management

Coastal Zone Management Act (16 U.S.C. 1451, et seq.), as amended, provides for the preservation, protection, development and, where feasible, restoration or enhancement of the nation's coastal zone. As required by Section 307(c) of the Coastal Zone Management Act, a

proposed federal action must be consistent with the approved Florida Coastal Management Program to the maximum extent practicable.

The Magnuson-Stevens Fishery Conservation Management Act (16 U.S.C. 1801-1882), established regional Fishery Management Councils and mandated the creation of fishery management plans to responsibly manage exploited fish and invertebrate species in Federal waters of the United States. Congress re-authorized the Act in 1996 with several changes. One change was to charge NOAA Fisheries with designating and conserving EFH for Federally managed species. The revisions to the act are intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat. The statute requires Federal agency consultation with NOAA Fisheries on any project that may adversely affect EFH.

Executive Order 13089 (63 FR 32701-32703 (1998)), "to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment." The Executive Order directs that all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

National Defense Authorization Act of 2004, Public Law 108-136. This law recognizes that adequate conservation measures specified in an INRMP, and meeting other criteria that ensure implementation of the measures, can obviate the need for critical habitat designation on Department of Defense lands.

Additional Sources of Information

Telephone Contacts:

NOAA, Habitat Conservation Division: Kurtiss Gregg, 561-440-3167

NOAA, Protected Species: Joe Heublein, 727-209-5962

Florida Keys National Marine Sanctuary: Joanne Delaney, 978-471-9653

Internet Addresses:

Protected Resources: <https://www.fisheries.noaa.gov/region/southeast>

Essential Fish Habitat: <https://www.fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat>

4.3 Fish and Wildlife

Fish and wildlife management actions are designed to conserve, enhance, and regulate habitat for non-game indigenous wildlife species. This section addresses: 1) wildlife management, 2) threatened and endangered species and natural communities, and 3) prevention and control of wildlife damage and disease.

4.3.1 Wildlife Management

Wildlife management involves the implementation of general management practices to manipulate wildlife habitat in order to diversify existing wildlife populations. Growth and development on and surrounding the Installation will require the implementation of many general management practices to conserve and enhance terrestrial, aquatic and avian wildlife populations on NASKW and in the region.

Objectives

9. *Preserve, protect and manage wildlife and their habitats to ensure healthy productive populations.*

Long-Term Management

Manage wildlife habitats to sustain wildlife resources on the Installation consistent with the military mission. Presented below are many general long-term management concepts and protective measures that apply to terrestrial wildlife habitats, both regionally and on the Installation.

Sustain and enhance habitats for terrestrial and avian species using various combinations of the following management concepts. These management concepts will be implemented at the discretion of the Natural Resources Manager.

Terrestrial Wildlife Management

Protect natural communities necessary for the continuation of healthy wildlife populations.

Avoid habitat fragmentation. Arbitrarily locating human-made linear and non-linear structures within wildlife areas undermines ecological processes by separating wildlife populations and may render the fragmented parcel unsustainable for wildlife.

- Establish designated wildlife areas where appropriate throughout the Installation.
- Protect wetland areas that provide foraging, mating, and nesting resources for wildlife.
- Conserve mature hardwood communities to provide suitable large snags and trees for dens and cavities.
- Provide nest boxes/platforms for birds and bats.
- Leave brush material along upland woodland edges following necessary clearing, for instance, in support of the military mission.
- Plant trees and shrubs or seed open areas for soil stabilization and to provide wildlife habitat.
- Create or enhance corridors between natural areas to facilitate wildlife movement. The necessary characteristics of connections will vary depending on the species; for instance, amphibians need water or moist areas to move between ponds and wet areas, and most vertebrates require protective cover such as trees, shrubs, dense ground cover, downed trees, and existing burrows.
- Maintain vegetative buffers around ponds, wetland areas and along shorelines.
- Leave snags and downed logs for nesting, roosting, foraging, cover, perching, and/or territorial displays.
- Maintain hardwood areas for foraging activities.
- Coordinate maintenance (e.g., mowing, pruning, trimming) with seasonal wildlife needs, where it does not conflict with BASH requirements or other military mission activities.
- NAS Key West will coordinate with federal, state, and county agencies regarding the protection and enhancement of wildlife habitat and natural communities.

Migratory Bird Management

Under provisions of the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711), no one may take, pursue, hunt, capture, kill, attempt to take, capture, or kill, possess, sell, purchase, barter, or offer for sale, import, export, or transport any migratory bird, or their parts, including feathers, nests, and eggs—except under the terms of a valid permit issued pursuant to federal regulations. The Department of the Interior (DOI) currently recognizes 832 species of migratory birds. The list of species protected by the MBTA appears in 50 CFR 10.13.

In 2003, Congress passed the National Defense Authorization Act which directed DOI to prescribe regulations authorizing the Armed Forces to take migratory birds incidental to military readiness activities. In passing the Authorization Act, Congress itself determined that allowing incidental take of migratory birds as a result of military readiness activities is consistent with the MBTA and the treaties.

On 28 February 2007, DOI issued the final regulation regarding military readiness activities and the MBTA (50 CFR Part 21). The regulation provides that the Armed Forces must confer and cooperate with the U.S. Fish and Wildlife Service on the development and implementation of conservation measures to minimize or mitigate adverse effects of a military readiness activity if it determines that such activity may have a significant adverse effect on a population of migratory bird species. This rule also requires that when conservation measures implemented under this authorization require monitoring, the Armed Forces must retain any monitoring data for five years from the date the action is commenced. In addition, it will apply to military readiness training wherever it occurs (land, air and sea).

The requirement to confer with DOI is triggered by a determination that the military readiness activity in question will have a significant adverse effect on a population of migratory bird species. Such determinations will be based on analysis of the environmental impacts of a proposed military readiness activity through the National Environmental Policy Act (NEPA) process using the best scientific data available. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. Assessment of impacts should take into account yearly variations and migratory movements of the impacted species. Due to the significant variability in potential military readiness activities and the species that may be impacted, determinations of significant measurable decline will be made on a case-by-case basis.

A Memorandum of Understanding (MOU) developed in accordance with Executive Order (EO) 13186, addresses migratory bird conservation relative to Department of Defense non-military readiness activities. The MOU was signed on 31 July 2006. DoD responsibilities discussed in the MOU include, but are not limited to:

- (1) Obtaining permits for import and export, banding, scientific collection, taxidermy, special purposes, falconry, raptor propagation, and depredation activities,
- (2) Encouraging incorporation of comprehensive migratory bird management objectives in the planning of Department of Defense planning documents,
- (3) Incorporating conservation measures addressed in Regional or State Bird Conservation Plans in Integrated Natural Resource Management Plans,
- (4) Managing military lands and activities other than military readiness in a manner that supports migratory bird conservation,

- (5) Avoiding or minimizing impacts to migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds, and
- (6) Developing, striving to implement, and periodically evaluating conservation measures for management actions to avoid or minimize incidental take of migratory birds, and, if necessary, conferring with the Service on revisions to these conservation measures.

The MOU and EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) both direct the Department of Defense to emphasize Birds of Conservation Concern (BCC) when managing migratory birds. The U. S. Fish and Wildlife Service (2002) has provided lists of BCC by region of the country. These regions correspond to the Partners In Flight (PIF) conservation plan regions. PIF was launched in 1990 in response to growing concerns about declines in the populations of many land bird species, and in order to emphasize the conservation of birds not covered by existing conservation initiatives. The Department of Defense is one of the many federal agencies that signed a Memorandum of Agreement supporting the PIF initiative of bird conservation.

PIF's goal is to focus resources on the improvement of monitoring and inventory, research, management, and education programs involving birds and their habitats. PIF has developed Bird Conservation Plans (BCPs) for each physiographic area and/or state in the United States. These plans are among many recent efforts to address conservation of natural resources and ecosystems in the United States. They primarily address nongame landbirds, many of which are exhibiting significant declines that may be arrested or reversed if appropriate management actions are taken. BCPs emphasizes effective and efficient management through a four-step process designed to identify and achieve necessary actions for bird conservation:

- (1) Identify species and habitats most in need of conservation (i.e., prioritization),
- (2) Describe desired conditions for these habitats based on knowledge of species life history and habitat requirements,
- (3) Develop biological objectives that can be used as management targets or goals to achieve desired conditions, and
- (4) Recommend conservation actions that can be implemented by various entities at multiple scales to achieve biological objectives.

The Bird Conservation Plan for the Subtropical Florida was developed for the physiographic area encompassing NASKW. NAS Key West will implement long-term migratory bird management practices in support of PIF and the Bird Conservation Plan while

ensuring the Installation’s military mission. In addition to the terrestrial wildlife management practices discussed above, the following practices will be implemented for migratory bird management where consistent with the mission at NASKW:

- Monitoring for resident and transient migratory birds with emphasis on priority species to determine population trends in association with habitat management,
- Protection of the remnant natural habitats which support migratory birds and also are extremely important for in-transit migrants, and
- Developing other management strategies for high priority species designated in the Bird Conservation Plan for Subtropical Florida.

The management outlined in this plan, including conservation of mature hardwood hammock forest and mangrove swamp along with the control of invasive species will all have positive impacts on the white-crowned pigeon, yellow warbler, prairie warbler, reddish egret, black whiskered vireo and mangrove cuckoo -- all of which are BCC that reside on the Station in small numbers.

The MBTA does authorize permits for take of migratory birds for non-military readiness activities such as scientific research, education, and depredation control (50 CFR parts 13, 21 and 22). Takings could include habitat modifications, shooting, pesticide application, nest or egg removal, and occasionally, tree removal. The Station’s Natural Resources Manager will be informed before any action is taken that may affect any migratory bird species. The Natural Resources Manager will determine if the possible impacts associated with the action would impact migratory bird species and, if necessary, will initiate discussions or negotiate a permit with the USFWS.

The Commanding Officer maintains a depredation permit so a BASH control agent at NASKW may legally take migratory birds that pose a BASH threat. The agent needs to cooperate with the NRM to ensure that the goals, objectives, and strategies for migratory bird management are achieved in concert with the goals, objectives, and strategies of BASH control.

Florida’s Wildlife Legacy Initiative

U. S. Congress created the State Wildlife Grants Program to encourage a new conservation standard and work towards managing species before they become imperiled. This program is dedicated to an approach that includes all species, but is centered on conservation of species that are not included in current initiatives such as threatened and endangered species protection. The FWC has created Florida’s Wildlife Legacy Initiative in order to meet the intent

of the State Wildlife Grants Program. The goal of the Initiative has been to develop a strategic vision for conservation of all of Florida’s wildlife. The three main objectives of the Initiative have been: (1) to create partnerships for wildlife conservation across the State of Florida; (2) to support partnership building and use of the Strategy by making funding available through Florida’s State Wildlife Grants Program; and (3) to develop and implement Florida’s Strategy.

The purpose of Florida’s State Wildlife Grants Program has been to fund projects that benefit Florida’s wildlife and their habitats through implementation of the Strategy. Under the Grants Program, game, sport fish, or endangered species projects have not been excluded but they have not been given priority because those species already have federally dedicated funding sources. The Grants Program has focused on multiple-species or habitat-level projects aimed at keeping common species common and preventing future declines in wildlife populations. Additional information about the Grants Program has been posted at:

<https://myfwc.com/conservation/special-initiatives/fwli/grant/>

The FWC has developed a Comprehensive Wildlife Conservation Strategy (Strategy) for the state that conserves the broad array of wildlife and habitats within its boundaries. Florida’s Strategy uses a habitat category approach to arrange wildlife species and habitats, and the conservation threats and actions needed to conserve them, into meaningful and manageable categories. Although this plan encompasses the entire state, it includes the unique wildlife and habitats in the Florida Keys, many of which are found on NASKW properties. NAS Key West’s goals, objectives and strategies for managing its wildlife and habitats are in coordination with those identified within Florida’s Strategy.

Climate Change

Changing climatic conditions, such as long periods of excess precipitation or drought, may make habitats unsuitable for some species of birds and wildlife and may also allow for the arrival of new species on an installation, both native and non-native. The appearance of new, and increase in existing, wildlife diseases and parasites is an issue of concern as well. Adaptation will require more active management of both species populations and their priority habitats. The installation’s longstanding emphasis on ecosystem-based management should help in this endeavor through its focus on restoration and enhancement of ecosystem functions and services. Adaptation may require changes in the management and conservation strategies that are currently used to sustain populations of desirable species and control populations of invasive species, and

installation managers should be prepared to work with conservation partners to identify when and how to initiate such changes.

Project Summaries

Project 7: Nuisance Animal Control

Strategy: Eliminate the damaging effect that nuisance animals have on threatened and endangered species populations.

Tasks: (1) Entrap and remove raccoons and feral cats from NASKW.
 (2) Promote education of base personnel on the importance of eliminating feral animals from base lands and restricting the movements of domestic pets.

Project 8: Community Outreach and Natural Resources Information and Awareness

Strategy: Implement programs and initiatives that foster citizen participation in ecosystem education and stewardship.

Tasks: (1) Disseminate information related to natural resources and environmental awareness.
 (2) Offer hands-on training and individual participation in activities to better demonstrate ecosystem management on the Installation.
 (3) Provide information about natural resources at NASKW to visiting commands prior to the command initiating actions.

Project 9: Listed and Rare Bird Assessment and Habitat Improvement

Strategy: Protect and manage species of concern by enhancing habitat on NASKW.

Tasks: (1) Enhance habitat for birds by adding sand, rock, crushed shell and gravel to coastal beaches, dunes and islands. Provide nesting platforms for ospreys.

Project 10: Fish and Wildlife Conservation Informational Signage

Strategy: Protect and manage species of concern by enhancing habitat on NASKW.

Tasks: (1) Provide the supplies and equipment necessary to develop and install signage to further the conservation of fish and wildlife on the installation.

Project 12: Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals

Strategy: Protect and maintain ecological diversity in native plant communities including tropical hardwood hammock, mangrove fringe and transitional zones.

Tasks: (1) Conduct ecological monitoring and mapping of the plant communities and wildlife species of concern at NASKW.

Project 13: Marine Resources Survey

Strategy: Conduct quantitative surveys of benthic marine resources located near NASKW maritime facilities.

Tasks: (1) Survey nearshore benthic resources, habitats, and species on a minimum five-year basis.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Wildlife Management

Sikes Act, as amended 16 USC 670 a-o, requires each military department to manage fish and wildlife resources in accordance with a tripartite cooperative plan agreed to by the USFWS and state wildlife agency, to provide its personnel with professional training in fish and wildlife management.

Migratory Bird Treaty Act (MBTA), as amended 16 USC 703-712, prohibits the taking or harming of a migratory bird, its eggs, nests, or young without the appropriate permit.

Fish and Wildlife Conservation Act, 16 USC 2901, encourages all federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats.

Endangered Species Act (ESA), 16 USC 1531-1543 , Title 50 Code of Federal Regulations (CFR) Part 17, provides for the identification and protection of threatened and endangered species of fish, wildlife, and plants and their critical habitats. Requires federal agencies to ensure that no agency action is likely to jeopardize the continued existence of a threatened or endangered species.

Federal Noxious Weed Act of 1974, 7 U.S.C. 2801 et. seq., provides for the control and eradication of noxious weeds and their regulation in interstate and foreign commerce.

Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 136, requires that all pesticides, whether for commercial or private use, be applied in accordance with product labeling and that containers are properly disposed of. EPA is responsible under FIFRA for the registration of all pesticide active ingredients used in the United States.

Marine Mammal Protection Act of 1972, 16 USC 1361-1407, prohibits the taking or harming of marine mammals without the appropriate permit.

EO 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems.

OPNAVINST 5090.1E, 12-3.5 discusses laws that govern natural resources management relating to the protection and management of fish and wildlife resources.

Additional Sources of Information

Internet Sites:

Florida's State Wildlife Action Plan:

<https://myfwc.com/conservation/special-initiatives/fwli/action-plan/>

DoD Conserving Biodiversity: <http://www.dodbiodiversity.org/>

DoD Partners in Flight: <https://partnersinflight.org/>

DoD Partners in Amphibian and Reptile Conservation:

<http://www.dodnaturalresources.net/DoD-PARC.html>

USFWS Migratory Birds: <https://www.fws.gov/birds/index.php>

4.3.2 Threatened and Endangered Species and Natural Communities

Based on scientific and commercial data, species are listed as endangered or threatened if there is a current or threatened habitat loss, disease, over-exploitation, or other factors affecting its existence. The ESA was federally mandated in 1973 to provide a means to conserve endangered and threatened species and the habitats on which these species depend. The ESA also prohibits federal agencies from authorizing, funding, or carrying out any actions that destroy or adversely modify designated "critical habitat." Critical habitat for a threatened or endangered species would be designated by USFWS or NMFS. It is generally defined as: (1) the specific areas within the geographical area occupied by the species at the time it is listed as threatened or endangered on which are found physical or biological features essential to the conservation of the species, and which may require special management considerations or protection; and (2) specific areas outside the geographical areas occupied by the species at the time it is listed, upon a determination by the Secretary of Interior that such areas are essential for the conservation of the species. Additionally, the Florida Endangered and Threatened Species Act was state legislated to provide additional protection to species.

Federally or state-listed animal and plant species that occur or may occur on NASKW (Section 3.8) have been identified as conservation priorities and require special protection efforts. The management actions and projects described in this INRMP benefit these species and their habitats, as depicted in Table 4-2 and described on the following pages.

Objectives

11. *Protect and manage critically important habitats of resident and migratory threatened and endangered species, and species of special concern.*

Management Actions and Projects that Benefit Animals, Plants, and Their Habitats on NAS Key West																								
Management Activities that Benefit the Species and its Habitat									INRMP Projects that Benefit the Species and its Habitat															
Soil Conservation and Erosion Control	Stormwater and Water Quality Control	Grounds Maintenance and Landscaping	Invasive, Exotic, and Noxious Species	Coastal and Marine Management	Wildlife Management	Threatened Species & Natural Communities	Control Wildlife Damage and Disease	Outdoor Recreation		Wetlands Protection & Shoreline Enhancement	Wetland Restoration Mitigation Monitoring	NAS Key West INRMP Review and Update	Eval. of Vegetative Maint. on LKMR Habitat	Lower Keys Marsh Rabbit Survey	Federally Listed Species Assessments	Nuisance Animal Control	Community Outreach and NR Awareness	Listed and Rare Bird Habitat Improvement	Fish and Wildlife Conservation Signage	Habitat Management Restoration (Invasives)	Ecological Survey	Marine Resources Survey	Smalltooth Sawfish Survey	Sea Turtle Protection Lighting
M	M	M	M	M	M	M		M		P	P	P			P		P		P		P	P	P	
M	M	M	M	M	M	M	M	M		P	P	P					P	P	P	P	P			
M	M	M	M			M	M					P	P		P		P		P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M		M		M		P	P	P			P		P		P			P	P	
M	M	M	M	M	M	M	M	M		P	P	P	P		P	P	P	P	P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M		M	M	M	M		P	P	P	P	P		P	P	P	P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P	P	P			
M	M	M	M	M	M	M		M		P	P	P			P	P	P		P		P	P		P
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P		P		P	P		P
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P		P		P	P		P
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P	P	P	P	P			P
M	M	M	M	M	M	M		M		P	P	P			P	P	P		P		P	P		P
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P		P		P	P		P

Management Activities that Benefit the Species and its Habitat **INRMP Projects that Benefit the Species and its Habitat**

Soil Conservation and Erosion Control	Stormwater and Water Quality Control	Grounds Maintenance and Landscaping	Invasive, Exotic, and Noxious Species	Coastal and Marine Management	Wildlife Management	Threatened Species & Natural Communities	Control Wildlife Damage and Disease	Outdoor Recreation		Wetlands Protection & Shoreline Enhancement	Wetland Restoration Mitigation Monitoring	NAS Key West INRMP Review and Update	Eval. of Vegetative Maint. on LKMR Habitat	Lower Keys Marsh Rabbit Survey	Federally Listed Species Assessments	Nuisance Animal Control	Community Outreach and NR Awareness	Listed and Rare Bird Habitat Improvement	Fish and Wildlife Conservation Signage	Habitat Management Restoration (Invasives)	Ecological Survey	Marine Resources Survey	Smalltooth Sawfish Survey	Sea Turtle Protection Lighting
M	M	M	M		M	M	M	M		P	P	P	P	P		P	P	P	P	P	P			
M	M	M	M		M	M	M	M		P	P	P	P	P		P	P	P	P	P	P			
M	M	M	M	M		M	M	M		P	P	P	P		P		P		P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M	M	M	M	M		P	P	P					P	P	P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P	P	P	P	P			
M	M	M	M	M	M	M	M	M		P	P	P			P	P	P	P	P	P	P			
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M		M	M			P	P	P			P	P	P	P	P	P	P			
M	M	M		M		M		M		P	P	P			P		P		P			P	P	
M	M	M	M	M		M		M		P	P	P			P		P		P			P		
M	M	M	M	M	M	M		M		P	P	P			P		P		P	P	P	P		
M	M	M	M		M	M	M	M		P	P	P	P		P	P	P	P	P	P	P			

The denoted project benefits the denoted species and its habitat.

red; FP = Federally Petitioned; FT = Federally Threatened; PE = Federally proposed as Endangered; PT = Federally proposed as Threatened; SMP = Managed under a State Management Plan; SSC =

12. *Monitor population demographic patterns of both resident and migratory threatened and endangered species, and species of special concern.*
13. *Protect and maintain ecological diversity in native plant communities including tropical hardwood hammock, transitional zones, and mangrove fringe.*

Long-Term Management

NAS Key West shall actively manage for the species listed below, but will also manage for other species of concern as conditions warrant. Several listed species have been identified as conservation priorities. Changes in management practices may result from: 1) the listing or removal of a species, or 2) a change in species occurring on the Installation. NAS Key West will continue to conduct species surveys and monitor changes in populations and habitats. Species information provided by the surveys will be used to modify management practices. When practicable, buffer zones will be established between listed species habitat and construction or training activities. Management practices will be modified by the Natural Resources Manager in consultation with other Navy biologists, as well as other federal and state agencies.

American Crocodile (*Crocodylus acutus*)

Status. Endangered - Federal and State; Critical habitat has been designated but does not extend to the lower Keys.

Habitat Use and Requirements. The American Crocodile is typically found in freshwater or brackish coastal habitats. Mangrove-lined estuaries with access to inland water sources like artificial impoundments, non-vegetated wetlands, and salt marshes provide the most ideal habitat at NASKW. Suitable nesting sites at the installation have been located on southern Boca Chica Key and the southwest shore of Sigsbee Key (Mazzotti 2014; Metzger et al. 2016).

Habitat Conditions. Suitable habitat of mangrove swamps, low-energy mangrove-lined bays, creeks, and inland swamps exists on NASKW properties.

Limiting Factors. Habitat modification and destruction, encroachment, poaching.

Current Status. The presence of crocodiles on Boca Chica (in the lagoons and on the banks) were confirmed in 2014, when 21 American crocodiles were sighted during four nights of surveys (Mazzotti 2014). Only seven crocodiles were observed in a 2016 survey. Continued surveys are planned to better understand their abundance and movements on NASKW.

Management. Protect suitable habitat on NASKW. Promote public awareness of the potential for crocodiles to frequent Installation waters with a goal of preventing harassment of

individual animals and/or conflicts with Installation activities. Public awareness should also include general education about the crocodiles and their habits, potential threats, and laws and policies against feeding them.

This INRMP protects habitat for American crocodiles through active management of factors such as wetlands (Section 4.1.1), soil conservation and erosion (Section 4.1.4), stormwater and water quality (Section 4.1.4), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve American crocodile habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Ecological Survey, Smalltooth Sawfish Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Bald Eagle (*Haliaeetus leucocephalus*)

Status. Delisted under the Endangered Species Act; Federally-protected under the Bald and Golden Eagle Protection Act.

Habitat Use and Requirements. Bald eagles are considered a water-dependant species typically found near estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats. Their distribution is influenced by the availability of suitable nest and perch sites near large open water bodies, typically with high amounts of water-to-land edge. Throughout their range, bald eagles demonstrate a remarkable ability to tolerate perturbations to their habitat. Their adaptability to a variety of habitat conditions makes generalizations about habitat requirements and nesting behavior difficult. Though variable, eagles have basic habitat requirements that must be met in order to successfully survive and reproduce (USFWS 1999). The nesting season for this species (in the Southeast) is from October to May.

Habitat Conditions. Suitable habitat (feeding, roosting, and nesting areas) for bald eagles exists on the Installation.

Limiting Factors. Human disturbance during nesting, illegal shooting, and electrocution by power lines.

Current Status. Confirmed visitor. An adult and juvenile were observed flying together at Saddlebunch Key during the 2016-17 winter survey of rare fauna.

Bald eagles used to have a nest on Boca Chica Key, but the nest was removed to reduce the likelihood of a BASH issue. The nest was removed under a permit from USFWS in 2012.

Management. This INRMP protects habitat for bald eagles through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), stormwater and water quality (Section 4.1.4) and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve bald eagle habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Blodgett’s Silverbush (*Argythamnia blodgettii*)

Status. Threatened – Federal; State – Endangered; Critical habitat designation is pending.

Habitat Use and Requirements. Blodgett’s silverbush is found in open, sunny areas in pine rockland, at the edges of rockland hammock, at the edges of coastal berm, and sometimes in disturbed areas at the edges of natural areas. Plants can be found growing from crevices on limestone, or sand. The pine-rockland habitat where the species occurs requires periodic fires to maintain habitat with a minimum amount of hardwoods.

Habitat Conditions. Conditions in habitat areas on NASKW have been improved by the removal of invasive, exotic vegetation, but continue to be negatively affected by native hardwood species encroachment. Ongoing conservation actions taken by NASKW that protect and enhance the habitat of Blodgett’s silverbush and other species of conservation concern include removal of native hardwoods and control of invasive, exotic plant species.

Limiting Factors. Habitat loss and degradation.

Current Status. Blodgett’s silverbush was found at the same two sites on Boca Chica Key during the 2004-05, 2010-11 and 2016-17 surveys. These surveys covered the entire installation and no other areas of Blodgett’s silverbush were found. One of the sites is on the sunny edges of an area known as the “Weapons Hammock”, along the transition between mowed grounds and unmowed rocky hammock. The other site is on the east side of the airfield, south of Runway 26, in an area maintained as Lower Keys marsh rabbit habitat that is not mowed. Exotic plant

species have been removed from both sites. Blodgett’s silverbush is thriving and reproducing at the Weapons Hammock, but hardwoods on the airfield were cited as a cause for silverbush reduction at that location since 2010. The area is prioritized for hardwood reduction in 2020 with a focus on improving conditions for Blodgett’s silverbush.

Management. Areas occupied by Blodgett’s silverbush will be maintained by removing any nearby exotics and periodically removing and pruning encroaching native hammock trees and large shrubs. Management activities to enhance Lower Keys marsh rabbit habitat on the airfield, including no mowing, removal of exotics and clearing woody species, also provides a benefits to Blodgett’s Silverbush and its habitat.

The Natural Resources Manager shall monitor and document the status of Blodgett’s silverbush at NASKW every 2-to-3 years, assessing population trends at the two sites and evaluating the efficacy of management actions. Monitoring data shall be shared with conservation partners at the annual INRMP meeting to ensure effective adaptive management of this species.

This INRMP protects habitat for Blodgett’s silverbush through active management of factors such as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), grounds maintenance (Section 4.1.5), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve Blodgett’s silverbush include INRMP Review and Update, Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitat (including the removal of woody vegetation), Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Habitat Management and Restoration, and Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals (see Appendix A for descriptions and project accomplishments).

Corals:

- Boulder Star Coral** (*Orbicella franksi*)
- Elkhorn Coral** (*Acropora palmata*)
- Lobed Star Coral** (*Orbicella annularis*)
- Mountainous Star Coral** (*Orbicella faveolata*)
- Pillar Coral** (*Dendrogyra cylindricus*)
- Rough Cactus Coral** (*Mycetophyllia ferox*)
- Staghorn Coral** (*Acropora cervicornis*)

Status. Threatened - Federal.

Habitat Use and Requirements. These corals are primarily constrained to the oceanic environment between 30 degrees north and 30 degrees south latitude. These species are found off the Florida Keys, the Bahamas, throughout the Caribbean, and some of them are found in the Gulf of Mexico. Depending upon species, they are found in depths ranging from one to 75 meters. Habitats vary from back-reef and fore-reef to lagoons, rocky reefs, spur and groove formations, and channels.

Habitat Conditions. Threats to corals at NASKW include oceanic perturbations, sedimentation, hurricanes, bleaching, and oceanic water column warming

Limiting Factors. Habitat degradation is a serious threat to coral. Rising seawater temperatures and exposure to sunscreen have been linked to ever-increasing reports of coral bleaching. The loss of suitable habitat for successful recruitment is a significant source of population decline. Algae overgrowth and sedimentation hinder recruitment, growth, and proliferation of corals. Vessel groundings, vessel anchoring, human trampling (including damages caused by snorkelers and divers), and the entanglement of man-made debris (e.g., fishing nets, plastics, and line) require significant restoration and rehabilitation efforts. Other human-induced threats to corals include overfishing, coastal development, fertilizer runoff, and competition, predation, and parasitism by invasive species.

Current Status. Benthic surveys at NASKW in 2006 and 2013 identified the presence of *O. annularis*, *O. faveolata*, and *O. franksii* at the installation (see Table 3-4). Coral habitat was classified as “high-quality” at the Trumbo Point Area and Truman Harbor due to favorable water flow and wave action, and suitable substrate. Coral habitat was classified as “medium-quality” at the Fleming Key Dock and Fleming Key Army Special Operations due to poor water flow, sedimentation, and lack of suitable substrate. Coral habitat was classified as “low-to-medium-quality” off western Boca Chica Key due to lack of hard substrate and low water movement.

Management. This INRMP protects habitat for the seven federally-threatened coral species through active management of factors such as wetlands (4.1.1), soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), and coastal and marine management (Section 4.2). Appendix C details background information and management actions undertaken by NASKW that provide a conservation benefit to corals. Projects described in this INRMP that benefit and conserve coral habitat include Wetlands Protection and Shoreline

Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Dwarf Seahorse (*Hippocampus zosterae*)

Status. Petitioned – Federal.

Habitat Use and Requirements. Dwarf seahorse habitat is restricted almost completely to seagrass canopies. Seahorses are feeble swimmers that disperse by clinging to drift macroalgae and debris. The dwarf seahorse prefers areas with dense and high seagrass canopies in shallow waters less than two meters deep with high salinities. Dwarf seahorse density has demonstrated positive correlations with seagrass density and negative correlations with current velocity; they therefore are more likely to inhabit dense seagrass beds in protected lagoons than in open coastlines, channels, and cuts.

Habitat Conditions. According to the 2006 and 2013 benthic surveys, seagrass beds around NASKW have been characterized as dense and healthy.

Limiting Factors. Threats to the dwarf seahorse throughout its range include loss of seagrass habitat and range, overutilization resulting from commercial seahorse collection, inadequacy of existing regulatory mechanisms, vulnerable life-history parameters, noise, bycatch mortality, illegal fishing, invasive species, and tropical storms and hurricanes.

Current Status. One of the primary limiting factors for dwarf seahorse survival is availability of suitable seagrass habitat. The condition of seagrasses in quiescent areas around the installation appear to be in good status and their condition is expected to improve as causeways are opened to allow more efficient tidal flushing in the lagoons and backwaters around Boca Chica Key.

Management. Protect water quality and seagrass condition around NASKW. Direct impact to seagrasses commonly results from boat propeller damage and groundings. Restricted access to areas around the installation minimizes this threat. This INRMP protects water quality and habitat for dwarf seahorses through active management of factors such as soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), Boca Chica restoration (Section 4.1.7), and coastal and marine management (Section 4.2). Projects described in this

INRMP that benefit and conserve dwarf seahorse habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Eastern Black Rail (*Laterallus jamaicensis jamaicensis*)

Status. Proposed Threatened - Federal; critical habitat is not proposed.

Habitat Use and Requirements. Eastern black rail habitat can be tidally or non-tidally influenced, and range in salinity from salt to brackish to fresh. Impounded and unimpounded intermediate marshes also provide habitat for the subspecies.

Habitat Conditions. Coastal and upland marshes occur on several NASKW properties and have been improved at Boca Chica Key.

Limiting Factors. Habitat loss and predation.

Current Status. The Eastern black rail has not been identified on NASKW during past surveys, including the 2015 neotropical migratory bird survey.

Management. This INRMP protects habitat for Eastern black rails through active management of factors such as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), invasive species (Section 4.1.6), and Boca Chica restoration (Section 4.1.7). Projects described in this INRMP that benefit and conserve Eastern black rail habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, Listed and Rare Bird Assessment and Habitat Improvement, Evaluation of Vegetative Maintenance Methods on Lower Keys Marsh Rabbit Habitat, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management and Restoration, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Garber’s Spurge (*Chamaesyce garberi*)

Status. Endangered - Federal and State; No critical habitat designated.

Habitat Use and Requirements. Garber’s spurge occurs at low elevations either on thin sandy soils composed largely of Pamlico sands or directly on limestone. It is found in a variety of open to moderately shaded habitat types. In pine rocklands, it grows out of crevices in oolitic limestone. In the Florida Keys, it grows on semi-exposed limestone shores, open calcareous salt flats, pine rocklands, calcareous sands of beach ridges, and along disturbed roadsides.

Habitat Conditions. A few coastal rock barrens exist along Old Boca Chica road, but are susceptible to erosion from storm events, exotics and human disturbance due to public access.

Limiting Factors. Habitat loss and degradation.

Current Status. The documented distribution of Garber’s spurge has changed, as documented in the 2004-05, 2010-11, and 2016-17 surveys. In 2004, plants were only observed along the beach road, but in 2011 the beach road population appeared to be extirpated, although two new sites were found at the airfield and weapons hammock in Boca Chica, and plants appeared to be thriving in these new locations. However, in 2016, Garber’s spurge was found only along edges of the weapons hammock.

Management. Occupied areas should be maintained by removing any nearby exotics and periodically pruning the appropriate native shrubs. The coastal rock barren along Boca Chica road must be protected from disturbance.

The Natural Resources Manager shall monitor the status of Garber’s spurge at NASKW annually, assessing population trends at known sites and evaluating the efficacy of management actions. These observations shall be recorded and shared with conservation partners at the annual INRMP to ensure adaptive management of this species.

This INRMP protects habitat for Garber’s spurge through active management of factors such as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), grounds maintenance (Section 4.1.5), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve Garber’s spurge habitat include INRMP Review and Update, Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitat, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Habitat Management and Restoration, and

Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals (see Appendix A for descriptions and project accomplishments).

Giant Manta Ray (*Manta birostris*)

Status: Threatened - Federal.

Habitat Use and Requirements. The giant manta ray has a worldwide distribution in tropical and temperate climates. It spends most of its time in offshore waters, but occasionally ventures into to coastal waters, where it may come in vicinity of NASKW, although the likelihood is low.

Habitat Conditions. Water quality and marine habitats surrounding NASKW are suitable for giant manta rays.

Limiting Factors. Targeted catch by sportfishers is the principal threat historically, although such activities are no longer directed so intensively at manta rays. Other threats include development that affects nearshore benthic habitats.

Current Status. The giant manta ray is a possible transient of NASKW coastal water.

Management. This INRMP protects water quality for giant manta rays through active management of factors such as wetlands (Section 5.1.1), soil conservation and erosion control (Section 5.1.3), stormwater and water quality (Section 5.1.4), and floodplains (Section 5.1.6). Projects described in this INRMP that benefit and conserve water quality include Soil Erosion Control and Wetlands Delineations (see Appendix A for project descriptions).

Key Ringneck Snake (*Diadophis punctatus acricus*)

Status. Petitioned – Federal; Threatened – State.

Habitat Use and Requirements. The distribution of key ringneck snakes is confined to the lower Florida Keys. They typically occur in scrubby pine rocklands, and the edges and disturbed portions of tropical hardwood hammocks, generally near sources of fresh water.

Habitat Conditions. A few coastal rock barrens exist along Old Boca Chica road, but are susceptible to erosion from storm events, exotics and human disturbance due to public access. Habitat along portions of Old Boca Chica road have recently been restored to satisfy airfield mitigation requirements.

Limiting Factors. Habitat loss and degradation, and flooding as the result of tropical storms and sea level rise.

Current Status. Key ringneck snakes have not been observed during surveys of NASKW, but have been documented in vicinity of the installation in the Lower Keys. The installation provides areas of suitable habitat. None were detected during a cover board survey for herpetofauna in 2016-17.

Management. Protect coastal rock barren along Boca Chica road from disturbance. This INRMP protects habitat for Key ringneck snakes through active management of factors such as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), invasive species control (Section 4.1.6), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve Key ringneck snake habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Least Tern (*Sterna antillarum*)

Status. Threatened – State.

Habitat Use and Requirements. Least terns nest on beaches above the reach of ordinary tides in open, sandy, graveled or scarified areas. In recent decades, because of urban development, least terns have adapted to nesting on rooftops, which are graveled, or have historically been graveled. They feed in open water, diving to catch small fish and crustaceans.

Habitat Conditions. The surrounding marine waters provide plenty of feeding areas. Suitable nesting occurs on spoil areas, undisturbed exposed limerock, and flat gravel rooftops.

Limiting Factors. Lack of nesting habitat due to development and increased recreational use.

Current Status. Least terns nest in various locations on NASKW. They used to nest on gravel areas adjacent to the Airfield, but those areas were painted green, which successfully discourages nesting at such a dangerous proximity to aircraft. Nesting least terns have demonstrated nesting fidelity on the rooftops of Buildings 289, 290, and 291 on Truman Annex, even after the removal of gravel rooftops to satisfy building codes. The chief reason for this

fidelity is the placement of gravel-filled nest boxes in accordance with consultations undertaken with USFWS for roseate terns.

Management. The NRM will inventory and monitor any sites of observed colonial shorebird activity for least tern nesting. If least tern nesting occurs, the NRM will monitor each colony for fledging success. The NRM will enter seasonal nesting data into the Florida Shorebird Database (FSD; <https://public.myfwc.com/crossdoi/shorebirds/>). The NRM coordinates access to nesting sites for USFWS and FWC biologists to monitor nesting activity during nesting season.

NAS Key West airfield managers continue to paint gravel areas near runways and taxiways to deter least terns from nesting where they would present a heightened BASH hazard.

In order to minimize the potential adverse effects to least terns and the nesting habitat on the roof of buildings 289, 290, and 291 on Truman Annex, the Navy has implemented the following management actions:

1. Non-emergency roof repairs and other building maintenance activities on the roofs will be conducted outside of the nesting season to the greatest extent practicable.
2. A barrier will be maintained along the roof perimeter of the buildings to deter chicks from falling over the edge and off the roof.
3. Seasonal monitoring of least tern presence and populations will continue on NASKW properties and structures.
4. If emergency roof repairs or other building maintenance activities on the roofs need to be conducted during the nesting season, the Navy will contact the appropriate FWC personnel as soon as practicable to inform them of the required repair and maintenance activities.
5. Emergency roof repairs and maintenance will be conducted according to the following:
 - If practicable, repairs will be scheduled during the coolest times of day; first thing in the morning (before 9 a.m.) is preferred or in the evening (after 6 p.m.).
 - If practicable, rooftop work will be conducted in short increments (less than an hour). After an hour, everyone should leave the roof and give the birds a 30-minute break before returning to continue work. For example, a work shift could start from 6-7 a.m., break from 7-7:30 a.m., then resume from 7:30-8:30 a.m.
 - The number of people on the roof will be limited to as few as possible, working as quickly as possible, as practicable.
 - If practicable, a path to the repair site will be marked that avoids all nests. The safest path around nests may not necessarily be the shortest or most direct path to the repair site.
 - If practicable, everyone on the rooftop will minimize movement. Construction workers will be briefed to minimize noise, turn two-way radios down, and avoid sudden movements as much as possible.

- Nests will not be tampered with or marked in any way, as this makes them easier targets for predators.
- No open tar will be left on the roof such that it is accessible to adult nesting birds or chicks. If open tar from a repair is left on the roof, a barrier will be established around the repair in a fashion that will make it inaccessible to birds and chicks.
- The perimeter of the base of the building will be checked after rooftop work has ended for the day to make sure no chicks have fallen. Any fallen chicks will be returned to the roof immediately, unless they are injured, in which case, the Navy will bring them to a local wildlife rehabilitator (call 1-888-404-FWCC for contact information).
- If these conditions cannot be met for emergency roof repairs and maintenance, the Navy will contact the FWC for additional technical assistance.

This INRMP protects habitat for least terns through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.4) and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve least tern habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Lower Keys Brown Snake (*Storeria dekayi victa*)

Status. Threatened – State.

Habitat Use and Requirements. The Lower Keys brown snake can be found in pine rocklands and tropical hardwood hammocks, and frequently takes refuge beneath rocks or other cover.

Habitat Conditions. Conditions at suitable areas on NASKW have been negatively affected by invasive exotic species. However, conservation management has invested in removal of invasive plants on the installation, addressing habitat loss for this and other threatened species.

Limiting Factors. Habitat loss and degradation.

Current Status. The species has not been documented on NASKW, including a cover board survey for herpetofauna in 2016-17.

Management. Protect coastal rock barren along Boca Chica road from disturbance. This INRMP protects habitat for Lower Keys brown snake through active management of factors such

as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), grounds maintenance (Section 4.1.5), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve Lower Keys brown snake habitat include INRMP Review and Update, Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitat, Other Federally Listed Species Surveys, Community Outreach and Natural Resources Information and Awareness, Habitat Management and Restoration, and Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals (see Appendix A for descriptions and project accomplishments).

Lower Keys Marsh Rabbit (*Sylvilagus palustris hefneri*)

Status. Endangered - State and Federal; No critical habitat designated.

Habitat Use and Requirements. The LKMR exists as a metapopulation (a set of populations persisting in balance between local extinction and colonization) restricted to small patches of wetland habitats in the Lower Florida Keys. The Lower Keys marsh rabbit is habitat-specific, depending upon a transition zone of grassy marshes and prairies of the Lower Keys for feeding, shelter, and nesting. This species prefer areas with high amounts of clump grass, ground cover, and *Borrchia frutescens* present, areas closer to other existing marsh rabbit populations, and areas close to large bodies of water (Forys and Humphrey 1994). These marsh rabbits spend most of their time in the midmarsh (*Borrchia frutescens*) and high-marsh (*Spartina* spp. and *Fimbristylis castanea*), both of which are used for cover and foraging, while most nesting occurs in the highmarsh area (Forys and Humphrey 1994). Lower Keys marsh rabbits occasionally use low shrub marshes and mangrove communities (red mangrove—*Rhizophora mangle*, black mangrove—*Avicennia germinans*, white mangrove—*Laguncularia racemosa*, and buttonwood--*Conocarpus erectus*) for feeding and as a corridor between patches of transitional habitats.

The home ranges of adult marsh rabbits average 0.32 ha with same-sex home ranges rarely overlapping. Adult marsh rabbits have permanent home ranges, while male subadults tend to disperse. Adults of both sexes have similar home range sizes, although the size varies widely among individuals. This individual variability may be due to differences in habitat quality, population density, or the status of an individual in a social hierarchy. Juvenile Lower Keys marsh rabbits appear to use a home range near their nest site.

Habitat Conditions. NAS Key West properties on Boca Chica, Geiger, and Saddlebunch Keys have areas of suitable habitat for the LKMR.

Limiting Factors. Habitat loss and fragmentation, predation by cats, and road mortalities caused by automobiles.

Current Status. In 2004 and 2005, the Navy began a radio telemetry study to: (1) evaluate the effects of trimming vegetation on LKMR; (2) provide guidelines and insight for improving vegetation management efforts on Boca Chica Key; and (3) provide an update of LKMR population density and distribution on NASKW. This effort ended prematurely in October 2005 when Hurricane Wilma damaged the airfield and resulted in the loss of collared rabbits. The Navy and USFWS then determined to utilize pellet surveys for long-term monitoring of LKMR population on NASKW (INRMP Project No. 5). These surveys assumed that increased incidents of pellets correlated to increased rabbit numbers, as supported by Forys (1995). The surveys use systematic line transects within known rabbit habitat to tally numbers of pellets observed and record vegetation structure and composition. The monitoring program provided by this methodology has been conducted annually since 2006. Vegetative data is also collected to characterize LKMR habitat patches and monitor the effects of habitat enhancement.

The 2017 survey occurred approximately three months after Hurricane Irma made landfall. Compared to pre-hurricane 2016 patch occupancy, average patch pellet density, and western clade estimate data, the post-hurricane 2017 indicated these three parameters slightly decreased. However, the 2018 survey, which occurred a year after Hurricane Irma indicated greater patch occupancy, average patch pellet density, and western clade estimate, than was observed in 2017 or even during the pre-hurricane 2016 survey (TAMU 2017; TAMU 2018).

The results of the 2018 monitoring indicated that 35 out of 47 (74%) LKMR patches were occupied. Patches with pellets averaged greater than 50% herbaceous cover, approximately 30% of non-living cover, and less than 10% of woody cover. Patches associated with habitat restoration and the Airfield Restoration Project (ARP) continued to show LKMR habitat occupation with numerous created habitat patches providing high-quality LKMR habitat. Additionally, the 10 patches with the most pellets in 2018 were all previously restored through these efforts. Hardwood vegetation was removed from several patches in 2018, which is expected to result in similar increases in patch pellet densities as grasses and forbs revegetate those spaces (TAMU 2018).

Habitat succession consisting of native and exotic hardwood encroachment in LKMR habitat is a serious threat to the long-term persistence of LKMR. Since 2016, approximately 45 acres of hardwoods and 185 acres of invasive plants have been converted to marsh grasses. Outside of these efforts, which were completed with conservation funds, the airfield maintenance contract pays for additional acreage of hardwoods to be removed near the airfield. Regular treatments will continue.

Management. Management efforts for the LKMR are primarily based upon the 2016 LKMR Management Plan, developed in cooperation with USFWS (Appendix B). Efforts focus on reducing direct predation through predator population management and adjustment of human behavior. Off-road vehicle traffic was prohibited in LKMR habitat on NASKW. However, mortality over established roadways remains an issue. In order to reduce this risk, resource managers have supported lower speed limits, limited development near habitat, installed barrier fencing, and educated local stakeholders about LKMR presence and ecology.

This INRMP protects habitat for the LKMR through active management of factors such as wetlands (Section 4.1.1), soil conservation and erosion (Section 4.1.3), invasive species (Section 4.1.6), and Boca Chica restoration (Section 4.1.7). Projects described in this INRMP that benefit and conserve LKMR habitat include Lower Keys Marsh Rabbit Survey and Habitat Management, Evaluation of Vegetative Maintenance Methods on Lower Keys Marsh Rabbit Habitat, Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management and Restoration, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Monarch Butterfly (*Danaus plexippus*)

Status. Petitioned – Federal.

Habitat Use and Requirements. The monarch butterfly is found throughout the United States during warm months, but migrates to Mexico during winter. Monarch caterpillars exclusively eat milkweed leaves, so the presence of milkweed (*Asclepias* spp.) is a crucial habitat requirement.

Habitat Conditions. Whitevine milkweed (*Sarcostemma clausum*) was identified on NASKW during an FNAI survey in 2004-05.

Limiting Factors. The primary threat to monarch butterflies across its range is the loss of milkweed, primarily due to herbicide use and habitat conversion. The species has suffered a 90% decline in population over the past two decades.

Current Status. Monarch butterflies were identified on several occasions at Boca Chica and Fleming Key during the 2016-17 survey for rare species. Milkweed is known to occur on the installation and shall be specifically included for inventory during future vegetative surveys.

Management. Protect milkweed habitat around NASKW, and ensure public awareness of the importance of such habitats. This INRMP protects habitat for monarch butterflies through active management of factors such as floodplains (Section 4.1.1), soil conservation and erosion (Section 4.1.3), grounds maintenance (Section 4.1.5), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve monarch butterfly habitat include INRMP Review and Update, Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitat, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Habitat Management and Restoration, and Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals (see Appendix A for descriptions and project accomplishments).

Nassau Grouper (*Epinephelus striatus*) Status.

Threatened – State and Federal.

Habitat Use and Requirements. The Nassau grouper inhabits rocky offshore areas and coral reefs throughout the Caribbean Sea and along the Florida Keys. Adults associate with the benthos or vertical structure and typically range in depth to 90 meters. Juveniles utilize nearshore seagrass beds, which offer nursery habitat.

Habitat Conditions. Suitable seagrass beds, hard bottom, and other habitats that could be utilized by juvenile Nassau grouper are present in waters adjacent to NASKW.

Limiting Factors. By-catch mortality is a primary threat to this species, despite the prohibition against its harvest, as it is a member of the heavily-harvested snapper-grouper complex. Habitat degradation and loss are also factors contributing to its decline.

Current Status. Harvest of Nassau groupers is prohibited in the United States and the species has been listed as a threatened species under the ESA.

Management. Protect water quality and suitable habitats around NASKW. The installation consults with appropriate regulators prior to altering nearshore habitats such as mangroves, seagrasses, and coral/hardbottom. This INRMP protects water quality and habitat for Nassau groupers through active management of factors such as soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), Boca Chica restoration (Section 4.1.7), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve Nassau grouper habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Marine Resources Survey, and Smalltooth Sawfish Survey (see Appendix A for descriptions and project accomplishments).

Osprey (*Pandion haliaetus*)

Status. State Delisted – Monroe County, Florida.

Habitat Use and Requirements. Ospreys are coastal birds of prey that feed almost exclusively on fish. They nest in dead trees or trees with sparse foliage, but may also build nests on utility poles or similar artificial structures.

Habitat Conditions. Forage and nesting habitat exists on NASKW. Ospreys pose a BASH risk, so nesting structures are discouraged near the airfield. However, artificial nesting structures have been constructed elsewhere on the installation to encourage individuals to avoid dangerous areas.

Limiting Factors. Habitat degradation, deforestation, and proliferation of low-growing invasive exotic plant species are principle threats throughout the osprey’s range.

Current Status. Resident. The osprey forages over waters on and around NASKW. It also nests on the properties. Osprey were observed utilizing nesting platforms throughout NASKW properties during a 2016 breeding season survey.

Management. Continue to install nesting platforms close to water. Nesting platforms should include predator guards near the base of the support beam. This INRMP protects habitat for ospreys through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.3), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve osprey habitat include

Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Piping Plover (*Charadrius melodus*)

Status. Threatened – Federal and State. No critical habitat designated in the area.

Habitat Use and Requirements. Piping plovers breed on coastal beaches as far south as North Carolina but winter farther south, including in the Florida Keys, between September and early April.

Habitat Conditions. Beach conditions at NASKW are superior to the conditions of adjacent beaches. The installation has aggressively eradicated invasive exotic vegetation on its beaches and human traffic is substantially lower than at adjacent public access points. Nuisance animal controls are also in place to remove potential predators such as feral cats and raccoons.

Limiting Factors. The piping plover population has declined since the 1940s due to increased development and recreational use of beaches. Beach litter has also been detrimental in some areas by attracting predators that harass or kill plovers.

Current Status. Potential over-wintering migrant. Anecdotal observations of piping plovers on and around the beaches of NASKW have been made.

Management. This INRMP protects habitat for piping plovers through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.4) and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve piping plover habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Red Knot (*Calidris canutus* ssp. *rufa*)

Status. Threatened – Federal.

Habitat Use and Requirements. Red knots prefer marine habitats consisting of sandy coastal areas near tidal inlets such as those found at the mouths of bays and estuaries. Birds overwintering in Florida have been found to prefer salt marshes, brackish lagoons, tidal mudflats, and mangroves.

Habitat Conditions. Beach conditions at NASKW are superior to the conditions of adjacent beaches. The installation has aggressively eradicated invasive exotic vegetation on its beaches and human traffic is substantially lower than at adjacent public access points.

Limiting Factors. The species’ most prominent lay-over location is Delaware Bay where declining horseshoe crab populations have been identified as the prevalent limiting factor; red knots feed upon horseshoe crab eggs. Red knot sightings on and around NASKW are not common and it is unlikely that the species has a sufficient dependency upon the area to justify identification of any limiting factor other than access to beaches, which is available on the installation.

Current Status. Potential migratory visitor. No red knots were identified at NASKW during ecological surveys in 2004-05 and 2010-11, or the comprehensive migratory bird surveys in 2014-15. An internet search also did not reveal any positive documented identification of red knots in the vicinity.

Management. This INRMP protects habitat for red knots through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.4), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve red knot habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Rim Rock Crowned Snake (*Tantilla oolitica*)

Status. Petitioned – Federal; Threatened – State.

Habitat Use and Requirements. Rim Rock crowned snakes inhabit rockland and tropical hardwood hammocks near fresh water. They can be found in holes and depressions, in rotten logs, and under rocks.

Habitat Conditions. Rockland and hammock habitat is present on NASKW and is being improved, particularly through restoration efforts to satisfy airfield mitigation requirements and frequent invasive species control projects.

Limiting Factors. The main threat to the Rim Rock crowned snake is habitat fragmentation. This is an issue in the Florida Keys, but not as much on NASKW where development is subject to NEPA analysis and more habitats have been reclaimed in recent years to satisfy airfield mitigation requirements. Tropical storms are also a threat since they cause flooding in the species’ habitat. Global climate change may increase the frequency of flooding through increased storm frequency and rising sea level.

Current Status. Potential resident. No Rim Rock crowned snakes were identified at NASKW during ecological surveys in 2004-05, 2010-11, and 2016-17. An internet search also did not reveal any positive documented identification of Rim Rock crowned snakes in the vicinity.

Management. This INRMP protects habitat for Rim Rock crowned snakes through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.4) and and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve Rim Rock crowned snake habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Roseate Tern (*Sterna dougallii dougallii*)

Status. Endangered - Federal and State; No critical habitat designated.

Habitat Use and Requirements. Roseate terns commonly utilize open sand, salt marsh, and pea gravel. It prefers open sandy beaches isolated from human activity as nesting habitat (USFWS 1999). In extreme southern Florida, roseate terns typically nest on isolated islands, rubble islets, dredge-spoil, and rooftops (Smith 1996). Various amounts of debris and vegetation may be present in the nesting area. Artificial structures also have been used; at least three rooftops in the Middle and Lower Florida Keys have been exploited by nesting roseate terns in the past (Smith 1996).

Habitat Conditions. The surrounding marine waters provide plenty of feeding areas. Potential nesting sites include spoil areas and flat rooftops on the Installation. Elevated nesting platforms have also been installed on restoration areas on Geiger and Big Coppitt Keys.

Limiting Factors. Habitat loss and degradation, predation, storms, tidal inundation, flooding, or prolonged periods of cold wet weather which destroy the nests, eggs, or young.

Current Status. Roseate terns have nested on Building 289 and 290 at Truman Annex. Historically, these rooftops were graveled but the Navy has since replaced them in accordance with Florida building codes for hurricane prone areas. As part of the informal consultation with the USFWS, starting in 2016 the Navy agreed to place thirty-five gravel-filled nesting boxes on Buildings 289 and 290 as alternate nesting substrate. The Navy distributed these thirty-five nest boxes across both rooftops. In 2017, in coordination with USFWS, the Navy moved all thirty-five nest boxes to the rooftop of building 290 exclusively.

In 2017, the Navy, in coordination with USFWS and FWC, constructed an elevated nesting platform on Navy property at Big Coppitt Key as a demonstration project for the purpose of attracting roseate terns, least terns, and other shore and pelagic species to nest on an artificial nesting platform. In 2019, the Navy constructed a similar but larger-area platform at Navy property on Geiger Key. These platforms are intended to benefit nesting roseate terns by being located in a more natural area away from buildings and other infrastructure and by providing a raised structure to minimize the effects from ground predators. Only least terns have utilized the platforms; no roseate tern nests were observed on NASKW between 2017 and 2019.

Management. The NRM will inventory and monitor any sites of observed colonial shorebird activity for roseate tern nesting. If roseate tern nesting occurs, the NRM will monitor

each colony for fledging success. The NRM will enter seasonal nesting data into the Florida Shorebird Database (FSD; <https://public.myfwc.com/crossdoi/shorebirds/>). The NRM coordinates access to nesting sites for USFWS and FWC biologists to monitor nesting activity during nesting season. Management at NASKW continues to work with its partners to identify and implement viable alternative nesting sites.

In order to minimize the potential adverse effects to roseate terns and the nesting habitat on the roof of buildings 289 and 290 on Truman Annex, the Navy has agreed to implement management actions described in USFWS consultation (#04EF2000-2018-I-0899) dated 28 September 2018. A summary of these actions are provided below:

1. Non-emergency roof repairs and other building maintenance activities on the roofs will be conducted outside of the nesting season.
2. A barrier will be maintained along the roof perimeter of the buildings to deter chicks from falling over the edge and off the roof.
3. Seasonal monitoring of roseate tern presence and populations will continue on NASKW properties and structures.
4. If emergency roof repairs or other building maintenance activities on the roofs need to be conducted during the nesting season, the Navy will contact the appropriate USFWS and FWC personnel as soon as practicable to inform them of the required repair and maintenance activities.
5. Emergency roof repairs and maintenance will be conducted according to the following:
 - If practicable, repairs will be scheduled during the coolest times of day; first thing in the morning (before 9 a.m.) is preferred or in the evening (after 6 p.m.).
 - If practicable, rooftop work will be conducted in short increments (less than an hour). After an hour, everyone should leave the roof and give the birds a 30-minute break before returning to continue work. For example, a work shift could start from 6-7 a.m., break from 7-7:30 a.m., then resume from 7:30-8:30 a.m.
 - The number of people on the roof will be limited to as few as possible, working as quickly as possible, as practicable.
 - If practicable, a path to the repair site will be marked that avoids all nests. The safest path around nests may not necessarily be the shortest or most direct path to the repair site.
 - If practicable, everyone on the rooftop will minimize movement. Construction workers will be briefed to minimize noise, turn two-way radios down, and avoid sudden movements as much as possible.
 - Nests will not be tampered with or marked in any way, as this makes them easier targets for predators.
 - No open tar will be left on the roof such that it is accessible to adult nesting birds or chicks. If open tar from a repair is left on the roof, a barrier will be established around the repair in a fashion that will make it inaccessible to birds and chicks.

- The perimeter of the base of the building will be checked after rooftop work has ended for the day to make sure no chicks have fallen. Any fallen chicks will be returned to the roof immediately, unless they are injured, in which case, the Navy will bring them to a local wildlife rehabilitator (call 1-888-404-FWCC for contact information).
- If these conditions cannot be met for emergency roof repairs and maintenance, the Navy will contact the USFWS and FWC for additional technical assistance.

This INRMP protects habitat for roseate terns through active management of factors such as wetlands (Section 4.1.1), floodplains (Section 4.1.2), soil conservation and erosion (Section 4.1.4) and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve roseate tern habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

Sea Turtles:

Green Sea Turtle (*Chelonia mydas*)

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

Leatherback Sea Turtle (*Dermochelys coriacea*)

Loggerhead Sea Turtle (*Caretta caretta*)

Status. Loggerhead and Green, Threatened - Federal and State; Others, Endangered - Federal and State. Critical habitat has been designated in the Florida Keys for the loggerhead sea turtle, but the properties at NASKW are located outside the designated boundary.

Habitat Use and Requirements. The loggerhead is found in temperate and tropical marine waters across the globe, over the continental shelves and estuarine environments of the Atlantic, Pacific and Indian Oceans (USFWS 1999). The green is found across the globe in tropical and subtropical marine waters; in the United States from Texas to Massachusetts, around the U.S. Virgin Islands and Puerto Rico (USFWS 1999).

Contrary to other sea turtle species, leatherbacks are often found in colder waters in the summer months (USFWS 1999). The hawksbill is found in the tropical and subtropical waters, and are widespread in the Caribbean and western Atlantic Ocean (USFWS 1999). They are

common in Puerto Rico, the U.S. Virgin Islands, along the Gulf Coast, and along the U.S. eastern coast as far north as Massachusetts (USFWS 1999).

Habitat Conditions. The public beach area (south of Old Boca Chica Road) consists mostly of rocky shoreline with some sandy beach sections (Barham 2005b) and is considered nesting beach habitat. Portions of this shoreline are owned by the Navy, Monroe County, and the State of Florida. The limerock beach at Truman Annex is also nesting habitat, and nests are monitored there annually.

Limiting Factors. Limiting factors specific to NASKW are erosion, disturbance and marginal nesting habitat.

Current Status. Nesting and false crawls have been documented on the beaches at Boca Chica Key and Truman Annex. Surveys for loggerhead sea turtle activity at Boca Chica Marina Beach on Boca Chica Key and Patio Beach and Residential Beach in the Truman Annex are conducted annually. Loggerhead sea turtle nests, crawls, or both have been observed in small numbers at Truman Annex Beach since regular surveys began in 2005.

Management. Protect potential nesting habitat on NASKW. The NRM shall continue to organize nest monitoring during the nesting season each year. The NRM shall continue to be the lead for all turtle straining and salvage operations on NASKW property.

This INRMP protects habitat for sea turtles through active management of factors such as wetlands (Section 4.1.1), soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve sea turtle habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management Restoration, Ecological Survey, Marine Resources Survey, and Sea Turtle Protection Lighting (see Appendix A for descriptions and project accomplishments).

Silver Rice Rat (*Oryzomys palustris natator*)

Status. Endangered - Federal and State; critical habitat designated, however Saddlebunch Antenna Facility (SAF) is outside the legal boundary of the designated critical habitat.

Habitat Use and Requirements. Silver rice rats typically use three zones that are delineated by their salinity and topography: (1) low intertidal areas, (2) salt marsh flooded by spring or storm tides, and (3) buttonwood transitional areas that are slightly more elevated and only flooded by storm tides (Goodyear 1987). In general, rice rats use mangrove habitats primarily for foraging, while higher elevation salt marshes are used for nesting and foraging (Forys *et al.* 1996).

Semi-aquatic and capable swimmers, SRRs forage in the intertidal zones, feeding on fish, crabs, grasses and forbs (Forys 1996). Their home ranges are exceedingly large for an animal of their size, females ranging from 2.0 to 8.5 hectares and males from 3.4 to 11.0 (Mitchell 1996), and some individuals have been documented traveling up to 1 km in a day (Perry, 2004).

Habitat Conditions. NAS Key West properties on Boca Chica, East Rockland, Big Coppitt, Geiger, and Saddlebunch Keys have areas of suitable habitat for the SRR.

Limiting Factors. Habitat loss due to residential and commercial construction and habitat modification; predation and competition from various introduced mammals and low populations make it more susceptible to reduced genetic variability.

Current Status. A survey for Silver rice rats was conducted in 1997, 2004, 2010, and 2016 on habitats throughout extensive portions of Boca Chica, Big Coppitt, Geiger, East Rockland, and Saddlebunch Keys (Wolf, 1997; Perry and Lopez 2004; Perry and Lopez 2010; Sneckenberger 2016). No SRRs were trapped on Boca Chica, Big Coppitt, Geiger, or East Rockland Keys, but they were trapped on the Saddlebunch Antenna Facility (SAF) in 2004, 2010, and 2016. The Saddlebunch Keys contain sizable areas of suitable habitat and are known to harbor relatively high densities of SRRs and captures of reproductively mature individuals, as well as SRRs of various sizes, provides evidence of a relatively healthy breeding population at the SAF.

Management. Prevent degradation and loss of habitat, control and eradicate exotic plants, prohibit off-road vehicles, reduce feral cat numbers, continue to survey the distribution and status of silver rice rats on Saddlebunch Key, and increase awareness and stewardship for the protection of the species. This INRMP protects habitat for silver rice rats through active management of factors such as wetlands (Section 4.1.1), soil conservation and erosion (Section 4.1.3), invasive species (Section 4.1.6), and Boca Chica restoration (Section 4.1.7). Projects described in this INRMP that benefit and conserve silver rice rat habitat include Wetlands

Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Smalltooth Sawfish (*Pristis pectinata*)

Status. Endangered – Federal. No critical habitat is designated as NMFS has deemed it indeterminable.

Habitat Use and Requirements. Sawfish are known to utilize many different habitat types ranging from muddy near shore estuarine environments to hard bottom coral reef tracks. Sawfish may utilize habitats not previously identified such as coral reefs and deep coastal waters. There may also be a euryhaline association with the species. Historically, sawfish were abundant in near shore estuaries, such as the Indian River in Florida where there is a large freshwater influx.

Habitat Conditions. Sawfish are known to utilize shallow subtropical-tropical estuarine and marine waters as well as nearshore mangrove lagoon systems. Smaller smalltooth sawfish may be found in mangrove lagoons connected to open water at NASKW. Literature suggests increased occurrences of sawfish proximate to mangroves; however, varied salinity regimes within mangrove ecosystems may also affect species utilization (NAVY 2005, GOMEX MRA).

Limiting Factors. Wetland degradation, increased sedimentation and turbid conditions, eutrophication, point and non-point pollution, and hydrologic modification are considered to be the main limiting factors for the sawfish.

Current Status. Historically, the species could be found from New York to Brazil, but the only remaining population in U.S. waters exists off southern Florida. This population is likely isolated from other sawfish populations. Specialists from the Florida Museum of Natural History conducted sawfish surveys at NASKW in 2011 and 2017, but no sawfish were captured or directly observed during those efforts. However, between those same years, the Museum’s International Sawfish Encounter Database logged 31 confirmed smalltooth sawfish sightings in NASKW waters. The high quality and quantity of habitat on Navy properties suggests that NASKW may be an important area for the recovery of the smalltooth sawfish in U.S. waters.

Management. Protect the NASKW near-shore environment from increased turbidity, and prevent soil erosion and nearshore mangrove degradation. As part of the Boca Chica Airfield Restoration, the Navy has agreed to the following management actions:

- (1) An INRMP project was programmed to periodically survey for smalltooth sawfish use of installation waters (Project 14: Smalltooth Sawfish Survey),
- (2) The Navy conducted mitigation for open water mangrove impacts during mangrove removal in the 64.53 acres that were accessible to the smalltooth sawfish, and
- (3) The Navy agreed to minimize impacts to the smalltooth sawfish by trimming 2.47 acres of mangrove habitat south of the approach end of Runway 25 as opposed to removing it (Navy 2007, Volume II, Attachment A-2).

This INRMP protects habitat for smalltooth sawfish through active management of factors such as soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), Boca Chica restoration (Section 4.1.7), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve smalltooth sawfish habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Marine Resources Survey, and Smalltooth Sawfish Survey (see Appendix A for descriptions and project accomplishments).

West Indian Manatee (*Trichechus manatus*)

Status. Endangered - State and Federal; Critical habitat for the Florida manatee includes various locations in Florida, including Buttonwood Sounds between Key Largo, Monroe County; the mainland of Dade County; Biscayne Bay, and all adjoining and connected lakes, rivers, and canals (USFWS n.d.[a]). No critical habitat for the Florida manatee is located at NASKW.

Habitat Use and Requirements. Manatees occur in both fresh- and saltwater habitats within tropical and subtropical regions. They depend upon areas with access to natural springs or manmade warm water refugia and access to areas with vascular plants and freshwater sources. The manatee is a migratory mammal that seeks warmer waters in the cooler months (USFWS 1999). West Indian manatees feed primarily on freshwater aquatic vegetation.

Habitat Conditions. Although temperatures are suitable for manatees in the Florida Keys, the low number of manatees has been attributed to the lack of fresh water (Beeler and O’Shea

1988). Manatees are occasional visitors (particularly in the winter months) to the extreme western Lower Keys. They are known to frequent the area encompassed by the FKNMS.

Limiting Factors. Heavy mortality occurs from accidental collisions with boats and barges, and from canal lock operations. Another closely related factor in the decline has been the loss of suitable habitat due to incompatible human water traffic.

Current Status. Occasional visitor. Manatees have been observed at the Boca Chica and Sigsbee Marinas.

Management. Promote public awareness of the potential for manatees in Installation waters with a goal of preventing any boat/manatee collisions from occurring as a result of Installation activities, to include posting manatee educational signage in conformance with FWC guidelines (see <http://www.myfwc.com/wildlifehabitats/managed/manatee/education-for-marinas/>). Ensure that NASKW boating activities comply with manatee protective measures such as “no wake zones” in the marinas and access channels. Any collision with or injury to a manatee will be reported immediately to the FWC Hotline at 1-888-404-3922. Ensure that requirements are met to maintain annual Clean Marina status at Boca Chica Marina.

This INRMP protects habitat for manatees through active management of factors such as wetlands (Section 4.1.1), soil conservation and erosion (Section 4.1.3), stormwater and water quality (Section 4.1.4), and coastal and marine management (Section 4.2). Projects described in this INRMP that benefit and conserve manatee habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Federally Listed Species Assessments and Monitoring to Support Military Activities, Community Outreach and Natural Resources Information and Awareness, Fish and Wildlife Conservation Informational Signage, Habitat Management Restoration, Ecological Survey, and Marine Resources Survey (see Appendix A for descriptions and project accomplishments).

White-Crowned Pigeon (*Patagioenas leucocephala*)

Status. Threatened – State.

Habitat Use and Requirements. The white-crowned pigeon is a Caribbean bird that inhabits low-lying forest habitats with ample fruiting trees. Its distribution in the United States is restricted to Florida Bay, Biscayne Bay, and the Florida Keys. It is known to occur on NASKW and to eat the berries of poisonwood trees.

Habitat Conditions. Exotic species eradication and control has benefitted the low hardwood plots around NASKW. Specifically, the removal of leadtree and Brazilian pepper has opened these habitats for the preservation and progression of natural species upon which the white-crowned pigeon depend.

Limiting Factors. Habitat degradation, deforestation, and proliferation of invasive exotic plant species are principle threats throughout the pigeon’s range.

Current Status. Resident. The white-crowned pigeon ranked among the most commonly detected species during the course of a 2016 breeding season bird survey. The areas of occurrence for this species included the hardwood hammocks surrounding the weapons facility as well as the wetlands restoration areas on Boca Chica. White-crowned pigeons were also observed on Fleming Key, Big Coppitt Key, and Dredgers Key.

Management. Conserve remaining hardwood hammock forests and mangrove habitats. Continue effort to control invasive plant species. This INRMP protects habitat for white- crowned pigeons through active management of factors such as floodplains (Section 4.1.s), soil conservation and erosion (Section 4.1.3), grounds maintenance (Section 4.1.5), and invasive species (Section 4.1.6). Projects described in this INRMP that benefit and conserve white- crowned pigeon habitat include Wetlands Protection and Shoreline Enhancement, Wetland Restoration Mitigation Monitoring, INRMP Review and Update, Evaluation of Vegetation Maintenance Methods on Lower Keys Habitat, Federally Listed Species Assessments and Monitoring to Support Military Activities, Nuisance Animal Control, Community Outreach and Natural Resources Information and Awareness, Listed and Rare Bird Assessment and Habitat Improvement, Fish and Wildlife Conservation Informational Signage, Habitat Management and Improvement, and Ecological Survey (see Appendix A for descriptions and project accomplishments).

Natural Communities

The natural communities at NASKW support diverse populations of plants and animals, many of which are rare and endangered species. These communities will be managed to sustain and enhance their unique natural resources consistent with the military mission. Management techniques for natural communities are discussed below.

- **Beach dunes** should be renourished and/or stabilized and enhanced to provide endangered sea turtle nesting habitat.

- **Tidal swamp** should be buffered against industrial stormwater runoff to protect important fish nurseries and bird rookeries.
- **Coastal berm** should be buffered against stormwater runoff and enhanced by exotic species removal. This will provide transitional zone habitats important to the silver rice rat and the Lower Keys marsh rabbit.
- **Coastal rock barren** should be buffered against stormwater runoff and enhanced by exotic species removal to provide transitional zone habitats important to the silver rice rat and the Lower Keys marsh rabbit. In addition this community type should be fenced to protect the areas from illegal debris and dumping.
- **Rockland hammock** should be buffered or fenced to protect this community from illegal debris and dumping and harvesting of plant species. In addition exotic species should be removed from these areas.

Climate Change

Climate change places many species of wildlife at ever increasing risk. It affects migrants, such as birds, as well as species that cannot migrate due to highly localized habitat requirements, such as the Lower Keys marsh rabbit. Many migratory species time their arrival in a particular area to coincide with prey availability or vegetative production. Mild winters and warm springs, for example, can cause plants to seed earlier than normal and can reduce the recruitment of juvenile prey fishes, providing less forage for migratory birds that, for generations, arrived later in the season to take advantage of peak food source.

There are three primary ways in which climate change can affect birds and wildlife:

- Weather impacts, including events such as rising temperature, drought, flooding, excessive rainfall, and tropical storm events can cause direct effects.
- Collateral habitat damage can result from the above-mentioned weather events and can result in long-term changes, and even complete destruction, of a habitat. Storm surge from a tropical storm can alter the salinity regime of a coastal wetland. Drought can increase the chance of unplanned fire or alter plant species composition.
- Indirect threats may include the above-mentioned asynchrony of a bird migration with available food sources, as well as food chain effects related to impacts of aquatic prey on fisheries.

Under a normal, gradual rate of climate change, most species have time to adapt, are able to compensate for differences in temperature and weather patterns, and rebound from an

infrequent weather events. The recent increase in the rate of climate change, and the increasing frequency of droughts, floods, and storm surge, however, may outpace the adaptive abilities of many species. Some species are more vulnerable to these threats than others. This would include those with specialized habitat requirements, those with relatively slow reproductive cycles, and those that are sedentary plants or corals. A climate change vulnerability assessment would help managers at NASKW to prioritize species and habitats for which urgent adaptive management options should be implemented.

Project Summaries

Project: None.

Strategy: Annually survey and monitor all known and potential sites for roseate and least tern nesting.

- Tasks:**
- (1) Coordinate surveys and monitoring with federal and state wildlife biologists.
 - (2) During the active nesting season, ensure that no new roofing and/or repairs are conducted on buildings by nesting terns.

Project 4: Evaluation of Vegetation Maintenance Methods on Lower Keys Marsh Rabbit Habitats

Strategy: Protect and manage critically important habitats of the Lower Keys marsh rabbit.

- Tasks:**
- (1) Remove woody vegetation, prescribed burn, apply herbicides as appropriate, and restore habitat for the LKMR.
 - (2) Develop a grounds maintenance plan that preserves LKMR habitat on the airfield.

Project 5: Lower Keys Marsh Rabbit Survey and Habitat Management

Strategy: Continue to monitor the LKMR to determine distribution and population abundances and to evaluate management efforts and the effects of Navy operations on the resident population.

- Tasks:**
- (1) Coordinate with Navy wildlife biologists as well as federal and state biologists on the appropriate methodology to monitor LKMR populations.
 - (2) Work with cooperators and expects to develop a streamlined and easily replicated methodology for implementing the monitoring program.
 - (3) Seek additional information from other wildlife experts with local knowledge of LKMR biology (i.e. Texas A&M University).

Project 6: Federally Listed Species Assessments and Monitoring to Support Military Activities

Strategy: Protect and manage critically important habitats of threatened, endangered, and candidate species located at NASKW.

Tasks: (1) Continue efforts to monitor other (e.g. those species without specific monitoring projects) rare, threatened and endangered species such as the American crocodile, Blodgett's wildmercury, silver rice rat, and Schauf swallowtail butterfly on Installation properties.

Project 9: Listed and Rare Bird Assessment and Habitat Improvement

Strategy: Protect and manage species of concern by enhancing habitat on NASKW.

Tasks: (1) Enhance habitat for birds by adding sand, rock, crushed shell and gravel to coastal beaches, dunes and islands. Provide nesting platforms for roseate terns and ospreys, as needed and required.

Project 14: Smalltooth Sawfish Survey.

Strategy: Complete surveys for smalltooth sawfish and its habitats in waters around the NASKW properties.

Tasks: (1) Document the occurrence of sawfish in near-shore and open-water areas.
(2) Determine the potential of near-shore and open-water areas as suitable habitat for smalltooth sawfish.

Project 15: Sea Turtle Protection Lighting

Strategy: Reduce the emission of light that may disorient nesting sea turtles and hatchlings.

Tasks: (1) Replace lights with "turtle friendly" lighting that meets Florida Fish and Wildlife Conservation Commission (FWC) Guidelines.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Threatened and Endangered Species Management

Endangered Species Act, 16 USC 1531-1543 , Title 50 Code of Federal Regulations (CFR) Part 17, provides for the identification and protection of threatened and endangered species of fish, wildlife, and plants and their critical habitats. Requires federal agencies to ensure that no agency action is likely to jeopardize the continued existence of a threatened or endangered species.

Migratory Bird Treaty Act, as amended 16 USC 703-712, prohibits the taking or harming of a migratory bird, its eggs, nests, or young without the appropriate permit.

Sikes Act, as amended 16 USC 670 a-o, requires each military department to manage fish and wildlife resources in accordance with a tripartite cooperative plan agreed to by the USFWS and state wildlife agency, to provide its personnel with professional training in fish and wildlife management.

National Defense Authorization Act of 2004, Public Law 108-136. This law recognizes that adequate conservation measures specified in an INRMP, and meeting other criteria that ensure implementation of the measures, can obviate the need for critical habitat designation on Department of Defense lands.

Marine Mammal Protection Act of 1972, 16 USC 1361-1407, prohibits the taking or harming of marine mammals without the appropriate permit.

Fish and Wildlife Conservation Act, 16 USC 2901, encourages all federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency’s statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats.

EO 13112, 3 February 1999, requires executive agencies to restrict the introduction of exotic organisms into natural ecosystems.

OPNAVINST 5090.1E, 12-2, discusses laws that govern natural resources management relating to the protection and management of fish and wildlife resources.

Florida Statutes, Chapter 370.12, Saltwater Fisheries, regulates the taking, killing, destroying, harassing, disturbing, and molesting of any marine turtle.

Florida Statutes, Chapter 370.072, Florida Endangered and Threatened Species Act, is to conserve, protect, and manage the threatened and endangered species and their habitats.

Additional Sources of Information

Telephone Contacts:

USFWS, Vero Beach: Ashleigh Blackford, 772-469-4246

NOAA Fisheries PRD, St. Petersburg: Joe Heublein, 727-209-5962

FWC: Tim Towles, 772-469-4253

FWC, Roseate Tern POC: Ricardo Zambrano, 561-882-5719

Internet Sites

Habitat Conservation Planning Handbook:

https://www.fws.gov/endangered/what-we-do/hcp_handbook-chapters.html

USFWS, Endangered Species: <https://www.fws.gov/endangered/>

NMFS, Protected Resources Division:

<https://www.fisheries.noaa.gov/about/office-protected-resources>

FWC, Imperiled Species: <https://myfwc.com/wildlifehabitats/wildlife/>
 FWC Florida Shorebird Database: <https://public.myfwc.com/crossdoi/shorebirds/>

South Florida Multi-Species Recovery Plan:
<https://www.fws.gov/verobeach/ListedSpeciesMSRP.html>

4.3.3 Essential Fish Habitat

Essential fish habitat (EFH) is described as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. It includes physical factors, such as temperature and bottom type, as well as chemical factors, such as oxygen levels and dissolved minerals. The habitat requirements for each stage of a fish's life cycle—egg, larvae, juvenile, and adult—might vary within the same water body.

EFH in proximity to NASKW has been identified by the South Atlantic Fisheries Management Council (SAFMC) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The Navy consults with NMFS prior to undertaking any actions that may adversely affect EFH.

One of the greatest long-term threats to commercial and recreational fisheries is the loss of marine, estuarine, and other aquatic habitats. In this regard, NMFS encourages the establishment of living shorelines as opposed to hard shorelines (i.e., seawalls and jetties) to help preserve nearshore EFH, and the Navy will adopt this approach when practicable. Many fish habitats have been harmed to the point where fish populations cannot recover without human intervention, if at all. Impacts from certain fishing practices, such as bottom trawling, as well as coastal development, damage, alter, or destroy these habitats. Most Navy activities on NASKW that could potentially impact EFH include replacing or installing seawalls, docks, piers, and wharfs, which might temporarily damage EFH but are necessary to accomplish the installation's mission objectives. Early communication with the NMFS Habitat Conservation Division prior to any such activity helps the Navy to minimize or avoid impacts to EFH, resulting in efficient consultation to further facilitate mission objectives.

Objectives

1. *Protection of wetlands and their natural functions while upholding Installation's mission and facility development.*
11. *Protect and manage critically important habitats of resident and migratory threatened and endangered species, and species of special concern.*

Long-Term Management

Mangroves

Mangroves trees grow along the intertidal shorelines, in lagoons, and basins across NASKW. Three species occur on the installation properties in transitive zones, with red mangroves (*Rhizophora mangle*) growing in shallows and on the shoreline, black mangroves (*Avicennia germinans*) growing in areas that are dry during low tide, and white mangroves (*Laguncularia racemosa*) growing on higher ground where they are rarely inundated by tidal waters. Mangroves serve many ecological functions, including as habitat for birds, mollusks, crustaceans, and fish, as natural buffers against tropical storms, and for shoreline stabilization to prevent erosion. Mangroves also provide nutrients to adjacent ecosystems such as coral reefs and seagrass beds.

A 2006 comprehensive EFH Assessment at NASKW concluded that limited hydrodynamics has caused much of the mangrove habitat at Boca Chica Key to become basins, which do not fully support nursery or adult fish managed under the MSA. Since then, hydrodynamic restoration at Boca Chica Key is ongoing as part of the airfield recapitalization and Wetland Restoration Mitigation Monitoring project (Project 2 in Appendix A), and is likely to enhance the value of mangrove habitats to fish species managed under the MSA. Results of the 2011 smalltooth sawfish survey indicated that the mangrove habitat along the coastline of NASKW was suitable as habitat for that listed species (Project 14 in Appendix A). Installation managers continue to consult with FDEP, FWC, NMFS, and USFWS (when listed species are involved) with regard to any actions that affect mangroves and mangrove habitat on NASKW.

Seagrass

Seagrasses grow in shallow areas around NASKW. Their leaves and stems absorb wave energy and help settle sediments, while the roots help stabilize the substrate. Seagrasses protect shorelines from erosion, filter polluted runoff, and absorb nutrients that, in overabundance, lead to algae blooms that can impair water quality. They also provide fish, crabs, and other aquatic species with living space, refuge from predators, and essential nursery areas.

NASKW has surveyed seagrasses on several occasions and for various projects (CSA International 2003; E&E, 2006; CSA International 2007a; CSA International 2007b; Burgess et al. 2011; HDR 2013), and future surveys are prescribed by Project 13 (Marine Resources Survey; Appendix A). Seagrass surveys typically have been completed to assess impacts of mission-

critical actions such as dredging and to inform subsequent seagrass mitigation decisions. The hydrodynamic restoration at Boca Chica Key, which was associated with the airfield recapitalization enhanced tidal flushing and nutrient delivery to seagrasses in the previously-isolated embayments around the airfield, which will be notable to track.

Coral, Coral Reefs, and Hard Bottom

Coral reefs do not occur at NASKW but are found in nearby waters. Individual coral colonies occur on installation properties, primarily on artificial structures such as sea walls, pilings, and jetties. Hard bottom can also be found in shallow water in close proximity to installation properties. These habitats support wide ranges of fish species and their prey by providing shelter, refuge from predators, and substrate to which algae and other forage plants can attach.

The corals, coral reefs, and hard bottom habitats in the waters around NASKW are within the FKNMS and, as such, have been determined to meet the criteria for EFH habitat areas of particular concern (EFH-HAPCs). This determination originated with 1996 amendments to the MSA that allow the SAFMC to designate portions of EFH as being particularly important (EFH-HAPCs). As a result, the SAFMC provides additional protection for coral, coral reef, and hard bottom habitats within the FKNMS.

Erosion and runoff control are two key management strategies employed by NASKW that benefit corals adjacent to the installation. Additionally, Project 13 (Marine Resources Survey; Appendix A) involves recurring surveys of coral resources at NASKW properties.

NASKW cannot always avoid impacting corals due to mission-essential activities. An example was the replacement of dilapidated seawalls at the Truman Harbor mole pier. The Navy translocated hard corals growing on the seawalls, moving them to nurseries in the FKNMS, and partnered with scientific researchers, educational organizations, and other approved entities that collected corals for scientific and educational purposes. A total of 1,373 coral colonies and fragments were relocated in 2003-04 and 1,476 colonies and fragments were relocated in 2011 (Fitzgerald 2004; Frank 2011). These efforts were examples of effective conservation partnering. NASKW would continue to work with the FKNMS when additional coral translocations may be necessary for Navy activities.

Climate Change

Natural communities that serve as EFH exist within specific climate, water, and salinity regimes; coral reefs and seagrasses grow in clear, shallow seawater with abundant sunlight and stable temperatures while mangroves thrive in the often brackish areas between the low and high tide lines. In many climate change scenarios, the speed and direction of fluctuating conditions appears to be unprecedented, such that climate change may exceed the capacity of these vital habitats to keep pace. Mangroves and seagrasses are both limited by water depth. As seas rise, they may not survive in their current locations. The effects of ocean warming and acidification on corals has proven destructive. Successfully addressing the climate threats to essential fish habitat is certain to be a collaborative effort, aided by the installation's long history of successful partnering with the FKNMS. Continued benthic habitat surveys (Project 13), particularly with an eye toward the effect of climate on marine resources can be incorporated with other research in the region to help climate experts prioritize which climate effects and which living marine resources require adaptive action.

Project Summaries

Project 13: Marine Resources Survey

Strategy: Conduct quantitative surveys of benthic marine resources located near NASKW maritime facilities.

Tasks: (1) Survey nearshore benthic resources, habitats, and species on a minimum five-year basis.

Project 14: Smalltooth Sawfish Survey

Strategy: Complete surveys for smalltooth sawfish and its habitats in waters around the NASKW properties.

Tasks: (1) Document the occurrence of sawfish in near-shore and open-water areas.
(2) Determine the potential of near-shore and open-water areas as suitable habitat for smalltooth sawfish.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Coastal and Marine Management

The Magnuson-Stevens Fishery Conservation Management Act (16 U.S.C. 1801-1882), established regional Fishery Management Councils and mandated the creation of fishery management plans to responsibly manage exploited fish and invertebrate species in Federal waters of the United States. Congress re-authorized the Act in 1996 with several changes. One

change was to charge NOAA Fisheries with designating and conserving EFH for Federally managed species. The revisions to the act are intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat. The statute requires Federal agency consultation with NOAA Fisheries on any action that may adversely affect EFH.

Coastal Zone Management Act (16 U.S.C. 1451, et seq.), as amended, provides for the preservation, protection, development and, where feasible, restoration or enhancement of the nation's coastal zone. As required by Section 307(c) of the Coastal Zone Management Act, a proposed federal action must be consistent with the approved Florida Coastal Management Program to the maximum extent practicable.

Executive Order 13089 (63 FR 32701-32703 (1998)), "to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment." The Executive Order directs that all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

Florida Statutes, Chapter 370.103, Agreements with Federal Government for the Preservation of Saltwater Fisheries. The FWC is authorized and empowered to enter into cooperative agreements with the Federal Government or agencies thereof for the purpose of preserving saltwater fisheries within and without state waters and for the purpose of protecting against overfishing, waste, depletion, or any abuse whatsoever. Such authority includes the authority to enter into cooperative agreements whereby officers of the FWC is empowered to enforce federal statutes and rules pertaining to fisheries management. When differences between state and federal laws occur, state laws shall take precedence.

Additional Sources of Information

NMFS Habitat Conservation Division

Jocelyn Karazsia, NMFS West Palm Beach Field Office, 400 North Congress Avenue, Suite 120, West Palm Beach, FL 33401, (561-616-8880 ext. 207)

Internet Sites

NOAA Habitat Conservation: <https://www.fisheries.noaa.gov/topic/habitat-conservation>

NOAA EFH Mapper: <https://www.habitat.noaa.gov/protection/efh/efhmapper/>

South Atlantic Fishery Management Council: <https://safmc.net/>

4.3.4 Prevention and Control of Wildlife Damage and Disease

The prevention and control of wildlife damages are actions to reduce wildlife species’ conflicts with people or other wildlife species. The primary wildlife damage issue on NASKW is the potential for bird/animal aircraft collisions. Additionally raccoons, feral cats, and iguanas are known to occur on the Installation and may be considered nuisance individuals under certain circumstances. Some birds, such as house sparrows, starlings, pigeons, vultures, and crows may also be considered nuisance wildlife in some instances. Nuisance wildlife on the Installation could pose a threat to implementation of the military mission.

Prevention and control of wildlife disease addresses diseases transferred between wildlife species and/or diseases transferred directly or indirectly from wildlife species to humans. Diseases of wildlife can cause illness and death to individual animals and can significantly affect wildlife populations. Wildlife species can also serve as natural hosts for diseases that affect humans (zoonoses). The disease agents or parasites that cause these zoonotic diseases can be contracted from wildlife directly by bites or contamination or indirectly through the bite of arthropod vectors such as mosquitoes, ticks, fleas, and mites (McLean 1994).

Objectives

- 14. *Control nuisance wildlife and wildlife diseases that may adversely affect human health or welfare, the health of the ecosystem, and the military mission.*

Long-Term Management

Bird/Animal Aircraft Strike Hazard (BASH)

The NAS Key West BASH Plan is designed to reduce the bird/animal strike potential through promulgation of avoidance procedures, monitoring bird activity, and controlling bird/animal populations and movements through habitat manipulation and land use planning (Appendix D). The Aviation Safety Officer at NASKW is responsible for implementation, monitoring, and enforcement of the BASH Plan and is the leading member of the Bird Hazard Committee (BHC) (Appendix D). The Installation also has a Wildlife Hazard Management Plan

(WHMP) to guide mitigation, control, depredation, and removal of hazards to safe airfield operations (NASKW 2019).

NAS Key West will manage all habitats, natural and man-made, surrounding an airfield in order to discourage bird/animal hazards. Wildlife occurs at or near airfields generally because food, water, or shelter are nearby and/or during migrations. By managing areas so that they are less attractive to wildlife, it is possible to reduce hazards. Thorough and periodically updated ecological studies of airfields and their vicinities provide vital information to reducing bird/animal strike hazards. The Aviation Safety Officer will consult with the NRM to determine proper grounds maintenance practices in the vicinity of the airfields. Grounds maintenance activities will be implemented in the vicinity of airfields to reduce BASH-related incidents.

Birds may be discouraged from the vicinity of the airfield by using several active and passive techniques to reduce bird population. These techniques vary in cost and effectiveness depending on the situation. Active controls involve dispersing birds from an airfield to provide short-term relief to an immediate safety hazard. Passive techniques are more long range in nature and involve managing the airfield to eliminate those factors that attract birds to it.

Active bird controls include the following:

- **Frightening the birds from the airfield.** The keys to a successful bird frightening program include: a habitat management program to discourage birds before they become a hazard; always responding and responding rapidly to birds on the airfield (never allowing them to remain); and persistence in the use of the chosen control techniques. Techniques include:
 - **Bio-acoustics** are taped distress or alarm calls of actual birds. The equipment required to adequately project these calls include a cassette tape deck and a speaker that can be mounted on the exterior of a vehicle. Special care must be taken to play the calls in short intervals to prevent habituation by the birds. Play the tape for 20 to 30 seconds and then pause briefly. Repeat the procedure several times if necessary. The birds should respond by taking flight or becoming alert. These calls are effective for gulls, blackbirds, starlings, crows, and some shorebirds. If the birds become familiar with the tape, it should be reinforced with pyrotechnics.
 - **Pyrotechnics** are loud explosive devices, resembling a fire cracker, that are launched from assorted firearms. For example, some cartridges are 12-gauge and fired from a 12-gauge shotgun, while others are smaller and fired from a pyrotechnic pistol. The cartridges are fired into or above flocks of birds to scare them from the area. Pyrotechnics are to be used in conjunction with bio-acoustics. Playing the tape and launching the cartridges should be done simultaneously.

- **Depredation of birds** may sometimes be necessary. Birds must be killed occasionally as a reinforcement of other methods and will be used as a last resort when other methods have failed. Domestic pigeons, European starlings, and house sparrows can be killed without a permit. Shooting birds should be done while playing the bio-acoustic tape. The FWC will be notified before any proposed takings.

Passive controls include the following:

- **Grass height management.** One of the most important tools for bird reduction on airfield is the maintenance of grass height. Flocking birds must see each other to maintain flock integrity while feeding. Tall grass blocks the birds' view and also impedes raptors' ability to spot prey. Grass height will be maintained between 7 and 14 inches.
- **Brush control.** Brush attracts a variety of birds. The airfield clear zone will be kept clear of brush and weeds.
- **Standing water.** Standing, especially fresh, water is a major attractant to birds, including gulls and waterfowl. Any areas in the clear zone that retain fresh water long enough to attract birds following a rain will be regraded to increase drainage. This does not include permitted stormwater ponds and drainage ditches maintained for water quality and flood protection. Vegetation control in these systems will eliminate food and cover.
- **No feeding policy.** It is imperative to adopt a strict no-feeding policy, not only for birds, but for all wildlife. All food-related trash should be properly disposed of, and all trash should remain covered at all times.

Ultrasound, rubber snakes, stuffed owls, rotating/flashing lights, loud music, and other such devices are ineffective and will not be used. Driving vehicles through a flock of birds is also ineffective and will not be used as it works only temporarily; the birds circle, then land in the original area. Eliminating birds from the airfield and in hangars will be handled as problems arise.

If all other environmental modifications and active control measures are unsuccessful in reducing bird hazards, another option is to alter flying operations to reduce the bird strikes. These operational changes will be dictated by the severity of the problem, the performance capability of the aircraft and training and/or readiness requirements. Each BASH incident will be handled individually. Additional guidelines pertaining to BASH management are provided in the BASH Plan for NASKW.

Wildlife Damage

In the event that NASKW identifies a wildlife conflict, a damage control program will be established. The program will have four parts (Dolbeer et al. 1994):

- Problem definition: to determine the species and number of animals causing the problem, the amount of loss or nature of the conflict, and other biological and social factors related to the problem. To accomplish this, the Installation will keep records for the following:
- Ecology of the problem species: to understand the life history of the species, especially in relationship to the conflict.
- Control method: takes the information gained from parts 1 and 2 and develops an appropriate management program to alleviate or reduce the conflict.
- Evaluation of control: assesses the reduction in damage in relation to costs and impact of the control on target and non-target populations and the environment.

Wildlife Disease

There have been no reports of diseases affecting wildlife or humans on the Installation. However, NASKW will have a long-term management policy of public awareness (e.g., informing employees and visitors) about the issues of concern to management. Management will focus on, but will not be limited to, the following issues:

- Knowledge of the diseases in the area and the specific times of year that present the greatest risk of exposure.
- Knowledge of and recognition of early symptoms of diseases and the condition of exposure.
- The use of extreme caution when approaching or handling a wild animal, especially one that looks sick or acts abnormally.
- The use of protective measures against fungal diseases where there is an accumulation of animal feces (e.g., under bird and bat roosts).
- Protection from vector-borne disease in high-risk areas using measures such as mosquito or tick repellent or wearing special clothing.
- Reduction in host populations and their ectoparasites.
- NAS Key West will integrate regional issues and policies regarding wildlife disease control.

Climate Change

Extensive periods of drought can result in decrease ground cover through vegetative die-off, which facilitates more severe ground damage via rooting and digging. Similarly, gully-washes during severe rainfall events can exasperate or facilitate wildlife-induced erosion. Planting suitable drought-tolerant vegetation in sensitive areas and either vegetative or man-made fortification of potential wash-out zones could help mitigate these impacts. Reduced forage

during periods of drought could also force some animals to look for food in urbanized areas of the installation which could damage property and pose risks to residents. Securing trash cans and otherwise removing potential anthropogenic food sources would help discourage such behavior.

Disease vectors, such as insects, depend upon climatic factors such as temperature, sunlight, precipitation, relative humidity, and carbon dioxide for their development and productivity. Insect growth occurs only above a minimum temperature threshold and their rate of growth increases with warming temperatures up to a maximum threshold, which is species-specific. Climate change may therefore be expected to increase the growth rate and proliferation of various insect pests, and may even facilitate the introduction of pests that were intolerant of previously-existing temperature and precipitation regimes.

Weather patterns that may concentrate wildlife under stressful conditions, such as water shortages during extended drought, can concentrate feral animals at freshwater sources, enhancing conditions for the outbreak and spread of disease.

Project Summaries

Project 7: Nuisance Animal Control

Strategy: Control nuisance animals and wildlife populations as needed. NAS Key West will continue to entrap and remove raccoons and feral cats from Installation properties to support the recovery of the endangered Lower Keys marsh rabbit.

Tasks:

- (1) Develop an awareness program to educate Installation personnel and residents about the damaging effect that feral cats have on the survivability of the LKMR and the importance of eliminating them from base lands.
- (2) Through research and training, natural resources personnel will use the most recent methods and techniques to control nuisance and diseased wildlife.
- (3) Continue to use Integrated Pest Management techniques and emphasize the use of pesticides with low toxicity and low application rates.

Project: None

Strategy: Continue to implement the BASH Management Plan.

Tasks:

- (1) Monitor the airfield to spot and prevent BASH problems before damage occurs.
- (2) Utilize appropriate methods to control wildlife that is hazardous to aircraft; obtain required permits from USFWS and FWC.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Wildlife Damage and Disease

Forest Pest Suppression Memorandum of Agreement between the Department of Agriculture and DoD, 11 December 1990, is the planning, coordination, and execution of field operations to prevent and suppress damaging forest insects and disease outbreaks.

Additional Sources of Information

Internet Addresses:

- Naval Safety Center, Airfield Operations:
<https://www.public.navy.mil/NAVSAFECEN/Pages/aviation/AirfieldOperations.aspx>
- Prevention and Control of Wildlife Damage:
<https://digitalcommons.unl.edu/icwdmhandbook/>
- USDA, APHIS, Wildlife Services:
https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_Program_Overview
- USGS National Wildlife Health Center: <https://www.usgs.gov/centers/nwhc>
- Navy Feral Cat Policy: <https://www.denix.osd.mil/dodpif/legislation-and-policy/laws-and-statutes/migratory-birds-mbta/mbtadod/executive-order-mou/policy-letter-preventing-feral-cat-and-dog-populations-on-navy-property/>

4.4 Outdoor Recreation

For the purposes of this INRMP, outdoor recreation is defined as the use of natural resources, including indoor interpretive centers, where the primary focus is on the understanding and application of the natural environment. Outdoor recreation includes nature trails, picnic and camping areas, consumptive and non-consumptive uses of natural resources, establishment and management of recreational trails, scenic rivers, and other consumptive and non-consumptive uses of natural resources. The use of off-road vehicles and support of athletics facilities such as golf courses, tennis courts, ball fields, and swimming pools are not considered outdoor recreation in the context of this plan. The MWR Department is responsible for maintaining and developing recreational activities at NASKW, with the exception of natural resources-based outdoor recreational activities such as nature trails, watchable wildlife areas and fishing.

Objectives

15. *To implement existing and further develop (where needed) natural resource-based outdoor recreation programs to support present and future outdoor recreation at NAS Key West.*

Long-Term Management

NAS Key West will continue to provide boating, fishing, hiking, kayaking, camping and other high quality outdoor recreational activities for DoD Civilians, military and their dependents. Outdoor recreational opportunities will be planned, developed, and used consistently with the sustainability of the land. The natural resources program will identify outdoor recreation areas that are over-utilized and/or improperly located; the over-utilization or improper location of an outdoor recreation area may affect natural resources and the military mission. In accordance with Executive Order 11644, as amended by Executive Order 11989, Off-road vehicle use is prohibited on the Installation.

Allowing access to the general public to recreational opportunities on NASKW also presents challenges regarding protecting and ensuring the security of the military mission, the safety of military personnel engaged in fulfilling the mission, and the safety of individuals engaged in recreational opportunities. In general, access for outdoor recreation is limited to active duty and reserve military personnel assigned to work at the Installation, their dependents and accompanied guests; federal civilian employees, their dependents and accompanied guests; and military retirees. Public access to areas at NASKW may be granted for outdoor events on a reservation basis.

Climate Change

Outdoor recreational activities can be highly sensitive to weather, and accordingly, changing climatic conditions can affect the type, extent, and seasonality of recreation usage. For example, with increasing temperatures, certain recreational activities may decline during the hottest months but increase in the cooler months. However, hotter temperatures may also eliminate some recreational opportunities.

Climate-related increases in insect-borne diseases can also affect the extent of outdoor recreational usage. Further, climate change is expected to alter the distribution and availability of some popular fish species, which may result in altered recreational patterns. Increasingly severe storms and downpours can pose safety risks to anglers, campers, boaters, and others.

Project Summaries

Project : None.

Strategy: Develop additional natural resources-based outdoor recreational opportunities at NASKW.

- Tasks:**
- (1) Identify the types of outdoor recreational and educational opportunities compatible with the Installation's mission.
 - (2) Identify potential natural resources conflicts that could arise from increased recreational opportunities.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Outdoor Recreation

Sikes Act and Improvement Act of 1997, 16 USC 670a(b)(1)(G), requires public access to a military Installation for the necessary, appropriate, and sustainable use of natural resources by the public to the extent that the use is not inconsistent with the needs of the fish and wildlife resources or with safety and military security.

Outdoor Recreation – Federal/State Program Act, 16 USC 460 P-3, defines a program for managing lands for outdoor recreation.

OPNAVINST 5090.1E, 12-3.11, discusses natural resources management relating to the protection and management of outdoor recreational resources.

Additional Sources of Information

Internet Addresses:

National Parks Service: <https://www.nps.gov/index.htm>

Florida's Statewide Comprehensive Outdoor Recreation Plan:
<https://floridadep.gov/parks/parks-park-planning/content/statewide-comprehensive-outdoor-recreation-plan-scorp-workgrou>

**PLANNING, STAFFING,
AND TRAINING**

5 PLANNING, STAFFING, TRAINING AND SUPPORT

This section addresses the planning, staffing, training and support necessary to implement the natural resources program at NASKW while supporting the sustainability of the mission.

Objectives

16. *Ensure that land use and natural resource planning decisions sustain the mission of NAS Key West and seek to resolve land use conflicts by integration with other planning processes.*
17. *Continue collaborative partnering to protect and conserve the natural resources in the Florida Keys, maintain environmental compliance, and enhance NAS Key West's ability to meet its mission critical objectives. When possible, coordinate funding of Navy natural resource conservation actions to help achieve multi-agency cooperative goals.*
18. *Provide the staffing, training, budgeting and technology support to ensure implementation of the INRMP.*
19. *Conduct annual meetings in cooperation with the USFWS, FWC, NOAA NMFS, and NOAA FKNMS to review and update the INRMP.*

Because of the increased development in the Florida Keys over the past decades, much of the remaining undeveloped lands are federally owned. The responsibility for protecting and managing these lands have fallen more and more on the federal landowners. These lands often support unique habitats with diverse populations of plants and animals, many of which are threatened or endangered. NAS Key West shares in this responsibility, often working to conserve these sensitive resources without compromising the ability of the Installation to meet its mission. The natural resources program shall support military readiness and sustainability while continuing to protect and conserve the natural resources in the Florida Keys. Natural resources and land management planning should be integrated with other base planning processes. All projects occurring within NASKW that potentially impact natural resources (e.g. wetlands, natural areas, urban forests, floodplains, water quality) will be evaluated prior to implementation. This will allow projects potentially affecting natural resources to be reviewed by appropriate personnel, and potential constraints (e.g. threatened and endangered species, wetlands, floodplains) to be identified. The natural resources data should be integrated into the

Installation's Geographic Information Systems (GIS) and made available to planners and land managers to aid in decision making. Integration of natural resources data in to the GIS database will also ensure that the Installation is not using conflicting resource management techniques or planning land uses that conflict with natural resources conservation. The NRM must ensure that newly acquired or updated natural resources data is integrated into the Installation GIS database on a regular basis.

Natural resources personnel shall review pertinent literature staying informed on current methodologies and techniques for state-of-the-art natural resources management. Natural resources personnel should ensure that project plans, including military construction (MILCON) projects are consistent with the INRMP's management goals, objectives and strategies. NAS Key West will implement adaptive management to accommodate new strategies resulting from monitoring, scientific findings and new management guidelines.

Partnerships are often necessary and effective in implementing an INRMP while maintaining cost-effectiveness. Cooperative agreements are often used in partnerships with states, local governments, non-governmental organizations and individuals to provide for the maintenance and improvement of natural resources on, or to benefit natural resources research on DoD Installations. Cooperative agreements are authorized to implement INRMPs (OPNAVINST 5090.1E, 12-3.4). NAVFAC SE is tasked with providing the technical and administrative guidance for the development of cooperative agreements to implement natural resources plans and execute cooperative agreements on behalf of Installation commanders upon request.

The NASKW NRM cooperates with Navy natural resources support staff at NAVFAC SE, as well as state and federal regulatory agencies such as FWC, USFWS, NOAA NMFS, and NOAA FKNMS to support national defense and to protect and enhance the environmental quality of habitats on and adjacent to the Installation. This partnership benefits and conserves the Florida Keys' natural resources, maintains environmental compliance, and enhances the Navy's ability to meet its mission critical objectives through various initiatives:

- Identify baseline environmental and natural resources conditions at NASKW,
- Maintain and improve the sustainability and biological diversity of the ecosystem unique to the Florida Keys,

- Promote development of the best scientific and field-tested information for use in land management decisions,
- Facilitate and streamline regulatory and business processes,
- Ensure environmental and natural resources compliance,
- Provide for the continued coordination with federal and state fish and wildlife agencies,
- Promote information sharing and scientifically-based data collection and management planning,
- Develop strategies and processes for rapid response to environmental issues and concerns, and
- Pursue incentive-based conservation planning with regulatory and resources agencies.

The Installation command will assign specific responsibility, provide centralized supervision and assign professionally trained personnel to the program. The natural resources staff currently consists of one (1) full time Natural Resources Manager and one (1) full time contracted position for managing approximately 6,433 acres of land distributed across twelve (12) properties located in the Florida Keys. NAS Key West’s natural resources program will be provided with the facilities and equipment needed for managing the Installation’s natural resources. The management, implementation, planning, and enforcement of Navy natural resource management programs are to be inherently a governmental function (16 USC 670a (d)(a)).

Adequate training of natural resource personnel is essential to the success of military sustainability and in providing and sustaining skills necessary in managing the natural resources program at NASKW. The interdisciplinary nature of the natural resources positions require attending pertinent conferences, workshops, symposia, and training courses. Special training that may be required includes the following programs:

- | | |
|---|--|
| • Threatened and Endangered Species Conservation and Management | • Natural Resources Legal Requirements |
| • Wetlands Management | • Hazardous Waste Training |
| • Ecosystem Management | • Safety Training |
| • Technology (GIS/GPS) | • Pest Management |
| • Fire Management | |

Many of the training programs lead to certifications that are required to perform the job (i.e. prescribed burning, wetlands delineation, and pest management). Annual professional training conferences/seminars/meetings include DoD Natural Resources, The Wildlife Society Meetings and miscellaneous conferences such as invasive species conferences. CECOS classes offered include: Natural Resources Compliance, Historic Preservation Law and Section 106 Compliance for Natural Resources, Introduction to Cultural Resource Management Laws and Regulations, and Native American Traditions and Cultures: Implementing DoD Native American Policy. Natural resources personnel will be provided an opportunity to participate in natural resource management job-training activities and professional meetings.

The NASKW Commanding Officer has delegated to the NRM, within the Environmental Division, the authority to implement natural resources management activities. Because the INRMP must be implemented, the NRM is tasked to actively request, receive and use funds for all mandatory projects. These mandatory projects are required to meet recurring natural resources requirements or current legal compliance needs. All INRMP projects must be entered into Environmental Program Requirement website (EPRWeb) to receive approval. Once validated, and entered into EPRWeb, findings for all mandatory projects will be programmed. Stewardship projects should seek alternate funding sources such as legacy funds or agricultural outleasing. The *INRMP Guidance for Navy Installations* provides additional information on alternate funding sources. All projects contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under federal law.

Project Summaries

Project 3: NAS Key West INRMP Review and Update

Strategy: Review and update the INRMP annually in cooperation with the USFWS and FWC.

- Tasks:**
- (1) Evaluate the effectiveness of the strategies and adapt them as necessary.
 - (2) Utilize web-based metrics builder tool to evaluate the effectiveness of the INRMP.
 - (3) Determine if the current INRMP is in need of revision during the annual reviews with the federal and state partners.
 - (4) If a complete rewrite is necessary, develop action plan and initiate rewrite in full cooperation with the signature agencies.

Project 8: Community Outreach and Natural Resources Information and Awareness

Strategy: To implement programs and initiatives that foster citizen participation in ecosystem education and stewardship.

- Tasks:**
- (1) Coordinate outreach activities with the Environmental Director, Public Affairs Officer (PAO) and other appropriate Installation personnel.
 - (2) Promote awareness and encourage participation through Installation and local media.

Project: None

Strategy: Ensure that all command and tenant activities affecting natural resources are coordinated through the Environmental Department's NRM.

- Tasks:**
- (1) Coordinate with the CO and heads of department on the importance of review by the NRM prior to initiation of actions that may affect natural resources.
 - Integrate concepts of the INRMP into other Installation plans as appropriate.
 - Provide Installation personnel with the information needed to communicate effectively about issues related to natural resources management and sustainability.
 - Update or create Installation instructions due to changes in law, regulation, guidance and policy.

Strategy: Continue collaborative partnering to implement the INRMP, enhance conservation goals, and improve management. *When possible, coordinate funding of Navy natural resource conservation actions to help achieve multi-agency cooperative goals.*

- Tasks:**
- (1) Execute cooperative agreements with other agencies, nonprofit organizations and academic institutions to implement INRMP projects while maintaining cost-effectiveness.
 - (2) Partner with support staff at NAVFAC SE and state and federal regulatory agencies to receive expertise in natural resources compliance and planning, to meet conservation goals, and improve management.

Strategy: Provide natural resources personnel with proper training/ certifications for programs identified in this INRMP.

- Tasks:**
- (1) Identify training programs and needs.

Strategy: Continue to use and maintain a GIS system for natural resources mapping.

- Tasks:**
- (1) Compile, maintain and update GIS data coverages, as needed.

Strategy: Provide the Natural Resources Manager with intern support to assist and enable day to day workload accomplishment.

- Tasks:**
- (1) Identify potential candidates for the intern position.
 - (2) Develop workload list for in-house surveys and monitoring to be conducted annually.

Laws, Executive Orders, Regulations, Directives, and Memoranda Relevant to Natural Resources Staffing and Training

Sikes Act, as amended 16 USC 670 a-o, requires each military department to manage fish and wildlife resources in accordance with a tripartite cooperative plan agreed to by the USFWS and state wildlife agency, to provide its personnel with professional training in fish and wildlife management.

Fish and Wildlife Conservation Act, 16 USC 2901, encourages all federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats.

OPNAVINST 5090.1E, 12-3.15 discusses Installation's responsibilities to obtain services of professionals to manage natural resources and for receiving continued training.

Additional Sources of Information

Telephone Contacts:

FWC Stakeholder Coordination: Claire Blunden, 850-488-3831

USFWS Southeast, Sikes Act Coordinator: Marshall Williams, 404-679-4151

DoD National CESU Coordinator: Alison Dalsimer, allyn.a.dalsimer.civ@mail.mil

Internet Addresses:

CECOS: <https://www.public.navy.mil/netc/centers/csfe/cecos/Default.aspx>

USFWS NCTC: <https://training.fws.gov/>

NAVFAC Data Call Station (Metric Builder):
<https://eprweb.cnic.navy.mil/eprwebnet/web/logon.aspx>

Cooperative Ecosystems Studies Unit (CESU): <http://www.cesu.psu.edu/>

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LIST OF PREPARERS

7 LIST OF PREPARERS

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A

NAS Key West Projects

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Appendix A describes the projects to be implemented by NAS Key West. Projects were identified by the NAS Key West NRM and Regional NRM in consultation with fish and wildlife biologists with NAVFAC Southeast, as well as with federal, state, and county wildlife biologists and land managers. For each project, Appendix A discusses the purpose, location, description, cost, relevance to the goals and objectives, baseline, monitoring, and legal requirements.

It is the intent of NAS Key West to implement the projects as described in Appendix A to the greatest extent possible. All actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under federal law. Nothing in this INRMP is intended to be nor must be construed to be a violation of the Anti-Deficiency Act (31 U.S.C. 1341 *et seq.*) Funding for implementation of the INRMP will come from the Installation, Commander Navy Region Southeast (CNRSE), or other natural resources fund sources. The natural resources programs and projects described here are divided into mandatory and stewardship categories to reflect implementation priorities. Every effort will be made to acquire O & M(N) Environmental, or other funding to implement DoD mandatory projects in the timeliest manner possible. Stewardship projects will be funded through forestry, agricultural outlease, fish and wildlife, Legacy, or other fund sources as funding and personnel resources become available. Table A-1 summarizes the projects and Table A-2 shows project costs by fiscal year.

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Table A-1. List of INRMP Projects at NAS Key West, Florida

Project Description	Scheduled Implementation (FY)	Legal Driver	Funding Priority	Budget Criteria²	Funding Source	NEPA Requirement
Line Enhancement	Irregularly	2, 3	M	12035	ENV, STA	No
Monitoring	Annually	5	M	08995	ENV, STA	No
Review and Update	FYs '24, '29	2	M	12026	ENV	No
Maintenance Methods on Lower Keys Marsh Rabbit	Irregularly	2, 4	M	12036	ENV, LY	No
Survey and Habitat Management	Annually	2, 4	M	12036	ENV	No
Assessments and Monitoring to Support Military Activities	Bi-annually	2, 4	M	12025	ENV	No
	Annually	2, 15, 20	M	12036	ENV, STA	No
General Resources Information and Awareness	Annually	2	S	12036	STA	No
Plant and Habitat Improvement	FYs '22, '25, '28	2	M	12016	ENV, STA	No
Informational Signage	Bi-annually	2	M	12016	ENV, STA	No
Restoration (Invasive and Exotic Vegetation Control)	Annually	1, 2, 12	M	12035	ENV, STA	No
Wetlands, Rare Plants, Natural Areas, and Rare Animals	FY's '20, '25	2,4	M	12025	ENV, STA	No
	FY's '20, '25	6	S	08999	ENV, STA	Yes
	Irregularly	4	M	12025	ENV, STA	Yes
	Irregularly	4	M	12025	NEV, STA	No

Legal Drivers

- 1 = 7 U.S.C. 2814 Management of Undesirable Plants on Federal Lands
- 2 = 16 U.S.C. 670 a-f Sikes Act Improvement Amendment
- 3 = 16 U.S.C. 1456 Coastal Zone Management
- 4 = 16 U.S.C. 1531 and 1536 Endangered Species Act
- 5 = 33 U.S.C. 1251 Clean Water Act
- 6 = 16 U.S.C. 1955 Magnuson Stevenson Fisheries Management Act
- 7 = 16 U.S.C. 703 Migratory Bird Treaty Act
- 8 = 16 U.S.C. 2912 North American Wetland Conservation Act
- 9 = 16 U.S.C. 4408 North American Wetland Conservation Act
- 10 = EO 13148 Greening the government through environmental management
- 11 = EO 13112 Invasive Species
- 12 = EO 13089 Coral Reef Protection
- 13 = EO 12962 Recreational Fisheries
- 14 = EO 11990 Protection of Wetlands
- 15 = DoD INST 4715.3 Environmental Conservation Program
- 16 = OPNAVINST 3750.6Q BASH Plan
- 17 = OPNAVINST 5090.1C National Environmental Policy Act
- 18 = OPNAVINST 11010.1J Base Master Plan
- 19 = OPNAVINST 6250.4B Pest Management Operations

Source of Funds:

- AO = Agricultural Outleasing.
- ENV = Environmental O&M(N).
- FOR = Forestry.
- LY = Legacy.
- MWR = Morale, Welfare and Recreation.
- O&M(N) = Navy Operations and Maintenance.
- SCAC = Student Conservation Association Coordinator.
- STA = Station O&M(N).
- UF = User Fees.

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Project No. 1 Wetlands Protection and Shoreline Enhancement

(EPR Project Number: 00213B0112)

Purpose: To protect and maintain land and water resources through wetland restoration and enhancement while supporting the supporting the military mission.

Goal and Objective: Goal 1, Objectives 1, 2, 3, 4 and 5.

Location: NAS Key West.

Description: To implement mangrove wetland restoration projects identified in various reports and through base personnel. These projects will vary, but may include restoring fill areas to wetland habitats and enhancing existing wetlands by restoring tidal drainage/flow. Projects to remove fill pads, structures and roadbeds will be restored by scraping down these areas to original site topography which will precipitate re-colonization of mangroves. The expected ecological benefits of restoration projects include enhancement of wildlife habitat, shoreline protection and water quality functions that previously occurred on-site. Review any state and federal environmental permit requirements for project implementation.

Baseline: This project will function as the baseline.

Monitoring: Coordinated through the environmental permitting process.

Hours: Estimated time for base personnel = 72 labor hours.

Type: Mandatory

Funding Source: ENV O&M(N), Station O&M(N)

Legal Driver(s): 16 U.S.C. 1456 Coastal Zone Management; and Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f.

Related Legal: None.

Accomplishments: No restoration has been executed under this project. Instead, various wetlands restoration and enhancement projects were completed as part of the airfield restoration project. The areas addressed and associated costs of wetlands restoration and enhancement are presented below:

Area Addressed	Cost
Old Boca Chica Perimeter Road	\$858,357
Boca Chica West Lagoons	\$1,730,878
Big Coppitt Site 2 East	\$547,214
Former Antenna Pads	\$1,447,832
Rockland Staging Area Cleanup	\$358,032
NE Hydrological Restoration	\$2,278,845
North Geiger Subdivision	\$1,468,935
TOTAL COST	\$8,690,093

The individual details of the projects above vary but include removing fill to restore wetland habitats and enhancing wetlands by restoring tidal drainage and flow. Projects to remove fill pads, structures, and roadbeds have been restored by scraping down those areas to original site topography or surrounding wetland elevations to precipitate re-colonization by mangroves and other wetland vegetation via plantings and natural propagation. The ecological benefits include enhancement of fish and wildlife habitat, shoreline protection, erosion control, and water quality functions that previously occurred on-site.

The Navy is monitoring the success of these projects, as described in Project 2, in accordance with permits issued by the Army Corps of Engineers and Florida Department of Environmental Protection.

Project No. 2 Wetland Restoration Mitigation Monitoring
(EPR Project Number: 00213S0025)

Purpose: To protect and manage species of concern on NAS Key West.

Goal and Objective: Goal 1, Objective 7.

Location: NAS Key West.

Description: Conduct long –term monitoring of airfield restoration sites and mitigation areas as required in ACOE (#2006-494) and FDEP (#44-0137555-007) permits. This monitoring will require NASKW to conduct field surveys and prepare semiannual and annual monitoring reports detailing the progress of the restoration and mitigation sites. The permits describe in detail the specific monitoring protocols and information to be included in the reports.

Baseline: This project functions as the baseline.

Monitoring: None.

Hours: This project will use contractor or base personnel. Estimated time = 80 labor hours for base personnel administrative oversight.

Type: Mandatory.

Fund Source: Environmental O&M(N)

Legal Driver(s): Section 404 of the Federal Water Pollution Control Act (Clean Water Act), as amended, 33 U.S.C. 1251; North American Wetlands Conservation Act, 16 U.S.C. 4808; and Executive Order (EO) 11990 – *Protection of Wetlands*, Section 5.

Related Legal: Endangered Species Act, 16 U.S.C. 1531 et seq.; Clean Water Act: Section 401 Water Quality Certification, 1986, 33 U.S.C. 1341; OPNAVINST 5090.1C, par 24-7.c.

Accomplishments: Between \$49,000 and \$60,000 was spent each year from 2010 to 2014 to monitor the progress of wetland mitigation areas associated with the airfield restoration project at Boca Chica Key. This monitoring was required in accordance with USACE Permits SAJ-2006-00494(IP-IF) and SAJ 2006-494(IP-IK), and FDEP Permits 44-0137555-007 and 44-0137555-005. Beginning in 2015, additional funds were allocated to continue monitoring the progress of wetland vegetative cover as well as controlling invasive species encroachment and the spread of woody vegetation in these areas. Annual costs since 2014 have ranged from a low of \$83,582 in 2015 to a high of \$153,220 in 2018.

Project No. 3 NAS Key West INRMP Review and Update
(EPR Project Number: 00213B0181)

Purpose: To review and update the INRMP in accordance with OPNAVINST 5090.1C 24-5[c].

Goal and Objective: Goal 4, Objective 17.

Location: NAS Key West.

Description: This project is to provide periodic review and revision of the NAS Key West INRMP. The Installation is required to conduct informal INRMP reviews each year and formal INRMP reviews every five years with USFWS and State partners. During these reviews, it will be determined if the current INRMP is in need of revision.

Baseline: Current INRMP.

Monitoring: None.

Hours: This project will use contractor personnel. Estimated time = 60 labor hours for base personnel administrative oversight and review.

Type: Mandatory.

Funding Source: Environmental O&M(N)

Legal Driver: Sikes Act, 16 U.S.C. 670

Related Driver: None.

Accomplishments: Funding is programmed to update this INRMP on an annual basis and for NAS Key West and regional natural resources personnel to meet annually with the installations non-DOD conservation partners. This INRMP was last updated in 2020.

**Project No. 4 Evaluation of Vegetation Maintenance
Methods on Lower Keys Marsh Rabbit Habitat
(EPR Project Number: 00213B0215)**

Purpose: To protect and manage critically important habitats of the Lower Keys marsh rabbit.

Goal and Objective: Goal 2, Objectives 9 and 11.

Location: NAS Key West.

Description: This project will evaluate and implement management options for enhancing and maintaining LKMR habitat. Management tools used to maintain and enhance habitat may include manual removal of woody vegetation, prescribed burning, herbicides and habitat conversion. Woody vegetation within LKMR habitat on Boca Chica Field has become an airfield safety issue. This project will use an adaptive management approach to implement and monitor different maintenance options within habitats to determine effectiveness for managing woody vegetation encroachment while enhancing habitat. This approach will allow land managers to use the most appropriate management option/s within specific LKMR habitat patches. As part of the marsh rabbit recovery initiatives undertaken by NAS Key West, the NRM will consult with fish and wildlife biologists from DoN, as well as with federal, state and local biologists and land managers on the appropriate methodology to use in evaluation of management options to benefit marsh rabbit populations.

Baseline: This project will function as the baseline.

Monitoring: Annually.

Hours: The project may be accomplished through the use of contract and/or Navy personnel. Time estimate = 40 labor hours for base personnel administrative oversight. The cost estimate includes implementation and monitoring.

Type: Mandatory.

Funding Source: Environmental O&M(N)

Legal Driver: Endangered Species Act, 16 U.S.C. 1531 et seq

Related Drivers: USACE CWA Permits SAJ-2006-00494(IP-IF) and SAJ 2006-494(IP-IK); FDEP Permits 44-0137555-007 and 44-0137555-005; USFWS Biological Opinion, 22 January 1993.

Accomplishments: NAVFAC Southdiv, in 2003, grouped vegetation into patches, mapped them, and used telemetry data to assign LKMR habitat values to the patches. Saltmarsh was determined to be the most valuable habitat, followed by buttonwood and mangrove¹. NASKW was able to use this data to prioritize area for habitat conservation.

A prescribe burn was applied to 3.22 hectares of the Boca Chica airfield in April 2007. Pre-and post-burn surveys of vegetation and LKMR fecal pellets were also completed².

In 2015-16, the Institute for Regional Conservation experimented to determine the most effective way to control woody vegetation on the installation's airfield. They recommended using Garlon 4 at a 20% mix to eradicate woody vegetation in areas that are not wet. In wet areas, they recommended using Garlon 3A. Follow-up treatments with additional chemical spraying at three and six months were also recommended. After the sixth month, hand pulling was suggested to maintain low densities of hard wood at a management level³. This project ensures the protection of LKMR habitat on NASKW properties in compliance with the USFWS BO.

¹ Department of the Navy. 2003. Habitat values and population estimation for the Lower Keys marsh rabbit at Naval Air Station (NAS) Key West. Final Report. 29 pp.

² Texas A&M University. 2008. Application of prescribed fire for restoring and maintaining Lower Keys marsh rabbit habitat on Naval Air Station Key West. Final Report. 12 pp.

³ Van der Heiden, C. and C-M Miller. 2016. A study of Control Methods for Woody Vegetation at Naval Air Station Key West, to Support Efforts of the Airfield Clearing Project. Prepared for U.S. Navy. Prepared by The Institute for Regional Conservation, Delray Beach, Florida.

Project No. 5 Lower Keys Marsh Rabbit Survey and Habitat Management

(EPR Project Number: 00213B0224)

- Purpose:** To protect and manage populations of the Lower Keys marsh rabbit.
- Goal and Objective:** Goal 2, Objectives 11 and 12.
- Location:** NAS Key West.
- Description:** This project is to continue monitoring populations of the LKMR on NAS Key West. More recent population viability analyses have estimated the extinction of the species in as early as 30 to 50 years (Forys 1995). NAS Key West manages approximately one-third of the total habitat which is vital to the conservation and recovery of this species. In an effort to evaluate the effects of Navy activity on the resident LKMR population, a monitoring program has been implemented. Results from this monitoring will continue to provide NAS Key West natural resources managers with the data needed to manage LKMR populations while ensuring compatibility with the Installation’s mission. The NAS Key West will consult with fish and wildlife biologists from the DoN, as well as with federal, state and local biologists and land managers on the appropriate methodology to monitor LKMR populations.
- Baseline:** This project and past monitoring will serve as the baseline for subsequent monitoring efforts. Monitor population demographics patterns of the marsh rabbit.
- Hours:** This project will use contractor personnel. Estimated time = 40 labor hours for base personnel administrative oversight.
- Type:** Mandatory.
- Assessment Level:** ERL 4.
- Funding Source:** Environmental O&M(N)
- Legal Driver:** 16 U.S.C. 1531, 1536 Endangered Species Act
Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f; 16 U.S.C. 1536 (a) (2) “Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of (critical habitat) of such species.”

Related Driver: USFWS Biological Opinion, 22 January 1993; USACE CWA Permits SAJ-2006-00494(IP-IF) and SAJ 2006-494(IP-IK); FDEP Permits 44-0137555-007 and 44-0137555-005.

Accomplishments: The Navy contributed to the funding of several projects in the 1990s that examined the biology and status of LKMRs⁴, their home range and movements⁵, and a population viability analysis⁶. These studies provided a population baseline upon which subsequent management decisions and projects were developed.

In the mid-2000s, NASKW began mission-critical requirements to improve airfield safety. A new population viability analysis performed in 2006 found that the probability of population persistence was greatest if the clear zone was replanted with saltmarsh⁷. NASKW consequently proceeded with replanting after mangrove removal on the airfield. The replanting of these areas should be complete at the end of FY14.

Texas A&M University delivered a status assessment in 2009. The status report concluded that NASKW supported approximately 282 rabbits (2.12 rabbits/ha), representing almost 70% of the entire LKMR population. It further recommended controlling feral cat and raccoon populations to reduce predation and maintaining an open canopy on the airfield to promote the growth of herbaceous plants beneficial to LKMRs⁸. These recommendations are in alignment with the military mission and are carried out under Projects 7 and 4, respectively.

Texas A&M has also performed annual monitoring since 2005. The most recent contract covers annual monitoring for a five-year period, beginning in 2009, at a cost of \$31,579 per year. Reports have been submitted under this contract for 2009, 2010, 2011, and 2012. The results have indicated a population increase and recent stabilization since 2005, attributed in large part to the effective predator control program at NASKW. Data suggest LKMR populations are lower in cleared areas than in vegetated areas around the runway, but NASKW has been replanting those areas with low saltmarsh vegetation and is monitoring the progress of

⁴ Forsys, E.A. and S.R. Humphrey. 1994. Biology and status of the Lower Keys marsh rabbit. Final Report to NAVFAC Southdiv. 83 pp.

⁵ Forsys, E.A. and S.R. Humphrey. 1996. Home range and movements of the Lower Keys marsh rabbit in a highly fragmented habitat. *Journal of Mammalogy* 77:1042-1048.

⁶ Forsys, E.A. and S.R. Humphrey. 1999. Use of population viability analysis to evaluate management options for the endangered Lower Keys marsh rabbit. *Journal of Wildlife Management* 63: 251-260.

⁷ LaFever, D.H. and R.R. Lopez. 2006. Population viability analysis of the Lower Keys marsh rabbit on Boca Chica Key, Florida: scenarios of the airfield clearance safety project. Final Report. 24 pp.

⁸ Texas A&M University. 2009. Status assessment of Lower Keys marsh rabbits (*Sylvilagus palustris hefneri*) on Naval Air Station Key West. Final Report. 51 pp.

vegetative recovery through Project 2⁹. More recent surveys were completed in 2015¹⁰, 2017¹¹ and 2018¹².

An updated management plan for the LKMR was completed in 2015¹³.

⁹ Texas A&M Institute of Renewable Natural Resources. 2012. Monitoring of Lower Keys Marsh Rabbits on Naval Air Station Key West. Annual Report – 2012. 19 pp.

¹⁰ Texas A&M Institute of Natural Resources Institute. 2015. Monitoring of Lower Keys Marsh Rabbits on Naval Air Station Key West, Final Annual Monitoring Report 2015. Prepared by Texas A&M NRI, San Antonio, Texas. 26 pp.

¹¹ Texas A&M Institute of Natural Resources Institute. 2017. Lower Keys Marsh Rabbit Population Monitoring Report 2017. Prepared for NAVFAC Southeast. Prepared by Texas A&M NRI, San Antonio, Texas. 64 pp.

¹² Texas A&M Institute of Natural Resources Institute. 2018. Lower Keys Marsh Rabbit Population Monitoring Report 2018. Prepared for NAVFAC Southeast. Prepared by Texas A&M NRI, San Antonio, Texas. 56 pp.

¹³ Texas A&M Institute of Natural Resources Institute. 2015. Management Plan for the Lower Keys Marsh Rabbit for Naval Air Station Key West, Florida. Prepared for Department of the Navy. Prepared by Texas A&M NRI, College Station, Texas. 119 pp.

Project No. 6

Federally Listed Species Assessments and Monitoring to Support Military Activities

(EPR Project Number: 00213B0222)

Purpose:	To protect and manage critically important habitats of threatened endangered, and candidate species located at NAS Key West
Goal and Objective:	Goal 2, Objective 11.
Location:	NAS Key West.
Description:	To continue efforts to monitor other rare, threatened and endangered species such as the silver rice rat, American crocodile, Key Largo wood rat, Key Largo cotton mouse, Schaaf swallowtail butterfly, Stock Island tree snail and Eastern indigo snake on Installation properties. The NAS Key West NRM will coordinate with federal, state and local fish and wildlife biologists to collect and distribute information on threatened and endangered species populations.
Baseline:	A trapping survey for the silver rice rat was completed in 2004. This project functions as the baseline for other species.
Monitoring:	Monitor population demographic patterns of both resident and migratory threatened and endangered species, and species of special concern.
Hours:	This project will use contractor personnel. Estimated time = 20 labor hours for base personnel administrative oversight.
Type:	Mandatory.
Fund Source:	Environmental O&M(N)
Legal Driver(s):	16 U.S.C. 1531, 1536 (Endangered Species Act) , , Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f; 16 U.S.C. 1536 (a) (2) “Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of (critical habitat) of such species.”
Related Driver(s)	None.

Accomplishments:

Texas A&M was contracted in 2004¹⁴ and 2010¹⁵ to conduct surveys for silver rice rats (SRRs) on Boca Chica, Geiger, and East Rockland Keys, as well as the Saddlebunch Antennae Facility (SAF). The USFWS also conducted a survey in 2016¹⁶. No SRRs were trapped on Boca Chica, Big Coppit, Geiger, or East Rockland Keys, but they were trapped on the Saddlebunch Antenna Facility (SAF) in all three surveys. The Saddlebunch Keys contain sizable areas of suitable habitat and are known to harbor relatively high densities of SRRs and captures of reproductively mature individuals, as well as SRRs of various sizes, provides evidence of a relatively healthy breeding population at the SAF.

NASKW executed contracts to survey for the American crocodile on its properties in 2014¹⁷ and 2016¹⁸. Spotlight surveys confirmed that more than 20 American crocodiles occur on NASKW. Suitable crocodile nesting sites were located on southern Boca Chica Key and the southwest shore of Sigsbee Key.

¹⁴ Perry, N.D. and Roel R. Lopez. 2004. A Survey for Silver Rice Rats on U.S. Naval Property in the Lower Florida Keys. Prepared for NAVFAC Southeast. Department of Wildlife and Fisheries Science, Texas A&M University, College Station, Texas.

¹⁵ Perry, N.D. and R.R. Lopez. 2010. A survey for silver rice rats on U.S. Naval property in the lower Florida Keys. Texas A&M University. Final Report. 8 pp.

¹⁶ Sneckenberger, S. 2016. A survey for the silver rice rat (*Oryzomys palustris natator*) on Naval Air Station Key West, Florida. Prepared for NAVFAC Southeast. Prepared by United States Fish and Wildlife Service, Vero Beach, Florida. 15 pp.

¹⁷ Mazzotti, F.J. 2014. American Crocodile surveys on the Naval Air Station Key West. Prepared for NAS Key West. Prepared by Department of Wildlife Ecology and Conservation, Fort Lauderdale Research and Education Center, University of Florida, Fort Lauderdale, Florida. 5 pp.

¹⁸ Metzger III, E.F., J.H. Nestler, and F.J. Mazzotti. 2016. American Crocodile surveys on Naval Air Station Key West. Prepared for NAS Key West. Prepared by Department of Wildlife Ecology and Conservation, Fort Lauderdale Research and Education Center, University of Florida, Fort Lauderdale, Florida. 27 pp.

Project No. 7 Nuisance Animal Control
(EPR Project Number: 00213B0225)

Purpose: To eliminate the damaging effect that nuisance animals have on threatened and endangered species populations.

Goal and Objective: Goal 2, Objective 13.

Location: NAS Key West.

Description: Continue to entrap and remove raccoons and feral cats from NAS Key West. NAS Key West is required to control feral cats, which are known predators to adult and juvenile marsh rabbits, as part of a Biological Opinion issued by the USFWS under Section 7(a)(2) of the Endangered Species Act. The NAS Key West will promote education of base personnel on the importance of eliminating feral animals from base lands and restricting the movements of domestic pets. In addition the NAS Key West will enlist the services of federal, state and local personnel to assist in feral animal removal activities.

Baseline: This project will function as the baseline.

Monitoring: Annually as part of the trapping effort.

Hours: This project will typically use USDA APHIS Wildlife Services. Estimated time = 30 labor hours for base personnel administrative oversight.

Type: Mandatory.

Funding Source: Morale, Welfare and Recreation, Station O&M(N)

Legal Driver: 16 U.S.C.670 a-f (Sikes Act Improvement Amendment) 16 U.S.C. 1531 and 1536 (Endangered Species Act).
OPNAVINST 6250.4B (Pest Management Operations)

Related Driver: None.

Accomplishments: The nuisance animal control efforts are associated with USFWS Biological Opinion for the LKMR management. Approximately 80 cats and 539 raccoons were removed between 2005 and 2011. In 2013, five cats, 82 raccoons, and 18 iguanas were removed.¹⁹ Contracts with the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) were implemented in 2016 and 2017 for

¹⁹U.S. Department of Agriculture. Annual Status Report for Feral Cat and Raccoon Removal, Naval Air Station Key West, Boca Chica Key. January 1, 2013 – December 31, 2013.

the continued control of nuisance wildlife (native and non-native species) at NAS Key West.

**Project No. 8 Community Outreach and Natural Resources
Information and Awareness**

(EPR Project Number: 00213B0226)

Purpose: To encourage the use of volunteer groups on the Installation.

Goal and Objective: Goal 4, Objective 15.

Location: NAS Key West.

Description: To implement programs and initiatives that foster citizen participation in ecosystem education and stewardship. Continue to offer hands-on training or activity participation to better demonstrate the concept, application, and importance of ecosystem management through participation in Earth Day activities, beach clean-ups, and other environmental stewardship opportunities. The FWC has offered to assist in these efforts.

This project will use training sessions, pamphlets, flyers, and command and department representatives to disseminate information related to natural resources and environmental awareness. Representative/s from each Base Department and tenant command should participate in the technical education and training program to conduct training and education classes for their commands and departments they represent.

Offer hands-on training and individual participation in activities to better demonstrate the concept, application, and importance of ecosystem management on the Installation. Encourage participation from the DoD community by providing information about Installation natural resources and communicating each individual's important contributions to ensuring a viable ecosystem. Initiate an annual environmental awareness achievement award for project suggestions and participation.

Provide information about natural resources at NAS Key West to visiting commands (e.g., training groups) prior to the command initiating actions.

Actively pursue suggestions from NAS Key West personnel for natural resources/environmental enhancement projects that the general public could participate in. Initiate an annual environmental awareness achievement award for project suggestions and participation.

Baseline: None.

Monitoring: None.

Hours: Estimated NRM hours = 16 hours/year.

Type: Stewardship.

Funding Source: Morale, Welfare and Recreation, Station O&M(N)

Assessment Level: ERL 1.

Legal Driver: None.

Related Driver: None.

Accomplishments: Created and purchased educational materials on Sea Turtle Awareness and also printed and laminated pictures showing the different natural resources activities and wildlife at NASKW. These materials are used for Earth Day and other events.

Project No. 9 Listed and Rare Bird Assessment and Habitat Improvement

(EPR Project Number: 00213B0293)

- Purpose:** To protect and manage species of concern by enhancing habitat on NAS Key West.
- Goal and Objective:** Goal 2, Objectives 9 and 11.
- Location:** NAS Key West.
- Description:** To enhance habitat for least terns and other shorebirds by adding sand, rock, crushed shell and gravel to coastal beaches, dunes and islands. Roofs used for nesting will be upgraded and enhanced by installing and maintaining predator guards/shade devices. This project will also provide nesting platforms for ospreys.
- Baseline:** This project functions as the baseline.
- Monitoring:** Least tern and potential roseate tern nesting will be monitored annually through project 12.
- Hours:** This project will use contractor personnel or base personnel. Estimated time = 20 labor hours for base personnel administrative oversight.
- Type:** Mandatory.
- Fund Source:** Environmental O&M(N)
- Legal Driver(s):** Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f, Endangered Species Act, 16 U.S.C. 1531 et seq.
- Related Driver(s)** None.
- Accomplishments:** The most recent comprehensive survey of neotropical migratory birds at NASKW was conducted by Gulf South Research Corporation in 2014-15. Based on results of systematic point-count surveys, 88 species were observed across all properties on NASKW. Seven state-listed species of special concern were observed, as well as two state-listed threatened species, and two federally-listed threatened species²⁰. Project funds in 2019 were spent to survey roseate tern nesting habitat and develop more nesting platforms at Big Coppitt Key.

²⁰ Gulf South Research Corporation (GSRC). 2015. Inventory of neotropical migratory avian species, Navy Air Station Key West, Key West, Florida. Prepared for NAVFAC Southeast. Prepared by GSRC, Baton Rouge, Louisiana.

Project No. 10 Fish and Wildlife Conservation Informational Signage

(EPR Project Number: 00213B0294)

- Purpose:** To protect and manage sensitive habitats on NAS Key West.
- Goal and Objective:** Goal 2, Objectives 9, 10 and 11.
- Location:** NAS Key West.
- Description:** This project will provide the supplies and equipment necessary to carry out a comprehensive program for management of non-game species habitat improvements. The program will include habitat improvement and protection such as installation of signage in sensitive areas.
- Baseline:** This project functions as the baseline.
- Monitoring:** none.
- Hours:** This project will use contractor personnel or base personnel. Estimated time = 10 labor hours for base personnel administrative oversight.
- Type:** Mandatory.
- Fund Source:** Environmental O&M(N)
- Legal Driver(s):** Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f, Endangered Species Act, 16 U.S.C. 1531 et seq.
- Related Driver(s)** None.
- Accomplishments:** Signs have been manufactured and posted with regard to speed limits in sensitive habitats, such as those for LKMR. Signs have also been used to alert the installation populace to the presence of bald eagle nests and wetland restoration areas. Signs are also being prepared to assist grounds maintenance personnel to areas of the airfield that are LKMR habitat so they apply proper mowing protocols in those areas. Signs on the airfield will have to abide by height restrictions. Informational signs identifying wetlands, wildlife, and the value of these natural resources have been prepared and will be installed in 2014.

**Project No. 11 Habitat Management and Restoration
(Invasive and Exotic Vegetation Control)
(EPR Project Number: 00213S0008)**

Purpose: To manage natural areas and endangered species habitat through the eradication and control of invasive and exotic plant species, which are degrading habitat value by crowding out important native species. Exotic species have little or no wildlife food value.

Goal and Objective: Goal 2, Objectives 7, 9, 10 and 11.

Location: NAS Key West.

Description: To remove and undertake follow-up control of invasive and exotic vegetation from sensitive native habitats. Much of NAS Key West natural habitats are degraded by invasive and exotic plant species. These native areas are habitat for candidate, threatened and endangered species including the Lower Keys marsh rabbit, the white crowned pigeon and Blodgett’s silverbush. The goal of this project is to achieve 100% control of invasive and exotic species listed on the Florida Exotic Pest Plant Council’s category I and II list.

Baseline: Project 4

Monitoring: Implemented and monitored annually.

Hours: This project will use contractor personnel. Estimated time = 80 labor hours for base personnel administrative oversight.

Type: Mandatory.

Funding Source: Environmental O&M(N), Station O&M(N)

Legal Driver: 7 U.S.C. 2814(a)... “Each Federal agency shall – (1) designate an office or person adequately trained in the management of undesirable plant species to develop and coordinate and undesirable plants management program (2) establish and adequately fund an undesirable plants management program; (3) complete and incorporate cooperative agreements with State agencies regarding the management of undesirable species; (4) establish integrated management systems to control or contain undesirable plant species targeted under cooperative agreements.”

Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f.

EO 13112 “ Each Federal agency... shall, to the extent practicable and permitted by law,...subject to the availability of

appropriations, and within Administrative budgetary limits, use relevant programs and authorities to: prevent the introduction of invasive species, detect and respond rapidly to and control populations of such species...; monitor invasive species populations accurately and reliably; provide for restoration of native species...; conduct research on invasive species...; and promote public education on invasive species...”

Related Legal: 16 U.S.C. 670 a-f.EPR Project No. S0012

Accomplishments: The Institute for Regional Conservation (IRC) was contracted in 2011 to eradicate invasive exotic plants from 65.8 acres across 24 sites to improve native habitat for listed species. IRC also replanted approximately 3 acres of wetland restoration areas with mangroves²¹. This project also improved habitat for animals such as sea turtles by removing invasive Australian pines which shade nesting beaches.

IRC was contracted again in 2012-13 to eradicate invasive exotic plants from 50.3 acres at NASKW to improve habitat for listed species. Targeted species included Brazilian pepper, leadtree, and Australian pine.

Goodwill was contracted in 2014 to eradicate invasive exotic plants from approximately 3 acres at NASKW to improve shoreline stabilization and habitat for listed species. Targeted species include Brazilian pepper and Australian pine.

Ten acres of invasive plants, primarily Brazilian-pepper (*Schinus terebinthifolius*), Australian-pine (*Casuarina* spp.), portiatree (*Thespesia populnea*), oyster plant (*Tradescantia spathacea*), beach naupaka (*Scaevola taccada*), and white leadtree (*Leucaena leucocephala*), were eradicated on Felming Key in 2017²².

²¹ Miller, C-M, J. Karow, and C. vander Heiden. 2013. Habitat restoration project at NAS Key West. The Institute for Regional Conservation, Delray Beach, Florida.

²² van der Heiden, C., T. Watts, A. Blochel, and M.M. Smith. 2018. Protected Species Habitat Restoration at Naval Air Station Key West, Florida. Prepared for U.S. Navy. Prepared by The Institute for Regional Conservation, Delray Beach, Florida.

Project No. 12 Ecological Survey of Exotic Plants, Rare Plants, Natural Areas, and Rare Animals
(EPR Project Number: 00213S0009)

Purpose: To protect and maintain ecological diversity in native plant communities including tropical hardwood hammock, mangrove fringe and transitional zones.

Goal and Objective: Goal 2, Objective 7, 10 and 11.

Location: NAS Key West.

Description: To conduct long-term ecological monitoring and mapping of the plant communities at NAS Key West. Project will include surveys for populations of federally listed endangered, threatened, and candidate plants, state-listed endangered and threatened plant species. Surveys will evaluate federally listed plant populations from 2005 and 2010 surveys. This project will re-survey and map locations of invasive and exotic species within the major plant communities.

Baseline: FNAI survey completed in 2005.

Monitoring: Data collection will occur every five (5) years.

Hours: Work will be performed by contract personnel. Time estimate for base personnel administrative oversight = 40 labor hours.

Type: Mandatory.

Funding Source: Environmental O&M(N) and Station O&M(N)

Legal Driver: 16 U.S.C. 1536 (Endangered Species Act), Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f DoD INST 4715.3 (Environmental Conservation Program), 7 U.S.C. 2814(a) (Management of Undesirable Plants on Federal Lands), EO 13112 (Invasive Species).

Related Legal: None.

Accomplishments: Florida Natural Areas Inventory (FNAI) conducted biological inventories on NASKW and its properties in 2005 and 2010-11 mapped^{23 24}. The IRC conducted another inventory in 2016-17²⁵.

²³ Henize, T. and D. L. Hipes. 2005. Ecological survey of Key West Naval Air Station: exotic plant, rare plants, natural areas, and rare animals. Prepared by Florida Natural Areas Inventory, Tallahassee, Florida.

²⁴ Gullledge, K. D. Hipes, C. Elam, and P. Diamond. 2011. Biological survey of Naval Air Station, Key West: rare plants and rare animals. Prepared by Florida Natural Areas Inventory, Tallahassee, Florida.

Exotic plants, rare plants, natural areas, and rare animals – and their locations – were documented and mapped. Data gleaned from the resulting reports has been used to update this INRMP, inform exotic species removal, avoid sensitive areas during operations planning, and assist with other conservation decisions.

²⁵ van der Heiden, C., T. Watts, and S. Koi. 2017. Rare, threatened and endangered species survey, Naval Air Station Key West. Prepared for Department of the Navy. Prepared by Institute for Regional Conservation, Del Ray Beach, Florida.

Project No. 13 Marine Resources Survey
(EPR Project Number: 00213S0012)

Purpose: To conduct a quantitative survey of benthic marine resources located near NAS Key West maritime facilities.

Goal and Objective: Goal 1, Objective 8.

Location: NAS Key West.

Description: To complete a comprehensive marine resources survey

Baseline: This project functions as both a baseline survey and will also include future long term surveys of benthic resources adjacent to NASKW maritime facilities. Future updates are to occur on a five year cycle to assess trends in health and re-colonization of vertical substrate.

Monitoring: The surveys will be updated every five years to both monitor resource health and assess new potential coral cover. Staff from NOAA FKNMS and FWC Aquatic Habitat Conservation and Restoration Section shall be afforded an opportunity to comment and make recommendations on survey methods.

Hours: This project will use contractor personnel and Navy natural resources professionals. Estimated time = 80 labor hours for base personnel administrative oversight.

Type: Stewardship.

Fund Source: Environmental O&M(N)

Legal Driver(s): 16 U.S.C. 1456 Coastal Zone Management; Conservation Programs on Military Installations (Sikes Act) as amended, 16 U.S.C. 670 a-f., and 16 U.S.C. 1955 Magnuson Stevenson Fisheries Management Act.

Related Driver(s) None.

Accomplishments: A project was carried out by Continental Shelf Associates, Inc. in 2003 to assess the seafloor substrate and benthic biological communities along potential dredged material pipeline access routes to Fleming Key²⁶. The results enabled the Navy to offset and mitigate impacts resulting from this mission-critical activity.

²⁶ Continental Shelf Associates, Inc. 2003. Fleming Key resource survey associated with the environmental assessment supplement for fleet support and infrastructure improvements, Naval Air Station Key West. Final Report. 28 pp.

A seagrass survey was contracted in 2006 to assess impacts from tug and barge movements in the approach channel to Fleming Key. Scouring and exposed rhizomes were observed, but it was not possible to fully assess impacts due to the lack of control data and the unknown impacts of Hurricane Wilma, which passed over the area in 2005²⁷.

Two other benthic surveys were carried out in 2006 in association with the Key West Harbor dredging project. These assessed hard bottom, patch reef, bank reef, and seagrass areas in vicinity of the dredging activity. These reports documented the predictable reduction in all benthic resources except macroalgae in areas directly impacted by dredging activity, which helped the Navy to mitigate those impacts. They also provided valuable information on the distribution, speciation, and densities of those resources around NASKW^{28 29} to facilitate their future conservation.

A comprehensive benthic resources survey was completed by HDR EOC in 2013, at a cost of \$399,144, to inventory benthic habitat and federally-protected marine biota in order to assess, avoid, minimize, and mitigate potential impacts associated with various planned and future training, construction, and maintenance activities at NASKW³⁰.

A benthic resource assessment was conducted on the Central Mole Pier in 2010 to document living marine resources including hard and soft coral and seagrass communities that could be potentially impacted by recapitalization of the pier³¹. This assessment was not funded under Project 13, but complimented the project and the results of this survey were used to mitigate impacts to hard corals.

A benthic survey of the Patricia Target Area was completed in 2014³².

²⁷ Continental Shelf Associates, Inc. 2006. Survey of potential impacts to benthic seagrass and macroalgal communities along the approach channel to the Flemming Key gunnery dock. Final Report. 25 pp.

²⁸ Ecology and Environment. 2007. Naval Air Station Key West maritime areas benthic survey results. Final Report. 46 pp.

²⁹ Ecology and Environment. 2007. Post-dredging impact assessment monitoring survey final report for the Key West Harbor Dredging Project. Final Report. 46 pp.

³⁰ HDR Environmental, Operations, and Construction, Inc (HDR). 2013. Benthic habitat characterization, Naval Air Station, Key West, Florida. Prepared for NAVFAC Atlantic. Prepared by HDR, Norfolk, Virginia.

³¹ Terramar Environmental Services, Inc. 2010. Benthic resource assessment, Bulkhead 497 – Central Mole Pier, Naval Air Station Key West, Key West, Florida. Final Report. 39 pp.

³² HDR Environmental. 2014. Benthic habitat characterization, Patricia Target Jet Aircraft Range, Key West, Florida. Final Report. 41 pp.

Project No. 14 Smalltooth Sawfish Survey
(EPR Project Number: 00213S0024)

Purpose: To complete surveys for smalltooth sawfish (*Pristis pectinata*) and their habitats in waters around the NAS Key West properties.

Goal and Objective: Goal 2, Objectives 9 & 11.

Location: NAS Key West.

Description: Survey properties at NAS Key West to (1) document the occurrence of sawfish in near-shore and open-water areas, and (2) to determine the potential of these areas as suitable habitat for smalltooth sawfish.

Baseline: This project functions as a baseline survey. Future updates are to occur on a five year cycle to assess resident populations.

Monitoring: The surveys will be updated every five years.

Hours: This project will primarily utilize Navy natural resources professionals, however contract personal may also be used. Estimated time = 80 labor hours for base personnel administrative oversight.

Type: Mandatory.

Fund Source: Environmental O&M(N)

Legal Driver(s): 16 U.S.C. 1531 and 1536 Endangered Species Act

Related Driver(s) NMFS letter, dated 30 March 2007, Re: Restoration of clear zones and stormwater drainage systems at Boca Chica Field on Naval Air Station Key West (NASKW), which required this project be conducted.

Accomplishments: The University of Florida conducted monitoring in 2010-11³³ and 2016-17³⁴ to assess smalltooth sawfish presence and characterize potential habitat around the installation. No sawfishes were captured or observed, but characteristics of suitable sawfish habitat were documented.

³³ Burgess, G.H., J. Imhoff, and E. Warchol. 2012. Preliminary Assessment of the Presence of Smalltooth Sawfish (*Pristis pectinata*) and Characterization of Potential Critical Habitat in Water Surrounding Naval Air Station Key West, Florida, Properties. Final Report.

³⁴ Burgess, G.H., R.D. Grubbs, L. French, and S. Nehemiah. 2017. Historical and Current Presence of Smalltooth Sawfish (*Pristis pectinata*) in Waters Surrounding NAS Key West, Florida, Properties with Observations on Habitat Suitability. Prepared for U.S. Navy. Prepared by Florida Museum of Natural History, University of Florida. Gainesville, Florida. 44 pp.

Project No. 15	Sea Turtle Protection Lighting (EPR Project Number: 00213S0060)
Purpose:	To reduce the emission of light that may disorient nesting sea turtles and hatchlings.
Goal and Objective:	Goal 2, Objectives 9 & 11.
Location:	Street lights at the Truman Beach parking area and on United Street. Wall pack lighting on Buildings 1350, 437, 1279, 1332, and 4214.
Description:	Lights will be replaced with "turtle friendly" lighting that meets Florida Fish and Wildlife Conservation Commission (FWC) Guidelines. All fixtures must be full cut off and contain both amber and white LED's to reduce or eliminate visible light from Truman Beach and to reduce the overall "glow" from those areas. Streetlights will be operated with one photocell for dusk to dawn operation and one photocell to automatically switch to amber LED's during the Turtle season. Streetlights are to contain 60 white LED's and 60 Amber LED's and a 700 ma driver.
Baseline:	Pre-existing lighting and light emission.
Monitoring:	The surveys will be updated every five years.
Hours:	This project will primarily utilize Navy natural resources professionals, however contract personal may also be used. Estimated time = 80 labor hours for base personnel administrative oversight.
Type:	Mandatory.
Fund Source:	Environmental O&M(N)
Legal Driver(s):	Endangered Species Act; 16 U.S.C. 2912(a); 16 USC 1536 (a) (2)
Related Driver(s)	OPNAVINST 5090.1C CH-24, par 24-6
Accomplishments:	\$84,000 was spent in 2012 to carry out this project as described above.

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**APPENDIX B-
LKMR MGMT PLAN**

B The Lower Keys Marsh Rabbit Management Plan

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**Lower Keys Marsh Rabbit
Management Plan
for
Naval Air Station Key West, Florida**



Prepared for:

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Executive Summary

The Lower Keys marsh rabbit (LKMR) is a federally endangered species endemic to the Lower Florida Keys, and occurs on Naval Air Station Key West, Boca Chica Field (NASKW). Because the LKMR is federally protected, the Navy is required to manage the species in coordination with the United States Fish and Wildlife Service (USFWS). The USFWS estimates there are 2,116 acres of LKMR habitat in the Florida Keys, with approximately 329 acres, or 15% of the total habitat area on Navy lands. Consequently, the Navy plays a significant role in the management of LKMR as stewards of the species, and has an ongoing monitoring and management program that includes habitat and population monitoring, habitat management and restoration, predator control, and public education for NASKW staff and visitors.

The Airfield Restoration Project (ARP) was completed in 2015 and involved restoration of airfield clear zones and drainage system improvements throughout Boca Chica Field. These improvements were authorized by the USFWS, with specific requirements for ongoing management of the LKMR. Compliance with USFWS requirements is an important component of the LKMR management program at NASKW.

To facilitate ongoing management of the LKMR, an update to the 1994 LKMR management plan was completed. The primary management objective for the LKMR is to maintain viable populations consistent with historical population trends while supporting the military mission. Specific tasks to implement the objective include population monitoring, habitat monitoring, and habitat management. Specific tasks include annual population monitoring, annual habitat assessments, active management of habitat through vegetation control and limiting human activities, predator control (primarily feral cats) and restoration projects designed to restore historically degraded habitats.

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Introduction

The Lower Keys marsh rabbit (LKMR, *Sylvilagus palustris hefneri*) is a federally endangered subspecies of marsh rabbit endemic to the Lower Florida Keys (USFWS 1999). The LKMR typically occupies areas of salt marsh / buttonwood wetlands with dense vegetative cover, and occurs throughout the Lower Florida Keys from Big Pine Key south to Boca Chica Key (Figure 1). The LKMR occurs on Naval Air Station Key West (NASKW) properties including Boca Chica Field / Boca Chica Key, East Rockland Key, Geiger Key and Saddlebunch Key (Figures 2-4). Distribution of the LKMR on NASKW was initially established by Forsys (1995) with subsequent distribution updated by Faulhaber (2003).

LKMR populations are small and fragmented into distinct patches as a result of their habitat specificity and historical development. Current threats to LKMR populations include predation by feral and free-ranging house cats, habitat loss and fragmentation resulting from development, and habitat degradation resulting from native and non-native hardwood vegetation encroachment. Additionally, impacts to LKMR habitat from changes in sea level are poorly understood, but have the potential to dramatically alter the amount and availability of LKMR habitat from only small changes in sea level.

The USFWS estimates there is a total of 2,116 acres of potential LKMR habitat comprised of 229 discrete habitat patches within the range of the subspecies in the Lower Keys (USFWS 1999). Of this total, NASKW properties (on and adjacent to Boca Chica Key) support approximately 329 acres comprised of 46 discrete habitat patches, or approximately 15% of the total LKMR habitat area and an estimated 60% of the range-wide LKMR population. Consequently, the U.S. Navy plays a significant role in the management of LKMR as stewards of this habitat, and has an ongoing program that includes habitat and population monitoring, habitat management and enhancements, predator management, and public education for NASKW staff and visitors.

On March 7, 2007, the USFWS issued a Biological Opinion (BO) titled “Restoration of Clear Zones and Stormwater Drainage Systems, Naval Air Station Key West” (Attachment 1). The BO authorized construction of the Airfield Restoration Project (ARP), and specifically authorized incidental take of up to six LKMR resulting from the disturbance of up to 135 acres of occupied LKMR habitat potentially resulting from completion of the ARP. The 2007 BO included several non-discretionary Reasonable and Prudent Measures necessary and appropriate to minimize project impacts to the LKMR and other listed species. Table 1 details specific measures relevant to the Navy’s management of the LKMR. In addition, the 2007 BO included Terms and Conditions that implement the Reasonable and Prudent Measures (Table 2).

The original LKMR management plan was developed in 1994. Since then an extensive predator control program has been implemented, the LKMR population on NASKW has increased substantially, and extensive habitat manipulations including exotic vegetation control and the ARP have occurred. As a result, this revision reflects management strategies consistent with the species’ current status and habitat conditions.

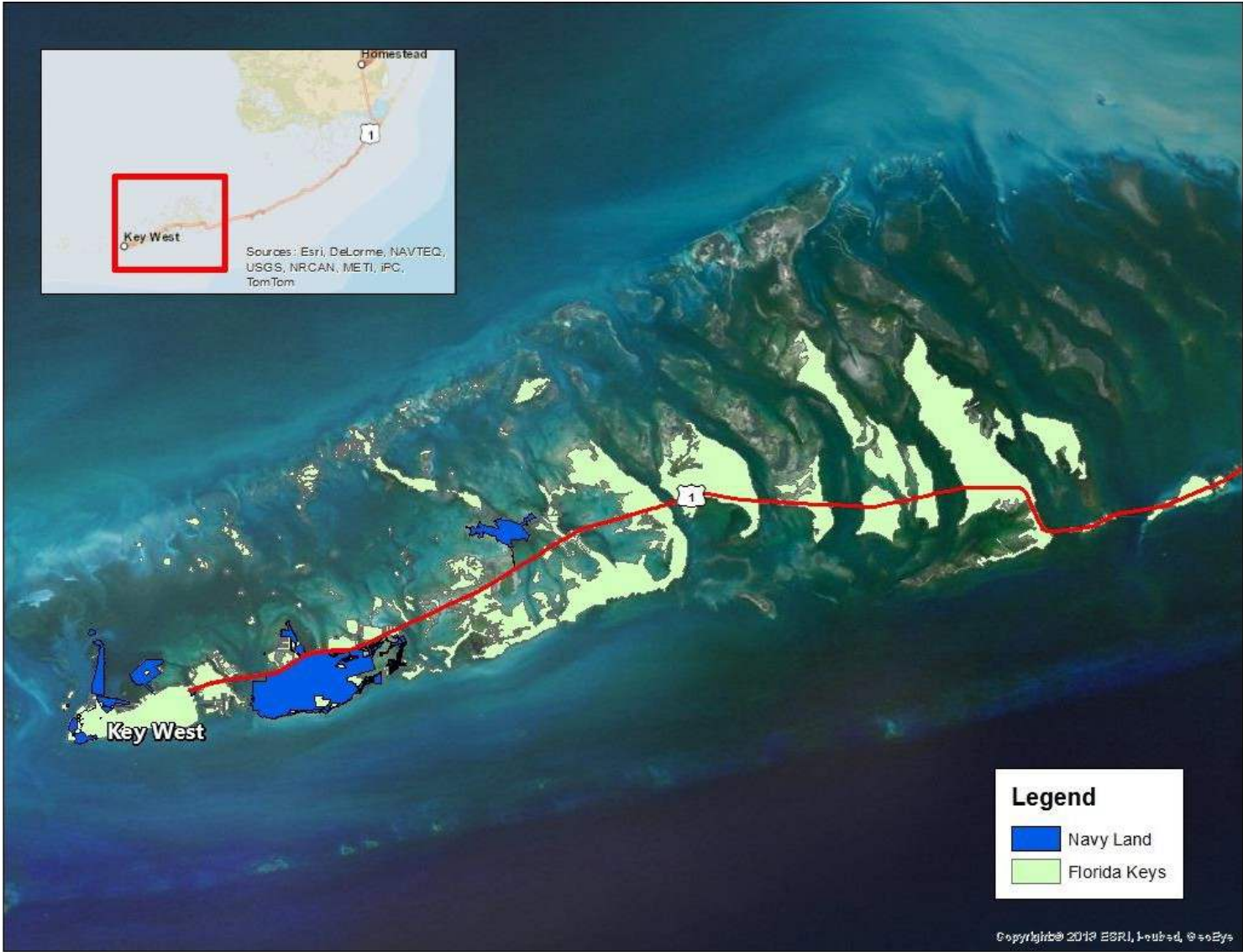


Figure 1. General Location Map NAS Key West

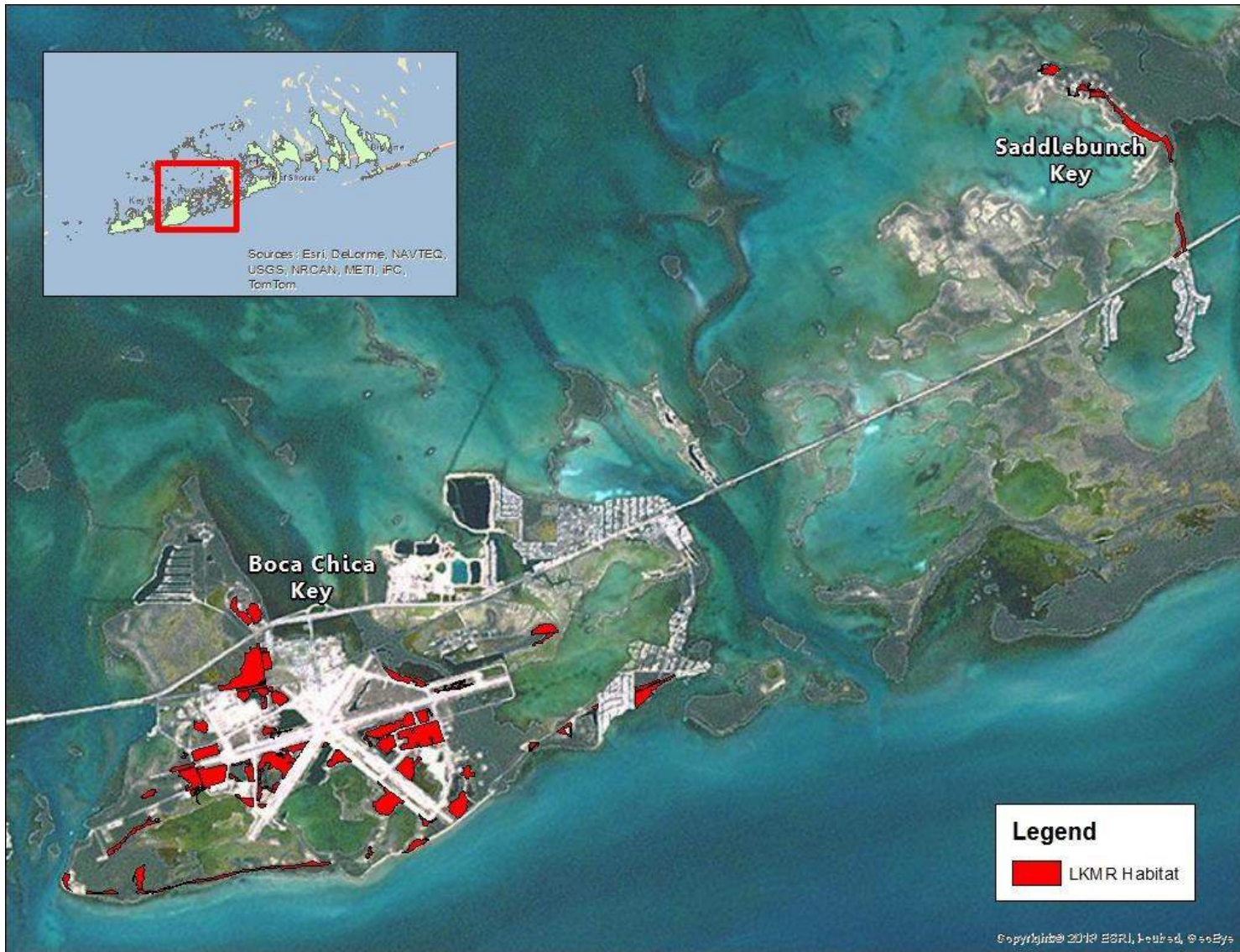


Figure 2. LKMR Habitat - NAS Key West and Saddlebunch Key

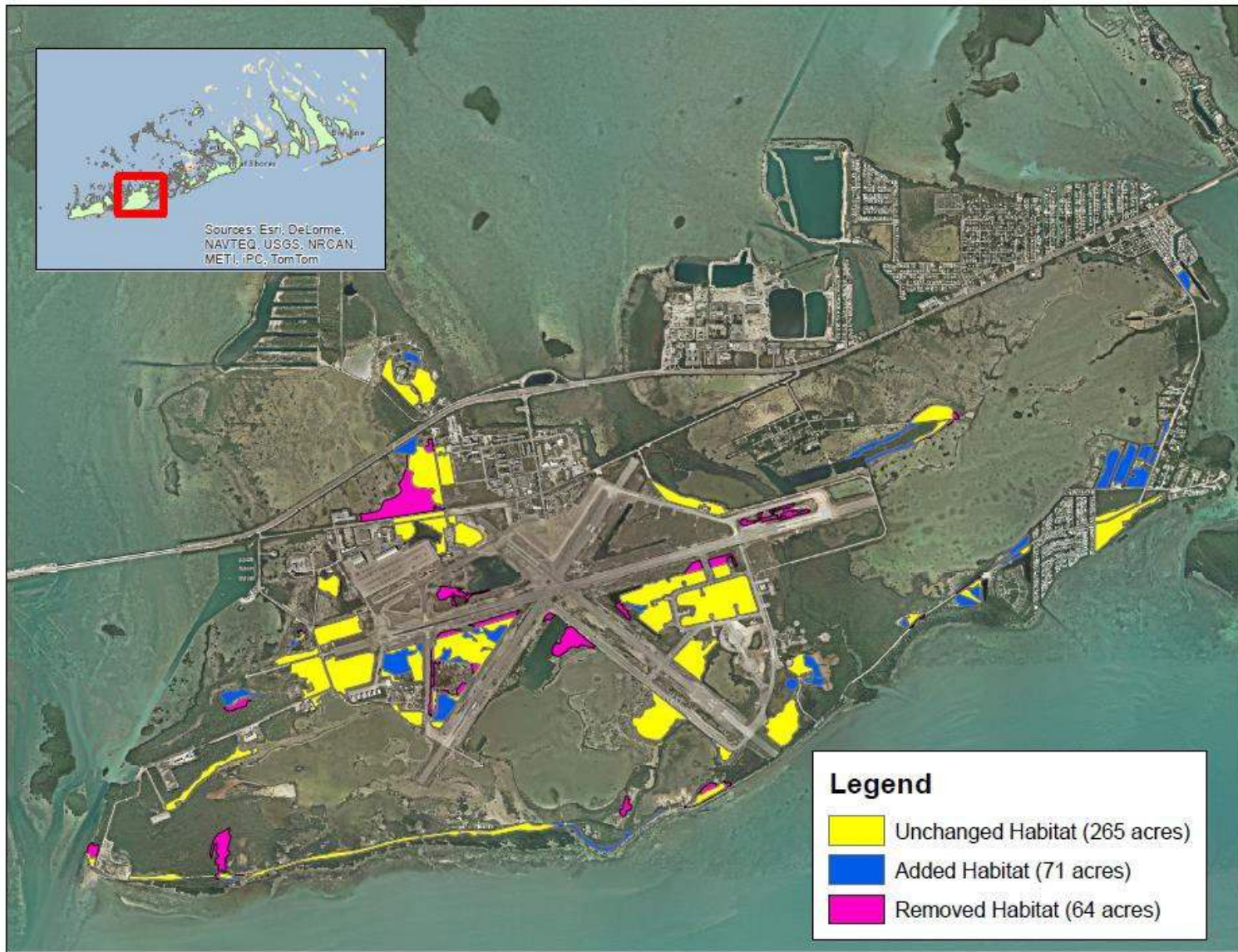


Figure 3. LKMR Habitat Patches - NAS Key West

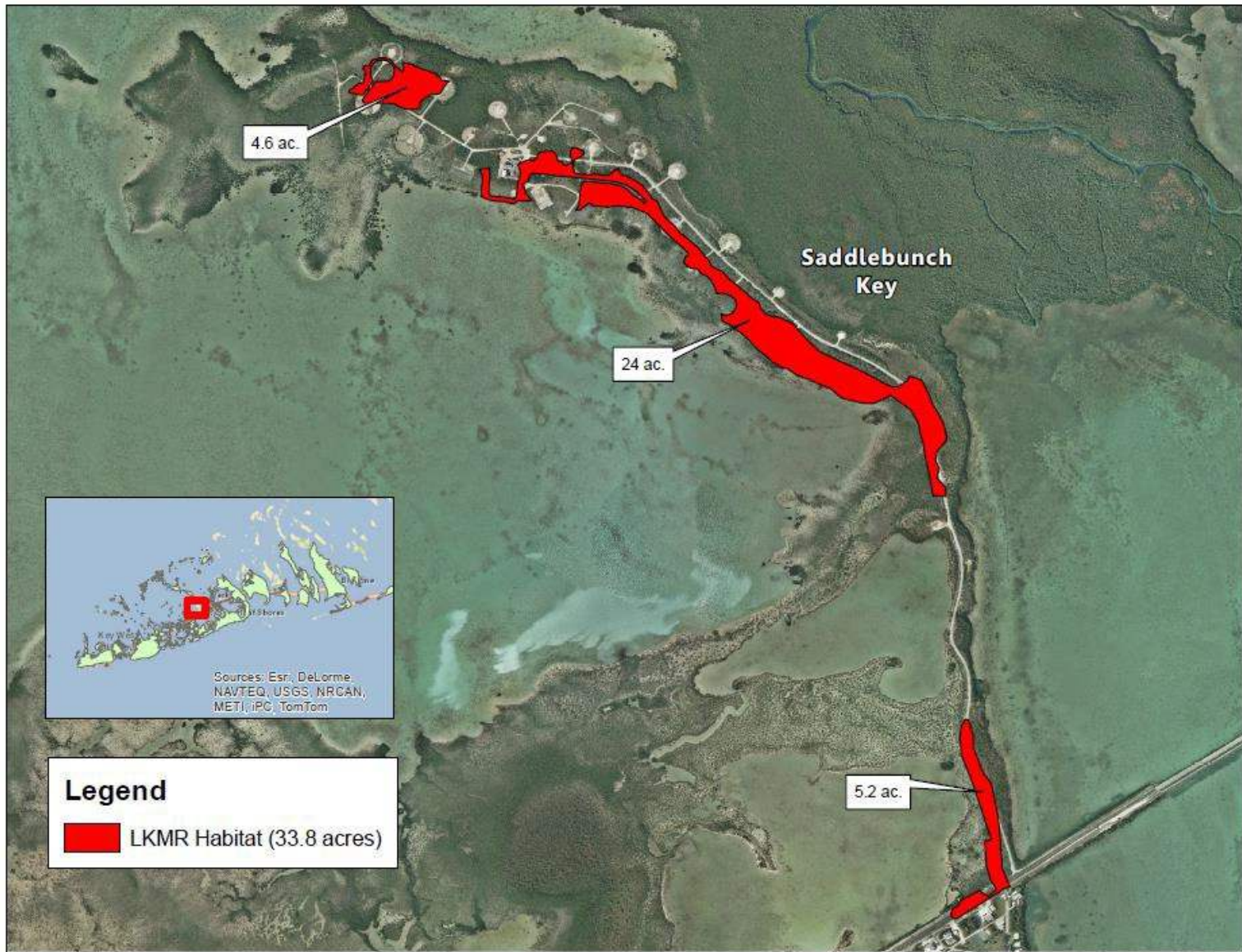


Figure 4. LKMR Habitat Patches - Saddlebunch Key

Table 1. Reasonable and Prudent Measures

ID	Description
1	Establish 'NO MOWING" areas to preserve LKMR habitat
2	Ban off-road vehicles from LKMR habitat
3	Eradicate invasive exoticvegetation in LKMR habitat
4	Educate military personnel and the publicregarding the LKMR
5	Maintain and manage LKMR habitat forthe long-term

Table 2. Terms and Conditions

ID	Description
1	The Navy will monitor the success of the ARP, specifically the success of the salt marsh conversion / revegetation work in accordance with regulatory permits
2	Exotic vegetation will be removed from all wetland areas within the project area
3	The Navy will submit monitoring reports that document the status of the salt marsh conversion / revegetation work and take remedial actions if required
4	The Navy will conduct long-term population monitoring for the LKMR on NASKW, and provide annual monitoring reports to regulatory agencies
5	The Navy will implement education and outreach activities to its personnel about the adverse effects of ORV and free ranging house cats use in LKMR habitat
6	The Navy will conduct feral and domestic cat and raccoon monitoring and control annually for the life of the project
7	Where feasible, the Navy will alter current mowing practices of areas adjacent to, or near, occupied patches affected by the action to increase cover and foraging opportunities for LKMR over the duration of the project
8	The Navy will notify the USFWS upon locating a dead, injured or sick LKMR, or other Federally-listed T & E species, on NASKW

Objectives

The goal of this management plan is to maintain and promote a viable population of the LKMR at NASKW consistent with the implementation of the Reasonable and Prudent Measures and Terms and Conditions of the 2007 BO without encumbering the Navy's mission at NASKW. The following primary objectives and associated tasks define the management plan.

Maintain Distribution and Abundance

The objective is to manage the LKMR population at NASKW to maintain a running 5-year average distribution and abundance consistent with the existing 5-year average distribution and abundance (years 2000 – 2015) as indexed by stable habitat patch occupancy rates and stable fecal pellet counts. The following tasks will accomplish the objective:

Task 1. Monitor LKMR Population Distribution and Abundance

- 1a. Continue annual fecal pellet counts as an index of distribution and abundance.
- 1b. Incorporate annual presence / absence surveys in newly-created and suitable habitat patches as an index of habitat patch occupancy.
- 1c. Incorporate new and adaptive survey methodologies to ensure management is based on the best available science. Revise survey methods as new information becomes available.
- 1d. Report survey and data analysis results annually.

Task 2. Monitor LKMR Habitat Distribution and Condition

- 2a. Identify and map LKMR habitat distribution based on habitat attributes and pellet observations.
- 2b. Evaluate LKMR habitat condition during abundance surveys, especially presence of invasive exotic vegetation and adverse modifications/alterations.
- 2c. Report qualitatively on the state of LKMR habitat and make recommendations for habitat management in the annual monitoring report.

Task 3. Manage, Maintain and Restore LKMR Habitat

- 3a.** Control invasive exotic and native hardwood vegetation in LKMR habitats in order to maintain optimal habitat conditions.
- 3b.** Continue predator control actions for feral and free ranging house cats and raccoons at the current level of effort. Expand efforts to include surveillance of non-native constrictors (pythons, boas) and other potential predators (e.g. tegu lizards, opossum).
- 3c.** Identify habitats in need of restoration that have been previously altered through dredge, fill and drainage actions, by unauthorized access, or by invasive plant infestations. Provide summary restoration and management actions as part of the annual LKMR monitoring reports.
- 3d.** Prevent unauthorized vehicle access in LKMR habitat and manage airfield and grounds turf mowing to protect LKMR habitats to the maximum extent practicable without encumbering the Navy's mission.
- 3e.** Educate NASKW personnel and the public regarding management needs of the LKMR including impacts from free ranging and feral house cats, and off road vehicle impacts to LKMR habitats.

Study Area and Airfield Restoration Project (ARP) Description

Boca Chica Field is 4,700 acres with three runways and various facilities including security, supply, weapons, a fuel farm, administration, public works and quarters. NASKW's primary mission is to provide pilot training facilities and services, as well as access to superior airspace and training ranges for tactical aviation squadrons. As such, NAS Key West serves as the Navy's premier east coast pilot training facility for tactical aviation squadrons. Boca Chica Field contains three asphalt Class B runways: primary Runway 07/25 is 10,000 by 200 feet (3,048 by 61 meters) and crosswind Runways 03/21 and 13/31 are both 7,000 by 150 feet (2,134 by 46 m). Runway 07/25 is the most active runway with a utilization percentage of 54%. The second most active runway is Runway 13/31, which is used 34% of the time (Navy 2007).

Boca Chica Field is required to comply with *Airfield Safety Clearances* (Naval Facilities [NAVFAC] P-80.3), *Airfield and Heliport Planning and Design* (Unified Facilities Criteria [UFC] 3-260-01), and *Objects Affecting Navigable Airspace* (Federal Aviation Regulation [FAR] Title 14 CFR Part 77). An airfield inspection in February 2002 by Naval Air Systems Command (NAVAIR) found Boca Chica Field to be out of compliance with the above-mentioned airfield safety zone criteria due to extensive vegetative growth within the clear zones that resulted in impacts to airfield drainage systems. In order to meet airfield safety standards, a project - "Restoration of Clear Zones and Stormwater Drainage Systems at Boca Chica Field, Naval Air Station Key West, Florida"- was developed and implemented.

The Airfield Restoration Project involved the removal of woody vegetation impacting clear zones and the drainage system. Tidally influenced and impounded wetland areas that typically support mangrove vegetation within airfield clear zones were converted to natural salt marsh wetlands. The intent of this habitat conversion was to raise elevations in mangrove areas to prevent the regrowth of

mangroves, enhance endangered species' habitat, and facilitate long-term maintenance by preventing the reestablishment of mangrove and other hardwood vegetation. Mangrove areas within LKMR habitat were converted to salt marsh wetlands, the preferred habitat of the LKMR, while mangrove areas outside LKMR habitat were converted to "maintainable wetlands." "Maintainable wetlands" are mangrove areas converted to salt marsh wetlands, and then maintained by mowing equipment.

Mangrove wetlands were converted to salt marsh wetlands by clearing and grubbing, de-mucking, backfilling with structural fill with a topsoil overlay, final grading to target elevations, and replanting. Long-term maintenance of the airfield restoration project involves ongoing removal of hardwood vegetation (e.g., mangroves, buttonwood, and exotics) so that horizontally and vertically controlled airfield surfaces are maintained. Maintenance methods will include mowing, hand-clearing, herbicide treatment, and prescribed burning where feasible.

The design and approval of the ARP was coordinated through the preparation of an environmental impact statement (EIS), and subsequently authorized by several federal approvals including the USFWS and the U.S. Army Corps of Engineers (USACE) (Table 3).

Table 3. Federal Environmental Approvals Associated with the Airfield Restoration Project

Date	Description
May 18, 2004	Biological Opinion for Runway 07-25 Safety Zones, Naval Air Station Key West - Authorized incidental take for the LKMR associated with the Runway 07 Clear Zone Restoration Pilot Project
March 7, 2007	Biological Opinion for Restoration of Clear Zones and Stormwater Drainage Systems, Naval Air Station Key West - Authorized the Airfield Restoration Project
September 16, 2007	U.S. Army Corps of Engineers permit SAJ-2006-494 - Authorized wetland impacts associated with the Runway 07 Clear Zone Restoration Pilot Project
August 2, 2011	Restoration of Clear Zones and Stormwater Drainage Systems, Naval Air Station Key West - Authorized wetland mitigation projects associated with the Airfield Restoration Project
October 4, 2011	U.S. Army Corps of Engineers permit SAJ-2006-494 - Authorized wetland impacts associated with the Airfield Restoration Project

Airfield Restoration Project and LKMR Habitat Modifications

The ARP was conducted in three phases:

1. Runway 07 Approach (pilot project)
2. Phase 1 Airfield Restoration
3. Phase 2 Airfield Restoration

Habitat conversion work was initiated in February 2010 and all work was substantially completed by February 2015. The project was completed in a series of Vegetation Conversion Areas (VCAs) that were established to provide for habitat clearing in a manner that was least disruptive to LKMR habitats and populations (Figure 5).

There are approximately 329 acres of potential and occupied LKMR habitat mapped in 46 discrete habitat patches on Boca Chica Field and adjacent Navy-owned areas on Boca Chica Key, Rockland Key and Big Coppitt Key. There are an additional 32 acres mapped in six discrete patches on Saddlebunch Key, a Navy-managed military property located nine miles to the east of Boca Chica Field. Approximately 131 acres of LKMR habitat occurred within the Airfield Restoration Project area, with 37.59 acres of LKMR habitat directly impacted by the project. The LKMR habitat that was impacted by the project was replaced at a 1:1 ratio through habitat conversion to high quality salt marsh habitat within the project limits (Table 4).

Table 4. LKMR Habitat Areas on Navy Lands

Location	LKMR Habitat (acres)
Boca Chica Field and associated areas	329
Saddlebunch Key Facility	32
LKMR Habitat on all Navy Property	361
Total LKMR Habitat within ARP Area	131
Total LKMR Habitat Altered by the ARP	37.59

The ARP was designed specifically to maintain the total amount of LKMR habitat before and after project completion, and reconfigure habitats to maintain and maximize acreage where possible. Where feasible, LKMR habitat was reestablished in areas removed from active airfield operations and re-established in locations adjacent to natural areas and occupied LKMR habitat.

The reconfiguring and consolidation of LKMR habitats as part of the Airfield Restoration Project resulted in an overall benefit to the LKMR. Overall LKMR habitat acreage within the project limits remained equal, however reconfigured and consolidated LKMR habitat areas resulted in larger, more contiguous viable habitat compared to the fragmented habitat configuration that existed on the airfield prior to the Airfield Restoration Project (Figure 3). Examples of beneficial LKMR habitat reconfiguration include the small, isolated habitat patches located in VCA 02 and 08 that were consolidated into the large, more viable habitat patch located in VCA 2.

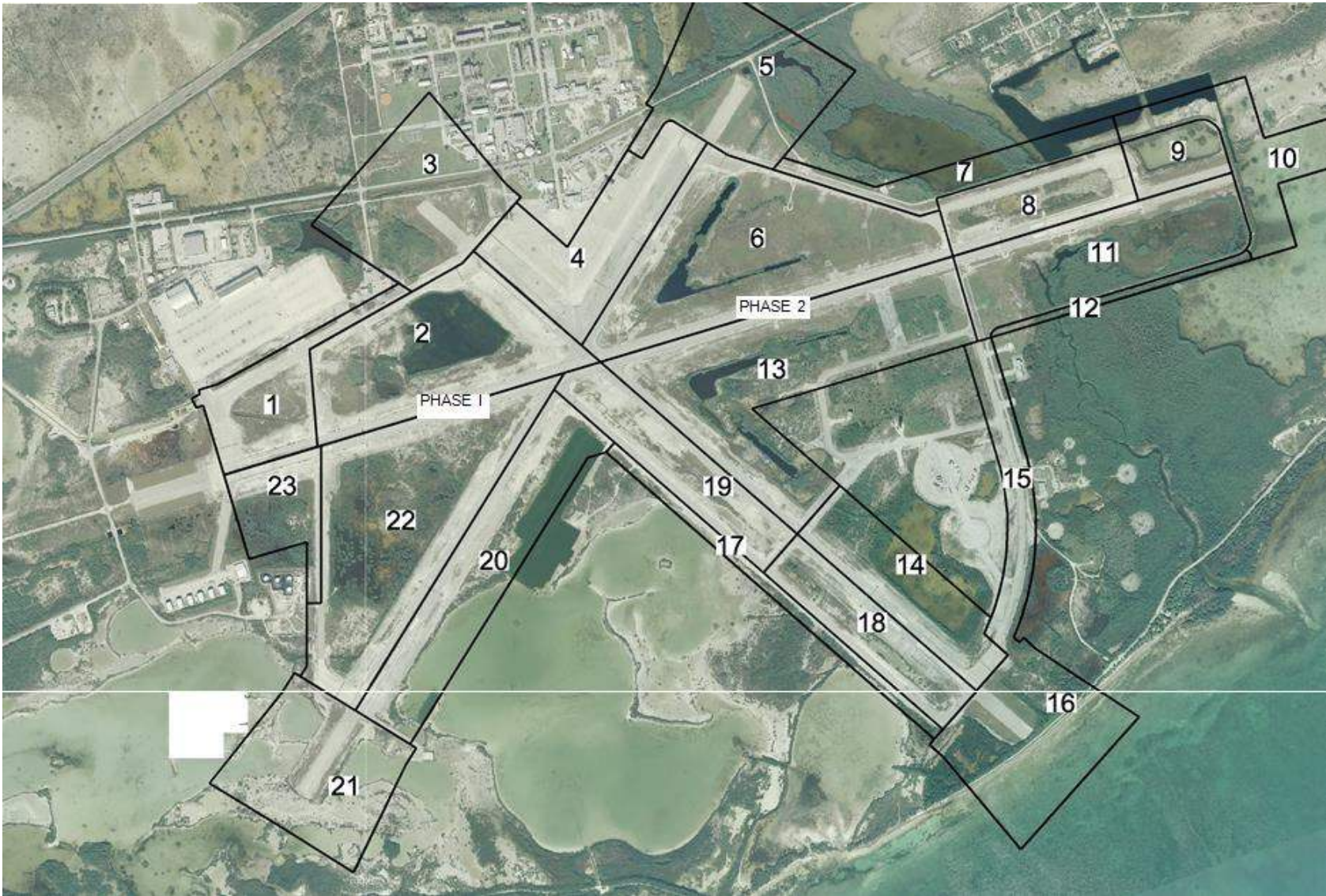


Figure 5. Airfield Vegetation Conversion Area

The following are specific benefits of LKMR habitat re-configuration and consolidation:

- Larger habitat patches are more viable than smaller habitat patches
- Contiguous blocks of LKMR habitat are more viable than convoluted patches as edge area is minimized. Larger contiguous habitat areas are more resilient to invasion by exotic vegetation and possibly predators, providing a more secure, viable habitat configuration for LKMR
- Patches adjacent to existing occupied habitat patches are more viable than isolated patches as the LKMR can more effectively disperse between habitat patches and the total amount of accessible habitat is maximized

A meeting was held between the USFWS Vero Beach Field Office and NASKW / NAVFAC staff on February 13, 2014 to discuss the reconfiguration and consolidation of LKMR habitats as part of the Airfield Restoration Project. Final maps of LKMR habitat on the airfield were evaluated for consistency with the March 07, 2007 USFWS BO. The benefits of LKMR habitat reconfiguration and consolidation were discussed and it was the consensus of USFWS staff that the final LKMR habitat reconfiguration and consolidation was within allowed parameters of the BO and resulted in optimal LKMR habitat configuration for long-term management. USFWS staff provided their concurrence on the final LKMR habitat maps for the Airfield Restoration Project in writing (via email from Brian Powell, USFWS, Vero Beach) on March 03, 2015.

LITERATURE REVIEW

Taxonomy and Description

The LKMR was first described as a subspecies in 1984 based on morphological differences between the Lower Keys marsh rabbit population and Upper Keys and mainland marsh rabbits (Lazell 1984). Historically, the LKMR was likely found on larger islands from Big Pine Key to Boca Chica Key (Faulhaber et al. 2007). Management of the new subspecies immediately faced challenges. LKMR habitat was in the initial stages of steep loss and fragmentation by the time of the subspecies designation. From 1979-1999, >50% of LKMR habitat was destroyed for residential and commercial development (USFWS 1999). A total of 64% of available habitat was lost by 2006, with much of the remaining LKMR habitat degraded by habitat fragmentation, urbanization, invasive-exotic plant species, and off-road vehicles (Schmidt et al. 2012).

Initial population surveys, habitat analyses, and long-term projections lead to listing under the federal Endangered Species Act by 1990 (Lazelle 1984). Research and management efforts increased after 1990 with detailed studies on population, population projections, occupancy, habitat, demography, threats, and management protocols by the end of the decade. From 2000-present, research and management efforts have included reintroductions, further habitat delineation, population and habitat sampling refinements, genetic analyses, habitat management recommendations, population viability analyses, and impacts of natural disasters.

LKMR Habitat Characteristics and Use

LKMR preferred habitat is upper marsh areas characterized by bunch grasses and shrubs, or transition zones (Forys and Humphrey 1996). These areas provide both cover and forage. The transition zones are highly fragmented due to decades of habitat destruction and contain few areas greater than 12 acres (5 hectares). LKMR home ranges rarely incorporate roads or large bodies of water and individuals often avoid crossing roadways. Preferred habitat occurs in “patches” of vegetation with low canopy coverage ($\leq 10\%$), high bunchgrass density (2.5-3.8/m²), high forb presence ($>5\%$), and tall vegetation (8-32 inches) (Perry 2006). These patches are often surrounded by a matrix of undesirable or less-desirable conditions (e.g., non-preferred vegetation, open water).

Estimates of the number of habitat patches have more than doubled in the 25 years since listing, from 59 patches encompassing 578 acres in 1999 to over 150 patches encompassing over 1,500 acres in 2007 (Forys and Humphrey 1999; Faulhaber et al. 2007; Schmidt 2009a). Some of this is undoubtedly due to increased capability of detecting patches or differences in patch delineation; however Schmidt (2009a) cautioned that habitat fragmentation also contributed to an increase in the number of patches with a concomitant decrease in patch size (mean area decline of 44% between 1959-2006). LaFever et al. (2007) estimated far more potential LKMR habitat (2,895 acres [1172 hectares]) spread out over Big Pine Key, Boca Chica Key, Little Pine Key, and the Saddlebunch Keys. Regardless, this fragmentation has increased patch edge and increased the distance between patches. These are worrying trends in light of LKMR limitations in movement. Forys and Humphrey (1999) found no rabbits in patches more than 1.5 miles (2.5 kilometers) from the nearest occupied patch. Though males can disperse well over 1.25 miles (2 kilometers) from natal sites, adult females show extreme site fidelity as they rarely disperse farther than 650 feet (200 meters).

The herbivorous LKMR feed primarily on *Borrchia frutescens*, *Spartina spartinae*, and a variety of other herbaceous plants (USFWS 1999, Gordon 2010). Gordon (2010) found that LKMR selectively feed on *B. frutescens* and *S. spartinae* when opportunity arises. Like many other island mammals, LKMR appear to have a high capacity for urine concentration and need little fresh water (USFWS 2007). This indicates that LKMR habitat is related less to water needs and more to cover and food requirements. This was supported by Dedrickson (2011) who found that variability in LKMR patch presence was primarily related to plant physiognomy, vegetation composition, and elevation.

Land development has significantly reduced and fragmented potential LKMR habitat. Additionally, sea level rise has impacted habitat quantity and quality (Schmidt et al. 2012). LaFever et al. (2007) demonstrated that even low levels of future sea level rise (1 foot [0.3 meter]) would negatively impact LKMR habitat and population. Moderate (2 feet [0.6 meter]) to high (3 feet [0.9 meter]) sea level rise would result in very low LKMR abundance. Schmidt et al. (2011) analyzed the impacts of Hurricane Wilma on LKMR habitat. The storm surge inundated important areas resulting in high (37.5%) patch abandonment and low (38.1%) rates of patch re-occupancy two years after the hurricane. Perry (2006) documented greater than two-thirds mortality of radio-collared LKMR as a result of the hurricane.

LKMR Population Trends and Ecology

Found on several islands throughout the Lower Keys, the LKMR population is composed of several smaller subpopulations, collectively referred to as metapopulation. LKMR spend most of their lives in a single habitat patch, but are capable of moving between patches (Forys and Humphrey 1996). At sexual maturity, most LKMR will disperse away from natal sites. Males disperse much farther than

females (1.25 miles [2 kilometers] to 650 feet [200 meters], respectively). This often requires that the individual leave its natal patch for another nearby patch. Connectivity between patches is an important component of metapopulation dynamics and subpopulation persistence as individual patches tend to have small populations and can disappear when cut off from other subpopulations. Connectivity is impacted by distance and the intervening matrix between patches. For instance, LKMR are more likely to cross densely vegetated native habitats than open disturbed areas (Forys and Humphrey 1999). In a fragmented area like the Lower Florida Keys where LKMR subpopulation extinction is common, recolonization is most reliant upon female ability to move to new habitat patches (Forys and Humphrey 1999).

Not all habitat patches are equally capable of supporting LKMR populations. Forys and Humphrey (1999) indicated that the Saddlebunch Keys continued to support LKMR only due to continued dispersal from Big Pine Key subpopulations. In more recent LKMR metapopulation research, Schmidt (2009b) and Eaton et al. (2014) found that subpopulation persistence in a patch was also related to patch size, vegetation structure, and distance from the coast. Interestingly, the LKMR population in the lower Florida Keys was determined to be comprised of two major metapopulations (eastern and western clades, or groups evolved from a common ancestor). These groups are separated by a barrier of uninhabited matrix (Crouse et al. 2009; Tursi et al. 2013). The intervening islands have no LKMR but do have approximately 50% of the potential habitat patches (Forys and Humphrey 1999; Faulhaber et al. 2007). The major difference between these islands and the nearby occupied islands is that they have fewer patches that are spaced farther apart.

Abundance, Density, and Genetics

Forys (1995) estimated the adult LKMR population at 100-300 individuals on 39 patches. Forys and Humphrey (1997) estimated that the mean LKMR density was 1.8 rabbits / hectare) with a range from a low of 0.4 rabbits/ha to a high of 7.6 rabbits/ha. Schmidt (2009a) estimated a similar density with a mean of 1.53 rabbits / hectare in occupied patches. This translated into a mean population estimate of 317 individuals (95% CI, 248-383) with 211 rabbits on Boca Chica alone. Despite the relative similarity in population estimates in the 20 years since the initial surveys, the 2009 population estimate covers a much broader sample of LKMR habitat patches (228 patches, a 260% increase over previous surveys), and included all age classes rather than just adults. Schmidt (2009a), therefore, determined that the LKMR population had declined since surveys conducted by Forys in the early 1990s. Additionally, Schmidt et al. (2010) found large differences in population size between the eastern subpopulation (Big Pine Key, $n = 25$ rabbits), western subpopulations (lower Sugarloaf / Saddlebunch, Geiger, Boca Chica; $n = 257$ rabbits), and translocated subpopulations (Little Pine Key, Water Key; $n = 35$ rabbits).

These population differences are especially important due to recently discovered genetic differences in the clades. Crouse et al. (2009) found evidence that the clades demonstrated significant genetic differences with little gene flow between clades. Although Tursi et al. (2013) suggested that differences among *S. palustris* subspecies did not warrant individual designations, they did suggest that the western clade be singled out for conservation priority due to low habitat availability and evidence of restricted gene flow.

Habitat Patch Occupancy

Much of the research on the LKMR has focused on habitat occupancy (the number or proportion of inhabited habitat patches out of the total number suitable patches). Of the 59 suitable patches documented by Fors and Humphrey in 1999, 42 were occupied at least some of the time, 20 were occupied during all surveys, and 22 were occupied for at least one survey). Consistently occupied patches had more evidence of reproduction (i.e., more juvenile pellets) than variably occupied patches.

Faulhaber et al. (2007) estimated 51% patch occupancy (112 occupied patches of 220 potential patches) throughout the Lower Keys. The increased number of occupied and potential patches was attributed to an increased search effort compared to previous surveys, rather than an actual increase in LKMR habitat areas or population levels. Faulhaber also documented LKMR on a higher number of islands including Sugarloaf, Annette, Mayo, Howe, Geiger, East Rockland, and No Name Keys. However, the survey teams found that some of the occupied patches surveyed in the 19902 on Big Pine Key were no longer occupied. Near the same time, Perry (2006) found 36 patches on Boca Chica Key and an estimated 21.4% occupancy rate. Schmidt (2009a) found an additional 38 patches of suitable LKMR habitat but concluded overall occupancy had declined to below 50% and habitat connectivity had decreased.

LKMR Population Management

The USFWS conducted LKMR translocations to Little Pine and Water Keys, two islands with large, federally protected unoccupied habitat patches. Faulhaber et al. (2006) previously identified potential habitat using geographic information systems and field verification. Five males and six females were translocated from Big Pine Key to Little Pine Key; Perry (2006) subsequently translocated three males and four females to Water Key a year later. Both efforts were initially successful with evidence of reproduction. However, no evidence of LKMR on Water Key was documented following the storm surge caused by Hurricane Wilma (Schmidt 2009a; 2009b). Perry (2006) found high mortality as a result of the storm surge amongst all radio-collared rabbits.

Range-wide population monitoring by USFWS is an ongoing effort as resources are available. NASKW has an established population monitoring program that has been in place since 2006. Schmidt (2009a) conducted the most comprehensive, range-wide habitat patch occupancy and density analysis for LKMR. Eaton et al. (2011) provided some additional input on survey methodologies, recommending that fewer, larger (10 m²) sample plots were superior for detecting the LKMR than a greater number of smaller (1 m²) plots. Monitoring protocols for the LKMR universally include pellet counts to determine relative abundance, simple population levels, and patch occupancy.

LKMR Mortality Factors

Primary causes of LKMR mortality are vehicles and predation. All off-road vehicle traffic in LKMR habitat was prohibited soon after the species was listed as endangered (NASKW 1994). However, by the mid- to late-1990s, a third of documented LKMR mortalities were due to vehicles (Fors and Humphrey 1999). Despite the high number of vehicle mortalities, the most significant cause of mortality for LKMR is predation by native and exotic species. Fors and Humphrey (1999) found that 53% of LKMR mortality was attributed to cats. Many of the cats observed in LKMR habitat patches wore collars indicating they were domestic rather than feral. Raccoons (*Procyon lotor*) were also critically important predators and barriers to the species' recovery (Schmidt et al. 2010). They might

directly predate LKMR or cause them to avoid otherwise suitable habitat.

LKMR Management

Management efforts for the LKMR have focused on reducing direct predation through predator population management and adjustment of human behavior. Off-road vehicle traffic was prohibited in LKMR habitat. However, mortality over established roadways remains an issue. In order to reduce this risk, resource managers have supported lower speed limits, limited development near habitat, installed barrier fencing, and educated local stakeholders about LKMR presence and ecology (Monroe County 2006).

Researchers and resource managers have recommended aggressive predator control programs in combination with educational outreach to local stakeholders (NASKW 1994; Forys and Humphrey 1999; Perry 2006). A trapping program was implemented for cats and raccoons on NASKW and remains in place. Agencies are also reached out to local stakeholders to emphasize the importance of keeping cats indoors and reducing open refuse containers that subsidize predators (NASKW 1994). Schmidt et al. (2010) recommended significant habitat management to reduce edge and increase interior space in order to reduce raccoon presence. Additionally, they recommended retention and promotion of bunch grass cover, and control of hardwood encroachment to decrease predation risk. This follows previous recommendations to recover habitat and reduce mowing (NASKW 1994; Forys 1995; Perry 2006; USFWS 2007).

Habitat Management

LKMR management will focus on three main factors:

- Reducing the amount of habitat edge relative to patch size where possible through patch reconfiguration
- Managing habitat succession and quality through removal and control of native and exotic hardwoods that degrade habitat quality by reducing ground cover. Manual or prescribed fire control of overstory hardwood vegetation may reduce patch edge, slow or reverse habitat succession, and improve the amount and diversity of desirable vegetation (USFWS 2007; Schmidt et al. 2010)
- Control of predators including feral cats and raccoons

Exotic Plant and Animal Species Impacts and Control Efforts

A variety of exotic plant and animal species threaten both LKMR populations and habitat. Forys et al. (2002) found significant populations of invasive-exotic fire ants (*Solenopsis invicta*) in surveys near roads throughout the lower Florida Keys. Approximately 8% of all ants documented were fire ants – the 7th most abundant ant found. Additionally, they were documented in 29% of transitional marsh transects, 30% of pineland transects, and 23% of hammock transects surveyed. Fire ants can potentially injure or prey upon young rabbits, reduce forage availability, and change LKMR habitat use patterns.

Other invasive species can impact LKMR populations and habitat as well. Although little research has addressed feral pigs in the lower Florida Keys, they too could potentially cause significant damage to soil and vegetation structure, transmit diseases, and directly predate rabbits (USFWS 1999). Invasive-

exotic vegetation is also a concern. On NASKW, several sites were degraded by Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*), and melaleuca (*Melaleuca quinquenervia*). Exotic vegetation can outcompete native species required by LKMR and reduce overall habitat cover and forage.

Invasive Species Management

Typically management of the invasive-exotic species included direct removal and mitigation of causative factors. Resources managers have recommended removal of feral cats, raccoons, and invasive vegetation in LKMR habitat. A 500-meter no-development buffer around LKMR has also been recommended as a precautionary measure, mainly to minimize feral / free-ranging cats and also to minimize potential for fire ant invasions. Control of invasive-exotic vegetation in LKMR habitat has included prescribed fire, direct manual and mechanical removal, and application of herbicides such as Garlon 3A (NASKW 1994).

LKMR Management Plan

In reviewing the available scientific literature, USFWS Recovery Plans for the LKMR, and consulting with various experts in LKMR ecology and management, several specific LKMR management activities were identified that would ensure long-term viability of the LKMR on Navy property.

Management Action 1 – Identification and Mapping of LKMR Habitat

LKMR habitat identification and mapping methods have evolved and improved since distribution of the species on NASKW was initially determined (Forys 1995; Faulhaber 2003). A reevaluation of LKMR habitat using current high-resolution aerial photography and updated field verification is needed to maintain accurate habitat maps that form the basis for management actions.

Revised LKMR habitat maps were developed in 2015 using high resolution aerial photography after completion of the ARP and field verification of habitat conditions. Mapping was performed using existing field maps and “heads-up” digitization onto high resolution aerial photographs in ArcGIS. Potential habitat patches were identified based on the following characteristics:

- Low hardwood canopy coverage (typically buttonwood and mangroves)
- High bunchgrass density (typically *Spartina* and *Fimbristylis*)
- High herbaceous vegetative cover (typically *Borrchia* and *Batis*)
- Generally dense ground cover that would provide suitable cover for LKMR (Perry 2006)

It is acknowledged that LKMR may use a variety of habitats for dispersal, but the mapping effort focused on high-quality salt marsh wetlands known to be their core habitat. Existing LKMR habitat polygons were reevaluated and new potential areas identified on all Navy property on Boca Chica and Saddlebunch Keys.

Modifications to boundaries were made as applicable. In some cases, areas formerly designated as LKMR habitat consisted of tidally inundated areas or dense mangroves were deemed not suitable for LKMR use. In other instances, adjacent polygons were consolidated where no clear barrier to LKMR movement was indicated; existing patch numbers were retained. A limited number of polygons were eliminated completely due to a lack of required habitat characteristics. The new habitat areas identified

during restoration and field verification efforts were mapped and assigned unique patch ID numbers (Attachment 2).

Management Action 2 – LKMR Population Monitoring

Annual LKMR fecal pellet surveys have been performed at NASKW by Texas A&M University since 2006, and provide an ongoing assessment of the general distribution and abundance of the LKMR population on Navy property (Attachment 3). The surveys are typically conducted in the fall by a team of 2 - 4 field technicians. The methods for previous LKMR monitoring events were quantitative assessments of fecal pellet density within 1-meter plots distributed randomly throughout LKMR habitat areas.

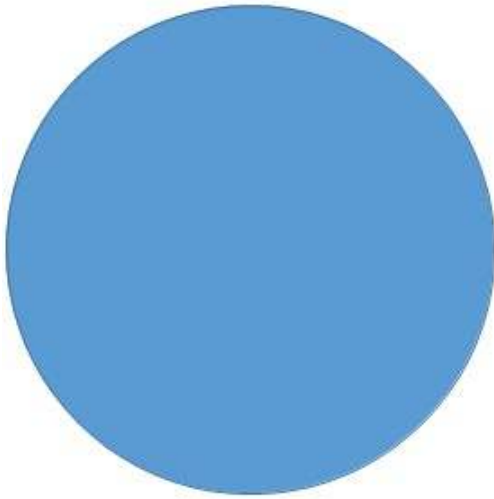
A review of survey methods determined that rather than rigid, fixed survey methods, LKMR monitoring methods should be flexible and adaptable to habitat modifications, changes in vegetation and changes in LKMR distribution over time. It was determined that larger plots established in a non-random manner within known LKMR habitat was a more effective method of determining LKMR distribution and abundance. In addition to quantitative methods involving fecal pellet surveys, more general qualitative presence/absence surveys of LKMR habitat patches improved detection probabilities for LKMR patch occupancy, relative abundance between patches, and population distribution. Therefore, a combined approach of both quantitative and qualitative survey methods will be used for the annual LKMR surveys, described below.

Monitoring Methods – Qualitative Presence / Absence Survey Methods

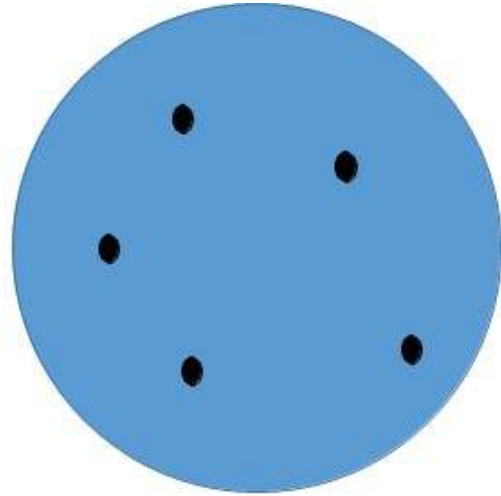
Qualitative presence / absence surveys covering the general extents of LKMR habitat patches will provide an efficient, reliable indication of LKMR presence / absence within a habitat patch. Additionally, patch-wide walking surveys will provide annual field verification for general ecological trends with a habitat patch. The following methods for qualitative presence / absence surveys will be followed:

- Conduct exhaustive walking surveys of each LKMR habitat patch to determine relative pellet density (absent, low, medium, high), spatial distribution of pellets within a habitat patch, and current patterns of occupancy (presence/absence) (Figure 6).
- Walking surveys consist of wandering transects through predetermined areas of optimal LKMR habitat (e.g., areas of high salt marsh, bunch grasses, appropriate cover), looking for LKMR sign (pellets). The observer will scan the ground for LKMR fecal pellets approximately 2 meters to either side of walking transect center line.
- For each pellet observation within a patch, the GPS location of pellets, number of pellets, pellet age / condition (old, fresh) and the age class of pellets (adult, juvenile) recorded.
- Record pellet data on field data sheets and enter into electronic database. Synthesize data into annual patch occupancy summaries that include an evaluation of LKMR presence within each patch along a relative abundance scale (absent, low, medium, high).

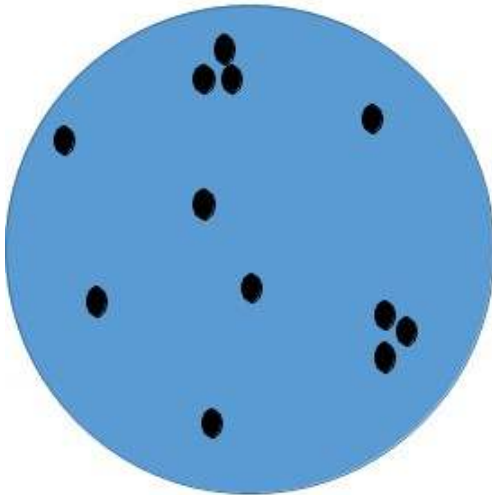
The characteristics detailed in Table 5 were used to estimate relative pellet abundance.



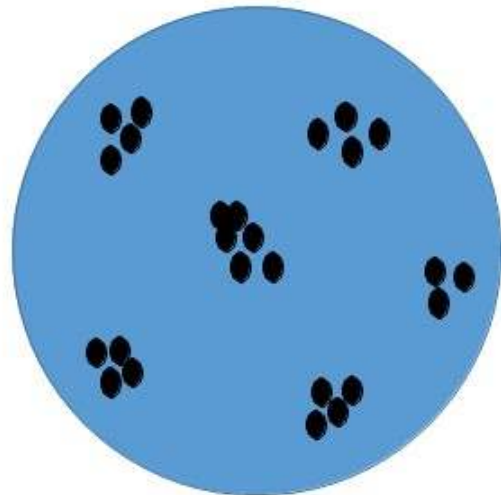
Absent



Low



Medium



High

Figure 6. LKMR Fecal Pellet Density Estimation

Table 5. Fecal Pellet Abundance Characteristics

Observations	Pellet Relative Abundance
No pellets observed in habitat patch	absent
Very few isolated pellets, widely scattered, significant search effort required to verify	low
Moderate pellet abundance, pellets easily observed, pellet occurrence isolated or in latrines	medium
Pellets easily observed, occurring throughout appropriate vegetation in habitat patch, often with numerous latrines	high

Monitoring Methods – Quantitative Fecal Pellet Surveys

Quantitative fecal pellet surveys will be conducted within LKMR patches to monitor patch occupancy rates, population age structure, and population trends. Fecal pellet survey points are non-random and can be adjusted from year to year to allow observers to conduct the most efficient surveys possible. The following methods are used to conduct fecal pellet surveys:

- Establish non-randomly placed survey points within areas of optimal LKMR habitat within established LKMR habitat patches. Maintain a minimum of 20 meters between survey points and center a 10 m² (3.6 m diameter) sample plot on survey points.
- Maintain approximately the same number of survey points / patch as in previous surveys up to a maximum of 20 points per habitat patch. With the larger sample points (increased from 1 m² to 10 m²) this represents a maximum 900% increase in survey area. However, final determination of survey area will be dependent upon on-the-ground realities (e.g., vegetation, topographical changes) and the final location of sample points within a patch can be adjusted to maximize the detection and monitoring ability for the LKMR.
- Once a sample point is established, drive a permanent marker (stake with PVC overlay) into the ground at each sample point for accurate and efficient re-sampling of sample points. Collect a GPS coordinate for each sampling point and enter coordinates into a digital database. Establish a circular sampling plot (10 m², 3.6 m diameter) around the survey point and count all fecal pellets present. A simple method to establish the circular sampling plot is to use a tape measure rotated around the center point at a 1.6-m radius (one-half of the diameter).
- Record the survey point at which pellets are found and the total number of pellets observed within each sample plot. Classify fecal pellets by age/condition (old, fresh) and age class (juvenile, adult). Fecal classification will follow guidelines established in previous research and reports (see Schmidt 2009). A diameter of 6.7 mm or larger will be used to classify pellets as adult whereas smaller pellet diameters will be considered juvenile. Pellets classified as “fresh” are described as shiny, consolidated, and dark brown in coloration. All other pellets not exhibiting these characteristics are classified as “old”.
- Observers should make opportunistic observations of LKMR sign (fecal pellets, flushed rabbits)

along travel routes from point to point for incidental observations of LKMR outside established sample points but within a habitat patch. If live or dead rabbits are observed in a patch, the GPS location recorded. If pellets are observed outside a sample point, the GPS location of pellets, number of pellets, and the age class of pellets recorded.

Monitoring Methods – LKMR Vegetative Cover Assessment

The species composition and structure of vegetation is a critical indicator of LKMR habitat quality, notably the extent of groundcover and hardwood overstory. Observers conducting the annual LKMR surveys will also collect relevant vegetative data during quantitative fecal pellet surveys described above. Vegetative sampling will occur at each quantitative fecal pellet sample location using the following methods:

- Estimate foliar cover of woody and herbaceous vegetation ($\leq 0.5\text{m}$ height) for each survey point to the nearest 10% (within 10 m^2 , 3.6 m diameter circular sample plot around permanent post).
- Record presence of wetland grasses and forbs known to be indicators of LKMR occupancy including cord grasses (*Spartina*), bluestems (*Andropogon*), sedge and rush species (*Eleocharis*, *Fimbristylis*) and sea daisy (*Borrchia*).
- Sum the occurrences of 4 herbaceous plant species for all sample units within a patch to obtain patch totals.
- Record all data onto data sheets and enter into an electronic database for inclusion into annual monitoring report.

Management Action 3 – Habitat Management

Habitat Monitoring and Surveillance

As part of the annual LKMR population monitoring efforts, the general condition of LKMR habitats will be documented so that management actions, if needed, can be implemented. The following parameters should be evaluated for each patch, and appropriate management recommendations made in the corresponding annual population monitoring report:

- Extent of hardwood cover in LKMR habitats using visual estimation techniques with recommendations for hardwood control as indicated (Figure 7).
- Presence and extent of invasive exotic vegetation (e.g. Brazilian pepper, Australian pine, seaside mahoe, leadtree, Asiatic colubrina) in LKMR habitat.
- Observations of LKMR predators including free ranging domestic and feral cats, exotic reptiles including exotic snakes (e.g. Burmese python, exotic boa constrictors), Tegu lizards (*Tupinambis spp.*), monitor lizards (*Varanus spp.*), or any other exotic predator capable on predateding the LKMR.
- Indications of encroachments, dumping, camping, off road vehicle damage, breaching of security fences or gates, and any other human-caused damage to LKMR habitat.

NOTE: OPTIMAL HARDWOOD DENSITY IN LKMR HABITAT = 20%

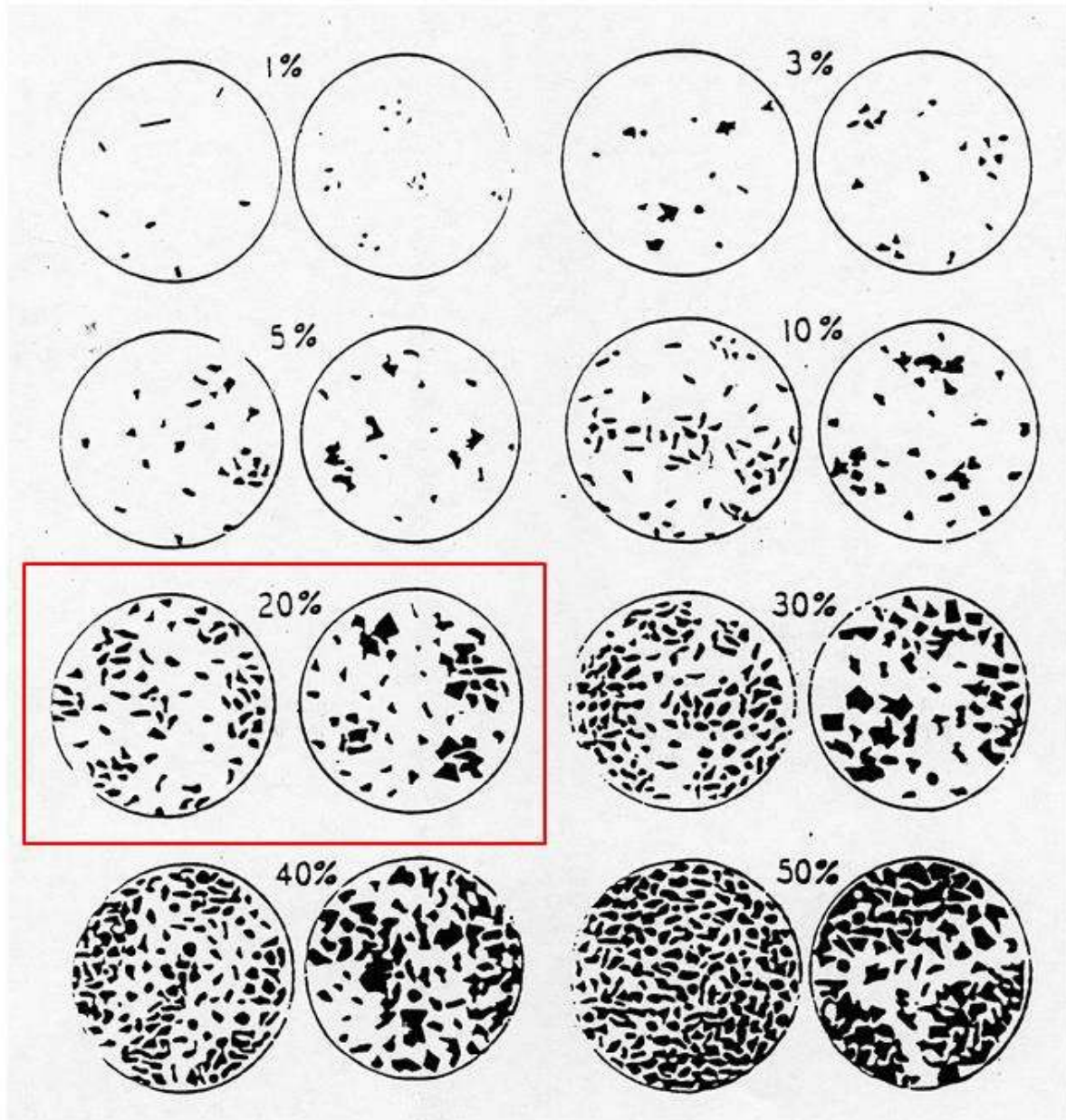


Figure 7. Comparison Chart for Visual Percentage Estimation

(reference Terry and Chillingar 1955)

Hardwood Vegetation Management

Habitat succession consisting of native and exotic hardwood encroachment in LKMR habitat is a serious threat to the long-term persistence of LKMR. Buttonwood, a native hardwood and transitional wetland plant, is especially problematic in salt marsh wetlands preferred by the LKMR, causing a reduction in essential herbaceous bunchgrasses and forbs. Additional species with the potential to adversely impact LKMR habitat include red, black and white mangroves. Although habitat succession may be considered a natural process, failure to manage hardwood density in LKMR habitats will be detrimental to LKMR population viability. Habitat monitoring and evaluation for hardwood encroachment coupled with management actions to remove and control hardwood density in LKMR habitats will ensure viable habitat is maintained.

LKMR habitat patches should be actively managed to control hardwood overstory encroachment and restore and maintain optimal LKMR habitat conditions. High salt marshes characterized by dense overstory of hardwoods (e.g., buttonwood) and decreased grasses and forbs may be unsuitable for the LKMR (Perry 2006, Schmidt et al. 2010). The LKMR prefers habitats with dense structure of low (<1 m) grasses and forbs with minimal overstory, and generally avoids areas with mature buttonwoods, high canopy cover and ground level biomass (Perry 2006). Although habitat succession may be considered a natural process, failure to intervene to reverse hardwood encroachment in LKMR habitats will ultimately render habitats unsuitable, resulting in a loss of LKMR populations.

Hardwood control should be conducted in a manner that minimizes damage to LKMR habitats and may include hand removal, treatment with herbicides or application of prescribed fire. Although prescribed fire has been suggested as a viable method to control hardwood vegetation in LKMR habitat at NASKW, prescribed fire as a management tool at NASKW is problematic for several reasons:

- Planning a prescribed fire is complicated and involves potential impacts to NASKW airfield operations. Prescribed fire is weather-dependent and therefore not easily scheduled and implemented. Prescribed fire in LKMR habitat may result in direct mortality to LKMR populations.
- Prescribed fire in LKMR habitat may result in a lack of grassland cover and cause the displacement of LKMR populations. Considering the habitat specificity and small range of the LKMR, prescribed fire may be overly disruptive compared to other methods.
- Due to the complexity of conducting prescribed fire at NASKW, and the possibility of direct mortality to LKMR from fire, hand removal and treatment with herbicides is likely the most effective and feasible method of hardwood control.

For the above reasons, hardwood vegetation control in LKMR habitat should be conducted by hand removal in general, with other methods (e.g., fire, mechanical control) considered on a case-by-case basis. Hand removal of vegetation involves cutting hardwood trees at ground level and treating the stump immediately with an approved herbicide (e.g., Garlon) to prevent re-sprouting. All cut vegetation would be removed outside of LKMR habitat and disposed of in an appropriate manner.

The extent of hardwood control in LKMR habitat to establish optimal habitat conditions is not clearly defined in the scientific literature. However in general, open grassland prairies with dense ground cover of bunch grasses and forbs and a sparse overstory of widespread hardwood trees are the habitats most preferred by the LKMR. Therefore it is recommended that overstory vegetation in LKMR habitat be

optimally managed between 0%-20% cover. LKMR habitat patches with an excess of 20% cover of overstory hardwood vegetation should be considered degraded and in need of management action.

The density of hardwood vegetation in LKMR habitat, specifically grassland-dominated salt marsh wetlands, should be evaluated as part of the annual LKMR population monitoring effort, with observations made through qualitative visual estimates of hardwood density using a cover estimation chart (Figure 7). Using qualitative visual cover estimation is efficient compared to more time consuming quantitative methods, and for general management purposes, likely yield similar results. LKMR habitat patches should be evaluated for hardwood vegetative cover at each fecal pellet sample point and also in general for the entire patch. Patches in excess of 20% hardwood cover should be considered candidates for hardwood control projects. Specific patch-by-patch management recommendations should be included as a discrete section in the annual LKMR monitoring reports provided to the NASKW Natural Resource Manager. It is recommended that the LKMR patch assessment form be used to ensure consistent observations and data collection (Attachment 4).

Through ongoing monitoring of LKMR habitats and populations on NASKW, specific habitat management projects can be identified and funded by the NASKW Natural Resource Manager based on the availability of appropriate funding. Habitat management projects should be developed in priority LKMR habitats, specifically those patches that are occupied by LKMR with a history of occupancy. As funds for restoration projects are available, habitat management projects could transition from priority habitat patches to those patches less frequently occupied, or patches that are in need of intensive management to be suitable for LKMR occupancy.

Habitat Restoration

Restoration of habitats impacted by historical placement of fill material, alteration of hydrology, and infestations of invasive exotic plants can adversely impact LKMR habitat quality and utilization. In addition, disturbed habitats can also facilitate establishment of invasive species. Specific projects designed to restore impacted LKMR habitat should be identified and implemented where feasible.

LKMR habitat restoration projects typically would involve removal of historically filled areas such as abandoned roads, abandoned fill pads, restoration of natural drainage to prevent impoundments, removal of native and exotic hardwoods, and other physical projects designed to create and reestablish optimal LKMR habitat conditions. The specific project design will require detailed site analysis, survey, construction plans and coordination and approval of the Navy. Examples of potential restoration projects that would benefit the LKMR are included in Attachment 5.

Management of Anthropogenic Factors to Maintain and Protect LKMR Habitat

The management of LKMR habitat requires protection from inadvertent impacts from airfield and facilities mowing, and general maintenance. It is important to maintain optimal habitat conditions by preventing unauthorized access, dumping, off road vehicle damage, inadvertent mowing and other detrimental activities resulting from human activity within or adjacent to LKMR habitats.

The establishment and implementation of the facility mowing plan is a critical component for the long-term protection of the LKMR and its habitat. The Navy has prepared and implemented a facility mowing plan for Boca Chica Field that avoids mowing areas designated as LKMR habitat (Attachment 6).

Additional protection for LKMR habitat requires educational signage and access control informing NASKW staff, visitors and contractors of the protected status of designated LKMR habitat and the need to stay out of restricted areas on Navy property. While protective measures are in place in most areas on NASKW, the development of a formal LKMR signage, fencing and vehicular and pedestrian access control plan is recommended.

Management Action 4 – Predator Control

Predation by native and exotic mammals, primarily free-ranging domestic cats and potentially raccoons, is a significant factor limiting LKMR populations, accounting for up to 50% of adult mortality (Schmidt et al. 2010; Forsys and Humphrey 1999). Raccoons have also been identified as significant predators for nesting and neonate rabbits. Predator control efforts on NASKW have indicated that raccoons are far more abundant than free-ranging domestic cats.

To address concerns regarding LKMR predation, the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) was contracted in September 2005 to trap and remove cats from NASKW properties. From 2010- 2015, WS removed a total of 33 cats and 344 raccoons on Navy properties in and adjacent to LKMR habitats (Table 6 and Attachment 7). Predator control efforts (USDA 2015) on NASKW have been important to the protection of LKMR and will continue to be conducted by USDA / WS. Predators cannot be effectively "trapped out" of LKMR habitats due to the proximity of non-Navy properties and the highly mobile nature of these predators. For this reason, long-term predator control will be required. Annual predator control by USDA / WS or a similarly experienced predator control agent should be conducted annually subject to the availability of appropriate resources.

Trapping should be conducted in areas where predator control is most effective for LKMR management, ideally in and adjacent to high quality, occupied LKMR patches, and in areas known to historically support predator populations. Trapping should be conducted using non-lethal methods and target only carnivorous predators capable of depredate LKMR. Predator traps should be deployed such that LKMR will not enter traps, e.g. baited with meat or other baits not attractive to LKMR. Data on trapping effort, locations, and species removed should be maintained by NASKW Natural Resource Management program so that long-term trends in predator abundance and removal efforts are monitored.

Table 6. Summary of USDA Predator Control Efforts

Year	# of Cats Removed	# of Raccoons Removed	Total Trap Nights
2010	11	39	704
2011	5	67	780
2012	10	39	804
2013	5	82	868
2014	7	97	1,550
2015	5	59	640
ALL	43	383	5,346

Predator control efforts implemented by NASKW are contributing to recovery through a reduction in predation. Efforts will continue subject to the availability of appropriate resources.

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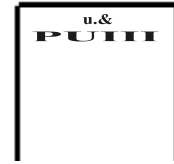
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Attachment 1 - USFWS Biological Opinion



United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960



March 7, 2007

Captain James R. Brown
Commanding Officer
Department of the Navy
Bldg A-324, Forrestal Street
Key West, Florida 33040-9001

Service Federal Activity No: 41420-2006-FA-1128
Service Consultation Code: 41420-2006-F-0297
Navy Application No.: N45/0550
Date Received: July 3, 2006
Formal Consultation Initiation Date July 3, 2006
Project: Restoration of clear zones and
stormwater drainage systems
Applicant: Department of the Navy
County: Monroe

Dear Captain Brown:

This document is the Fish and Wildlife Service's (Service) response to the Department of Navy's (Navy) determinations for the species listed below for the proposed restoration of clear zones and stormwater drainage systems, located at Boca Chica Field, Naval Air Station Key West (NASKW), Monroe County, Florida. It also transmits the Service's biological opinion (BO) for the endangered Lower Keys (=marsh) rabbit (LKMR). It is based on our review of the potential effects on federally protected species, in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 *et seq.*), and the provisions of the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*).

The Navy has determined the proposed action will have no effect on the following threatened and endangered species that occur or may occur on Boca Chica Field:

- Threatened eastern indigo snake (*Drymarchon corais couperi*)
- Endangered loggerhead sea turtle (*Caretta caretta*)
- Endangered green sea turtle (*Chelonia mydas*)
- Endangered leatherback sea turtle (*Dermochelys coriacea*)

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- Endangered hawksbill sea turtle (*Eretmochelys imbricata*)
- Endangered Kemp's Ridley sea turtle (*Lepidochelys kempii*)
- Threatened Stock Island tree snail (*Orthalicus resesreses*)
- Threatened Garber's spurge (*Chamaesyce garberii*)
- Threatened Blodgett's wild mercury (*Argythamnia blodgettii*)

The action is not anticipated to affect these species because surveys were conducted and they were not documented on lands where habitat alteration will occur.

The Service has reviewed maps, documents, and Geographic Information System (GIS) overlays and supports the NASKW's determination of no affect for these species.

The Navy has determined the proposed action "may affect, but is not likely to adversely affect" the following threatened and endangered species that occur or may occur on Boca Chica Field.

- Endangered Florida manatee (*Trichechus manatus latirostris*)
- Endangered silver rice rat (*Oryzomys palustris*)
- Threatened bald eagle (*Haliaeetus leucocephalus*)
- Threatened roseate tern (*Sterna dougallii dougallii*)
- Endangered American crocodile (*Crocodylus acutus*)

The Service has reviewed maps, documents, and GIS overlays and concurs with the NASKW determination that the proposed project "may affect, but is not likely to adversely affect" these species because they have not been observed on the proposed site or they may be present sporadically and are anticipated to incur insignificant discountable direct and and/or indirect negative effects as a result of the project.

The Navy has determined the proposed action "may affect, and is likely to adversely affect" the following endangered species that occurs on Boca Chica Field:

- Lower Keys (=marsh) rabbit (*Sylvilagus palustris hefneri*) (LKMR)

The Service has reviewed maps, documents, and GIS overlays and concurs with the NASKW determination that the proposed project "may affect, and is likely to adversely affect" the LKMR.

Therefore, this document transmits the Service's BO of the proposed restoration and maintenance of clear zones and stormwater drainage systems, located at Boca Chica Field, NASKW, Monroe County, Florida and its affects on the LKMR in accordance with section 7 of the Endangered

Species Act of 1973, as amended (Act) (87 Stat. 844; 16 U.S.C. 1531 *et seq.*) Your request for formal consultation was dated January 14, 2005.

This BO also relies on information provided in the U.S. Department of Navy's (Navy) Programmatic Biological Assessment (PBA) (NASKW 2006a) dated February, 2006 and supplemental information (NASKW 2006b) provided June 29, 2006, and meetings, telephone conversations, emails, and other sources of information. A complete administrative record of this consultation is on file at the Service's South Florida Ecological Services Office (SFESO), Vero Beach, Florida.

Consultation History

On February 23, 2004, the Navy, NASKW, made a determination that cutting oftrees and shrubs at the west end of runway 07-25, "is not likely to adversely affect the Lower Keys marsh rabbit or its habitat."

On May 18, 2004, the Service concurred with the Navy's February 23, 2004, determination, with additional conservation measures.

On August 24, 2004, NASKW held a public scoping meeting to identify concerns with restoration of Airfield Clear Zones and stormwater drainage systems.

On August 10, 2005, representatives of the NASKW meet with Service representatives to discuss the project and mitigation in a pre-application meeting.

On October 3, 2005, representatives of the NASKW meet with Service representatives to discuss the draft Navy biological assessment.

On December 21, 2005, NASKW presented a summary of post Hurricane Wilma effects on the lower Keys rabbit to the Service.

On January 19, 2006, NASKW and the Service updated members of the NASKW Natural Resources and Environmental Compliance Partnering Team on the project consultation.

On February 17, 2006, NASKW transmitted its request for formal consultation and its Programmatic Biological Assessment (PBA) for the Restoration of Clear Zones and Stormwater Drainage Systems at Boca Chica Field NASKW.

On May 11, 2006, in a meeting of NASKW and Service representatives, the Service suggested that a phased BO would be a better approach than a programmatic BO. The Service requested additional information about specific aspects of the proposed project.

On May 24, 2006, NASKW and the Service updated members of the NASKW Natural Resources and Environmental Compliance Partnering Team on the project consultation.

On May 24, 2006, NASKW and the Service updated members of the NASKW Natural Resources and Environmental Compliance Partnering Team on the project consultation. On June 29, 2006, NASKW provided the Service with supplemental information to the Programmatic Biological Assessment requested by the Service in the May 11, 2006, meeting.

The Use of Best Scientific and Commercial Information by the Service

The Service uses the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

Specifically, there is one such document cited in this biological opinion the Service acknowledges has been affected in its cited form by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the South Florida Multi-Species Recovery Plan (MSRP) of 1999 (Service 1999). The MSRP was designed to be a living document and to be flexible to accommodate the change identified through ongoing and planned research consistent with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this is what indeed occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

BIOLOGICAL OPINION

This section of the document provides a description of the action, an overview of the action area, the species that has been included in the biological opinion, and a summary of relevant biological and ecological information on the species included in the BO.

Description of the proposed action

Action

The action addressed in this BO is the restoration and maintenance of runway clear zones and the restoration and maintenance of stormwater drainage systems. The project site is located at Boca Chica Field, NASKW, Monroe County, Florida. The action area is a large runway complex consisting of three runways, associated taxiways, access roads, facilities, and accessory equipment. The species to be affected by the proposed action is the endangered LKMR.

Runways at NASKW must comply with Naval Facilities P-80.3, *Facility Planning Factor Criteria for Navy and Marine Corps Installations Airfield Safety Clearances*, United Facilities

Criteria 3-260-01, *Airfield and Heliport Planning and Design*, and Federal Aviation Regulation Part 77, *Objects Affecting Navigable Airspace*. Stormwater drainage ditches are clogged with vegetation and culverts are damaged impeding their ability to drain storm water from the complex.

There are about 252.58 acres of occupied LKMR habitat located at NASKW (NASKW 2006). Of those, 130.65 acres of LKMR habitat fall within the project area and will be directly and indirectly affected. About 37.59 acres of unoccupied mangrove habitat is proposed for conversion to high quality salt marsh habitat. NASKW proposes to restore the clear zones and stormwater drainage systems incrementally in five phases, including mitigation for each phase, as funding becomes available. NASKW believes the phased process may take ten years or longer to complete, depending on funding availability.

NASKW is proposing several conservation measures to minimize potential adverse effects of the project. To ameliorate potential negative long- and short-term impacts, NASKW proposes the following actions:

- 1) Phase the project over ten or more years and monitor restoration and other minimization measures between phases, as identified in the project proposal for phase I, and improve subsequent procedures based on monitoring results.
- 2) Hand clear existing woody vegetation where practicable.
- 3) Create 37.59 acres of salt marsh wetlands and restore 102.41 acres of existing habitat.
- 4) Control predators such as house cats and raccoons in and near the action area.
- 5) Establish "no mowing" areas to preserve habitat.
- 6) Ban off-road vehicles from the preserved areas.
- 7) Avoid construction during breeding season.
- 8) Eradicate invasive exotic vegetation.
- 9) Educate military personnel and the public about LKMR.
- 10) Employ erosion control measures.
- 11) Maintain and manage the action area at NASKW long-term.

Action area

The action area is in the Florida Keys, which extend from Key Largo south to Key West in Monroe County, Florida. NASKW is comprised of 6,387 acres of land in the Florida Keys, Monroe County, Florida. The station is located about 156 miles southwest of Miami and 90 miles north of Cuba. Boca Chica Field, NASKW's primary site and airfield, is located on Boca Chica Key, approximately 5 miles east of the city of Key West in Monroe County. Boca Chica Field covers approximately 3,560 acres and consists of an airfield, administrative and industrial facilities, and recreational areas.

The action area at Boca Chica Field is composed of the area adjacent to Boca Chica Field's three runways. The runways are asphalt Class B runways and include primary Runway 07/25 and crosswind Runways 03/21 and 13/31. The action area is defined as the "construction limit"

(Figure 1) identified in Figure 5-2 (reproduced in part as Figure I) in the February 2006 PBA for the "Restoration of Clear Zones and Stormwater Drainage Systems at Boca Chica Field NASKW".

The Keys are a 130-mile arc of islands extending from Soldier Key to Key West. The Keys are divided into three physiographic zones characterized by their shape, orientation, and underlying rock formations: the Upper Keys (Soldier southeast to Newfound Harbor Keys), the Lower Keys (East Bahia Honda to Key West), and the distal atolls (Boca Grande Key Group, Marquesas Keys and Dry Tortugas) (Hoffeister and Multer 1968).



Figure 1. Action area (construction limit).

The Lower Keys are a triangular group of islands lying at right angles to the Upper Keys in a northwest-southeasterly direction. The directional movement of tidal scour causes their orientation, which is a result of the tidal time and height differences between the Gulf of Mexico and the Straits of Florida. Several channels cut between the Lower Keys to connect the Gulf and Florida Bay. These passageways allow for greater water exchange between the two water bodies than the Upper Keys.

Most of the land area in the Keys lies between 2.0-3.0 feet above high tide. Two locations (located in the Upper Keys) have an elevation of 16 feet or more; here topography of the islands change from the typically flat island to elongated with southeast and northwest sides sloping to the Atlantic Ocean and Florida Bay.

Intertidal flats border the islands and give way to shallow water areas that gently slope to deeper water. Florida Bay lies beyond the flats on the northwest side of the Keys. Seaward towards the Straits of Florida, a band of living reefs parallel the coastline.

Boca Chica is a large island for the Florida Keys. Prior to colonization and development, the biological environment of NASKW was considerably different than it is today. Historically, the Keys were dominated by subtropical vegetative communities that are typical of the South Florida environment. Today, these communities are found only scattered throughout NASKW. Existing vegetative community types that characterize the Florida Keys include tropical hardwood hammocks, freshwater marshes and hardwoods, mangrove forests, buttonwood transition zones, and grassy and low salt marshes.

Vegetation communities consist of freshwater and salt water subsets. Both freshwater/upland and salt water communities have been invaded by exotic species. These communities and invasive exotic vegetation present at Boca Chica Field were discussed by NASKW in their 2006 biological assessment:

Freshwater environments and upland communities: Vegetation types on Boca Chica Field transition with increasing elevation from mangroves through a salt marsh/buttonwood transition zone to tropical hardwood hammocks and ridge/hammocks (Table 1).

Table 1*. Freshwater Environments and Upland Communities, Boca Chica Field, NASKW, Florida

Type	Acres (hectares)
Tropical Hardwood Hammock	94.32 (38.17)
Ridge/Hammock	23.21 (9.39)
Freshwater Marsh	56.34 (22.80)
Freshwater Hardwoods	8.87 (3.59)
TOTAL	182.74 (73.95)

*adapted from NASKW 2006

Typical tropical hardwood hammock communities include: strangler fig (*Ficus aurea*), gumbo-limbo tree (*Bursera simaruba*), false mastic (*Sideroxylon foetidissimum*), willow bastic (*Sideroxylon salicifolium*), lancewood (*Ocotea coriacea*), ironwoods (*Hypelate trifoliata* and *Krugi. odendronferreum*), poisonwood (*Metopium toxiferum*), pigeon plum (*Coccoloba diversifolia*), Jamaican dogwood (*Piscidia piscipula*), and Bahama lysiloma (*Lysiloma latisiliquum*). Live oak (*Quercus virginiana*) and cabbage palm (*Sabal palmetto*) are also occasionally observed within this community (FNAI and FDNR 1999a). Ridge/hammock communities are a subset of tropical hardwood hammocks and are essentially mounds of storm-blown material covered with hardwoods.

Two types of freshwater wetlands are also present at Boca Chica Field: freshwater marsh and freshwater hardwoods. Freshwater marshes are dominated by various combinations of pickerelweed (*Pontederia cordata*), sawgrass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), arrowhead (*Sagittaria* sp.), fire flag (*Thalia geniculata*), cattail (*Typha* sp.), spike rush (*Eleocharis* sp.), bulrush (*Scirpus* sp.), white water lily (*Nymphaea odorata*), and

various sedges (FNAI and FDNR 1999b). Sawgrass and spike rush are generally the dominant ground-level species in both types of freshwater wetlands on Boca Chica Field, but freshwater hardwoods support a canopy of broadleaf trees and shrubs.

In 2005, FNAI conducted an invasive and exotic plant survey for the Navy property on Boca Chica Key. Approximately 31 invasive and exotic vegetative species were documented on Boca Chica Key.

Coastal vegetative communities: The predominant coastal communities on Boca Chica Field include mangrove forests and the salt marsh/buttonwood transition zones (Table 2). Extensive mangrove forests mixed with tidal marshes (salt marsh/buttonwood transition zones) exist throughout the Florida Keys because of their ability to flourish in brackish or saline environments. Florida mangrove forests are unlike most worldwide mangrove forests; the substrate in which the mangroves are rooted in the Florida Keys, and the historical and current hydrology, play a major role in their size, extent, health, and function. Typically, mangroves in the Florida Keys are smaller in stature than they are elsewhere, including much of the Florida mainland (Lewis *et al.* 2005).

**Table 2*. Coastal Vegetative Communities
Boca Chica Field NAS Key West, Florida**

Type	Total Acres (hectares)
Mangrove Forest	698.33 (282.60)
Scrub Mangrove	301.47 (122.00)
Buttonwoods	102.71 (41.56)
Grassy Salt Marsh	130.05 (52.63)
Low Salt Marsh	99.49 (40.26)
Coastal Rock Barren	148.02 (59.90)
Coastal Berm	41.20 (16.67)
TOTAL	1,512.27 (615.62)

* adapted from NASKW 2006

Ecological functions of mangrove forests are largely based upon the sediments in which they are rooted and their hydrology. Mangrove trees trap and cycle various organic materials, chemicals, and nutrients through their submerged root system (Florida Keys National Marine Sanctuary [FKNMS] n.d.). Similarly, these roots trap sediments and filter out other materials that contribute to turbid water. Marine organisms can attach themselves to these roots as a form of protection, and many wildlife species utilize mangrove forests as nursery areas, rookeries, and food sources (FKNMS n.d.). Depending on their width, mangrove forests can protect upland areas from storms, winds, and waves and stabilize coastlines to prevent erosion (FKNMS n.d.).

Mangrove communities are dominated by four woody species, including three true mangrove species and one species associated with mangrove communities: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erectus*), respectively. These four species are most commonly recognized in a zonation pattern determined by water level and ground elevation, with red mangroves occupying the lowest zone (often partially submerged), black mangroves occupying

an intermediate zone, and white mangroves and buttonwoods occupying the highest zone (FNAI and FDNR 1990). Mangrove forests are defined as forests dominated by red mangroves and/or black mangroves, with white mangroves also present. Scrub mangrove communities are dominated by black and red mangroves, sometimes with a cover of grasses (MacAulay *et al.* 1994). Mangrove communities are also designated as being Habitat Areas of Particular Concern (HAPC) by the South Atlantic Fishery Management Council (SAFMC) (NOAA 2004). The intent of HAPC is to identify those areas that are known to be important to species which are in need of additional levels of protection from adverse effects.

The salt marsh/buttonwood transition zone can be subdivided into three vegetation types: (1) buttonwoods, which have ground vegetation similar to grassy salt marsh with a canopy formed by buttonwood trees; (2) grassy salt marsh, which includes open areas dominated by salt-tolerant grasses and shrubs such as seashore dropseed (*Sporobolus virginicus*), sea oxeye daisy (*Borrchiafrutescens*), Gulf cordgrass (*Spartina spartinae*), saltmeadow cordgrass (*Spartina patens*), and salt marsh fringerush (*Fimbristylis* sp.); and (3) low salt marsh, which is dominated by low-lying halophytic species (those species than are tolerant of salty conditions) such as key grass (*Monanthochloe littoralis*), glasswort (*Salicornia virginica*) and saltwort (*Batis maritima*) (McNeese and Taylor 1998; USWFS 1999; Faulhaber 2003).

Invasive exotic plant species: From January through December of 2004, FNAI conducted an ecological survey of all Navy properties in the Florida Keys. This survey included invasive exotic plants, rare plants, selected rare animals, and natural community descriptions (Henize and Ripes 2005). A total of 2,622 occurrences of invasive exotic species were documented on the Navy property throughout the Keys.

The most common invasive and exotic species found on Boca Chica Field are: Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia*), lead tree (*Leucaena leucocephala*), umbrella tree (*Scheffiera actinophylla*), seaside mahoe (*Thespesia populnea*) and the trumpet tree (*Tabebuia heterophylla*).

The 2005 FNAI Survey also determined which natural areas on Boca Chica Field were threatened by exotics. The following natural areas on Boca Chica Field are currently threatened by exotic species: Weapons Hammock, rock barrens (both sides of Runway 07 and the inner airfield), freshwater wetlands, lagoon berms, Old Boca Chica Coast Road berms (east and west side), and the beach dune (Henize and Ripes 2005)."

Species Included in this Biological Opinion

The Service has determined the proposed action may affect the following species that is provided protection under the Act:

Table 3: Species included in this Biological Opinion

Common Name	Scientific Name	Listed As
Lower Keys(= marsh) rabbit	<i>Sylvilagus palustris hefneri</i>	Endangered

In the action area, no critical habitat has been designated for the **LKMR**.

Status of the Species/critical habitat description

In this section, we briefly discuss the current legal status of the species, listing history, and current known range. For critical habitat, if designated, we discuss the extent of critical habitat, the primary constituent elements identified in the final rule, and any activities that have the potential to alter the primary constituent elements.

Species/critical habitat description

The LKMR, one of three subspecies of marsh rabbit (*Sylvilagus palustris*), is endemic to the Lower Florida Keys. The LKMR was listed as an endangered species on June 21, 1990 (Service 1990). Lazell (1984) described the LKMR as a distinct subspecies. LKMR have short, brown fur and a grayish-white belly. Their feet are small and their tails are dark brown and inconspicuous. Male and female LKMR do not appear to differ measurably in size or color. This marsh rabbit differs from the peninsular Florida marsh rabbits (*S. p. paludicola*) in several cranial characteristics (Lazell, 1984). The LKMR is the smallest of the marsh rabbit subspecies. There is no critical habitat designated for the LKMR.

Life history

Distribution: The LKMR is endemic to the Lower Keys and inhabits tidal, brackish, and transitional upland and freshwater environments. The LKMR's original range extended from Big Pine Key to Key West, encompassing a linear distance of about 30 miles. Historically, LKMR probably occurred on most of the Lower Keys that supported suitable habitat, but did not occur east of the Seven-mile Bridge where it is replaced by *S. p. paludicola*. Faulhaber (2003) conducted a comprehensive survey for LKMR. The LKMR is known from many of the larger Lower Keys including Sugarloaf, Saddlebunch, Boca Chica, and Big Pine Keys and some smaller islands near these keys (Forys et al., 1996; Faulhaber, 2003). Historically, the species has existed on Middle Torch Key, Big Torch Key (Lazell, 1984), Cudjoe Key, and may have existed on Ramrod Key, and Key West, but has been extirpated from these areas. Presently, there is a large gap in the distribution of LKMR from Cudjoe Key to the Torch Keys.

The following Keys were known to be occupied by LKMR subpopulations within the period 1988 to 1995: Annette Key, Big Munson Key, Big Pine Key, Boca Chica Key, East Rockland Key, Geiger Key, Mayo Key, No Name Key, Porpoise Key, Saddlebunch Key, Saddlehill Key, and Sugarloaf Key (Forys et al., 1996). During subsequent investigations, conducted from 2001 to 2003, LKMR subpopulations were not found on Big Munson Key, Porpoise Key, and Saddlehill Key. Reintroduction efforts during 2002 to 2004 resulted in the establishment of rabbits on Little Pine Key and Water Key (Faulhaber, 2003; Perry, 2005a). Additional Keys with potential rabbit habitat, as identified by Faulhaber (2003), are Big Torch Key, Cook Key, Cudjoe Key, East Water Key, Hopkins Key, Howe Key, Johnson Keys, Key West, Little Torch Key, Marvin Key, Middle Torch Key, Mud Key, Ramrod Key, Snipe Point, and Summerland Key. On the extreme ends of the range, eastern (Big Pine Key area) and western (Boca Chica

Key area) populations exhibit strong genetic differentiation, and limited genetic exchange (Crouse, 2005). Potential LKMR habitat throughout its range is shown in Figure 2.

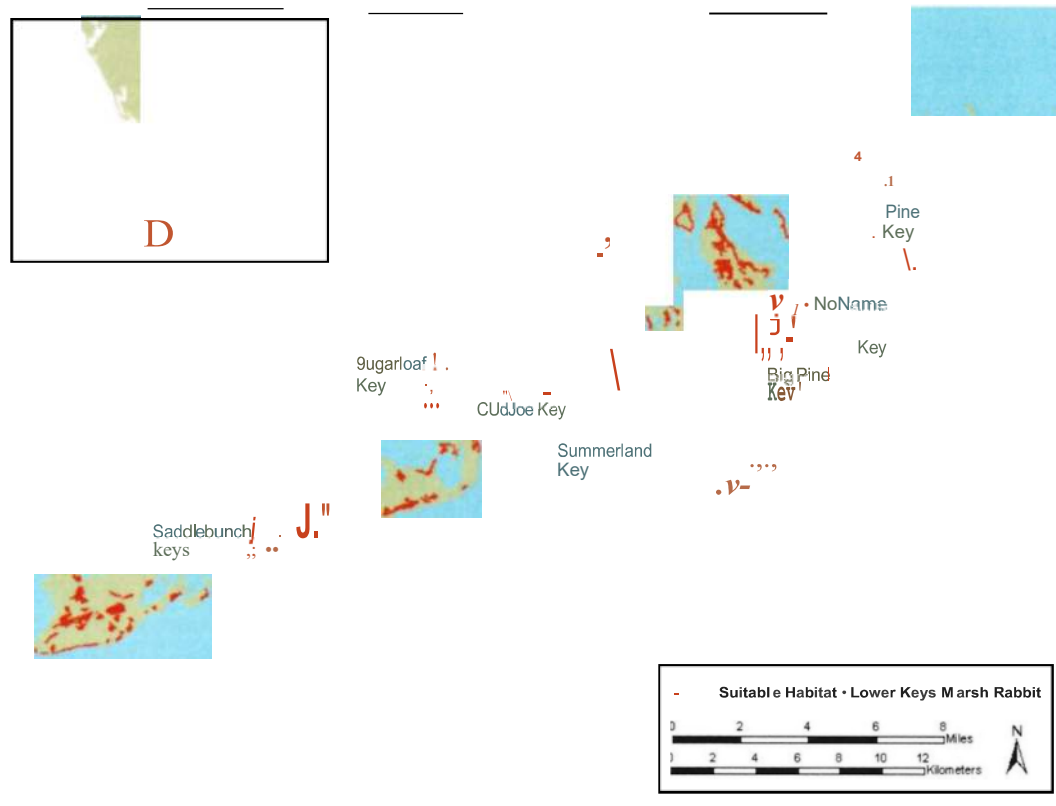


Figure 2. Potential suitable habitat for the Lower Keys marsh rabbit in the Florida Keys, Monroe County, Florida 2006.

The LKMR occurs in small, disjunct populations whose survival depends, on average, on occasionally immigration from adjacent subpopulations. In order to persist, the emigration rates of the LKMR have to be equal or greater than the death rates. This subspecies may be less fecund than others, thus naturally making it more susceptible to random demographic events and environmental fluctuations (Forys, 1995). Since breeding occurs year round, urbanization has affected the LKMR reproductive potential. In addition to natural threats, residential and commercial construction in the Keys have caused direct mortality to the marsh rabbit and disrupted their dispersal.

In 2002, a pilot study that reintroduced 13 LKMR to Little Pine Key, an isolated island with a relatively large area, and 32 acres of suitable habitat, was conducted to assess the effectiveness of reintroductions in the recovery of the LKMR (Perry, 2005a). High survival (81 percent) during the first 5 months and evidence of reproduction suggested reintroduction was a feasible management tool (Perry, 2005a). To evaluate the translocation techniques used, seven LKMR were introduced to Water Key, an island with about 25 acres of suitable habitat. Survivorship on Water Key during the first 5 months (100 percent) and evidence of reproduction validated these

translocation techniques as a viable tool for recovery biologists (Perry, 2005). Long-term success of this reintroduction program will depend on availability of translocation candidates and possibly an *in-situ* captive breeding program (Perry, 2005a).

Habitat: LKMR inhabit tidal, brackish, upland, and freshwater environments. The majority of suitable habitat area lies in a transitional zone between marine environments and uplands (Figure 2). Cover types that provide habitat include salt marsh, coastal prairie, coastal beach berms, buttonwood (*Conocarpus erectus*) woodlands, and salt marsh-buttonwood transition areas. They also use freshwater wetlands. LKMR often include areas of mangrove (red mangrove, black mangrove, and white mangrove [*Laguncularia racemosa*]) woodlands within their home ranges, and regularly pass through mangrove when traveling between the other habitats. Similarly, data from recent studies suggests that the species may range into the edges of pinelands and other upland habitat, although the frequency and degree of use is currently unknown (Faulhaber, 2003). During long-range dispersal events, such as when a juvenile leaves its natal home range, it is likely that rabbits pass through all natural terrestrial and wetland environments of the Lower Keys.

Faulhaber (2003) estimated that there were 1,291 acres of occupied habitat, and 687 acres of potential (unoccupied) habitat. The median size of all of the 228 occupied and potential habitat patches as delineated by Faulhaber (2003) was 4.5 acres. These habitat patches occur in a fragmented composite of native and disturbed habitat, with few contiguous areas of native habitat greater than 12 acres (Forys, 1995). Known localities for the rabbit are on privately owned land, State-owned land, and Federal land within the NKDR, Great White Heron National Wildlife Refuge, and Naval Air Station Key West. Suitable habitat for this species is highly fragmented across all of the Lower Keys (Forys and Humphrey, 1999b).

Typical LKMR habitat includes wet areas with dense cover. Herbaceous cover is a dominant feature within LKMR home ranges. This herbaceous cover is a mixture of grasses, sedges, and forbs. Such ground cover provides shelter as well as critical foods and nesting sites. The LKMR builds mazes of runs, dens and nests in herbaceous cover. Many of the grassy marsh and prairie rabbit habitats are in transitional plant communities that are similar in form and species composition to communities interspersed among mangrove forests of mainland Florida (Forys and Humphrey, 1994). These wetland communities lie in the middle of the salinity gradient in the Lower Keys. However, many areas occupied by the LKMR are rarely inundated by tides. In 2003, there were about 3,140 acres of occupied and potential habitat (extracted from Faulhaber 2003 data), of which 2,467 acres (78.6 percent) are in public ownership (Service, 2003). Forys et al. (1996) had identified about 625 acres of that habitat.

Proposed development and related impacts on Big Pine Key and No Name Keys were evaluated in a Habitat Conservation Plan (HCP) and BO completed in June 2006, along with related conservation activities, and incidental take was provided that will not jeopardize the survival and recovery of the species. As a result, this BO focuses primarily on other areas of LKMR, known as the "Other Islands." There are 1,045 acres within the boundaries of the Big Pine and No Name Keys HCP. Based on our GIS analyses, the remaining islands provide an additional 2,094 acres, with 1,557 acres in public ownership (72 percent). Potential suitable LKMR habitat

within vacant privately owned lands on the remaining islands is about 444 acres, representing 369 parcels.

The coastal prairie and wetland system of the Lower Keys is floristically simple, dominated by relatively few species of grasses and forbs. These include cordgrasses (*Spartina* spp.), seaside oxeye (*Borrchia* spp.), glassworts (*Salicornia* spp.), seashore dropseed (*Sporobolus virginicus*) rushes (family Cyperaceae), saltwort (*Batis maritima*), and marsh fimbry (*Fimbristylis spadicea*). In freshwater marshes, cattails (*Typha* spp.), sawgrass (*Cladiumjamaicense*), sedges (*Cyperus* spp.), and spikerush (*Eleocharis* spp.) are common components of the vegetation. Buttonwood is a typical woody component in rabbit habitats. All of the plant communities that provide rabbit habitats are adapted to fire, to some degree, and some may be fire dependent systems (Wade et al, 1980).

Perry and Lopez (2005b) evaluated habitat selection of rabbits on Boca Chica Key (NASKW) during a dry season (winter). They assessed the predictive ability of habitat variables, including visual obstruction, canopy coverage, bunchgrass density, horizontal obstruction, percent bare ground, percent grass, percent forbs, and percent litter, in delineating the core areas of rabbit home range from areas not included in core areas. Of these variables, high visual obstruction, low percent canopy coverage, and high bunchgrass density best explained the presence of LKMR home range cores. The effect of model parameters also differed by site, indicating that spatial variation was also important in predicting the presence of home range cores. Home range cores have a dense structure of low herbaceous cover, including bunchgrasses. They avoided areas with mature buttonwoods and high canopy cover. Forsy (1995) identified high amounts of bunchgrass and other ground cover, presence of seaside oxeye, and proximity to large bodies of water as habitat components selected by LKMR. Salt marsh habitat is the preferred type for the species and ultimately provides more foraging opportunities and escape cover. Forsy (1995) also concluded that rabbits that inhabit salt marsh spend most of their time in the mid-marsh (seaside oxeye) and high-marsh areas (cordgrasses and marsh fimbry), both of which are used for cover and foraging, while most nesting occurs in the high-marsh area.

Behavior: Adult LKMR of the same sex tend to maintain mutually exclusive home ranges. The home ranges of these rabbits average about 0.8 acre. Adult rabbits have permanent home ranges, while male subadults tend to disperse. Adults of both sexes have similar home range sizes, although the size varies widely among individuals. This individual variability may be due to differences in habitat quality, population density, or the status of an individual in a social hierarchy. Juvenile LKMR appear to use a home range near their nest site.

LKMR usually travel through a variety of habitats between their natal and permanent home ranges including areas with dense ground cover, mangroves, upland hardwood hammocks, and vegetation between road shoulders and water (Forsy and Humphrey, 1994). LKMR are good swimmers and will swim when pursued (Tomkins, 1935). Dispersing rabbits are susceptible to high mortalities, particularly when there is a lack of habitat between populations, presence of free-ranging cats, and roads to cross. This species appears to be chiefly nocturnal, although they can be active on cloudy days and when they are protected by dense cover.

Reproduction: LKMR rabbits sexually mature at about 9 months of age. During this time, the majority of the males disperse. Sexually maturing females are not as likely as males to disperse. Like other marsh rabbit subspecies, LKMR are polygamous, and generally breed throughout the year (Holler and Conway, 1979). Although LKMR do not display an apparent seasonal breeding pattern (Service, 1994), the highest proportion of females with litters occurs in March and September; the lowest proportion occurs in April and December.

The LKMR is less fecund than other marsh rabbits. Marsh rabbits in mainland south Florida (*S. p. paludicola*) can produce 14 to 18 young per female per litter, while only one to three young (average of 1.77) have been observed per nest for LKMR (Forys, 1995). The average for LKMR is 3.7 litters per year, which indicates a much lower fecundity rate than for marsh rabbits in southern Florida, which average 5.7 litters per year. Some marsh rabbits experience total litter resorption that can affect their reproductive output. The loss of these ova can be related to maternal physiological changes in response to stressful events. Rates of litter resorption in the LKMR are not known.

Feeding: Marsh rabbits are herbivores, feeding on grasses, succulent plants, and herbaceous shrubs. LKMR feed on at least 19 different plant species, representing 14 families (Forys, 1995). The most abundant species in the rabbit's diet include seashore dropseed, glassworts, cordgrass, seaside oxeye, red mangrove, and white mangrove.

The LKMR spends most of its time feeding in the mid- and high-marsh areas and the most important food species appears to be sea oxeye daisy (*Borrchia frutescens*) (Forys and Humphrey 1994). LKMRs have been seen foraging on a variety of grass, sedge, shrub and tree species, but have not been seen eating tree leaves or bark. The most prevalent species in the rabbit's diet include seashore dropseed (*Sporobolus virginicus*), glasswort (*Salicornia virginica*), Gulf cordgrass (*Spartina spartinae*), sea oxeye daisy, red mangrove (*Rhizophora mangle*) and white mangrove (*Laguncularia racemosa*) (Forys and Humphrey 1994, USFWS 1999).

Based on their distribution, LKMR appear to need only limited sources of freshwater to survive. In a study of several mammals from the lower Florida Keys, this rabbit has one of the highest capacities to concentrate urine (Dunson and Lazell, 1982). The LKMR may be able to survive solely on dew and brackish water, but probably cannot use seawater to meet their need for water.

Population size: In 1995, the LKMR population was estimated to be 275 individuals (Forys et al., 1996). Since then, additional habitat areas have been found, but rabbits have also been extirpated from many previously occupied habitat patches. The actual number of rabbits is hard to estimate. The current population in 2006 is believed to be about 500 rabbits that currently occupy about 600 acres of habitat (N. Perry, 2006, pers. comm.). The LKMR currently exists on 118 patches, which average 5.1 acres in size (N. Perry, 2006, pers. comm.). This equates to about 602 acres of occupied habitat, believed to contain about 500 animals, or an average density of about 1 rabbit per 1.2 acres of occupied habitat.

An index that may more accurately reflect LKMR abundance is patch occupancy, the number of occupied habitat patches (Faulhaber, 2003). Occupancy rates (the proportion of suitable habitat

patches that are occupied) can be compared among different subpopulation areas or different periods, in order to provide an index population decline or growth.

Habitat patch occupancy was documented by the presence of fecal pellets and other means by various researchers between 1988 and 1995. Overall, investigators identified and assessed occupancy in 142 patches during the period 1988 to 1995. Among those investigations, for example, Forsys et al. (1996) assessed occupancy in 125 patches of suitable habitat (potentially occupied patches). Of the suitable habitat patches in her sample, 50 (40 percent) were occupied. Subsequently, Faulhaber (2003) attempted to delineate all patches of potential rabbit habitat, and catalogue whether they were occupied during 2001 to 2003. Faulhaber (2003) identified and surveyed 228 patches of occupied and potential habitat during that period, where rabbits occupied 102 patches (45 percent).

The LKMR is habitat specific, depending upon a transition zone of grasses and sedges for feeding, shelter, and nesting. The majority of potential suitable habitat areas lie in transitional zones between marine environments and uplands. Potential suitable habitat for the Lower keys marsh rabbit is about 3,140 acres, of which 2,467 acres are in public ownership (78.6 percent). Habitat on military lands is 333.2 acres. Habitat on NKDR is about 1,833 acres, or 58 percent of the total. The current population estimate is about 500 rabbits in the Lower Florida Keys (N. Perry, 2006, pers. comm.).

Based on the information available to us, the LKMR currently exists on 118 patches, which average 5.1 acres in size (N. Perry, 2006, pers. comm.). The average home range size of a marsh rabbit is about 12.6 acres (N. Perry, 2006, pers. comm.). However, Hurricane Wilma storm surge inundated occupied habitat in 2005 and is believed to have had a significant effect on the marsh rabbit (N. Perry, 2006, pers. comm.). Patch occupancy monitoring is currently being conducted by the Navy, Service and TAMU.

Population structure: The LKMR exists in a metapopulation structure (Forsys, 1995; Forsys and Humphrey, 1999a; Faulhaber, 2003). Rabbits occupy distinct patches of habitat. Clusters of adjacent patches comprise subpopulations. Rabbits living in these habitat patches are socially isolated from rabbits in other patches and subpopulations, but interact through dispersal (Forsys et al., 1996). Distance among habitat patches is important because the ability of rabbits to recolonize vacant habitat patches depends upon the presence of viable habitat corridors. At the subpopulation level, interchange of rabbits may be rarer, depending on the distance between subpopulations. At the broadest scale, subpopulations may be so distant from other subpopulations that interchange may be nonexistent, and they constitute demes (isolated populations). For example, western subpopulations such as those on Boca Chica, Geiger, and Big Coppitt Keys are part of a metapopulation that is isolated from the metapopulation that encompasses Big Pine Key. Crouse (2005) identified strong genetic subdivisions between eastern and western populations.

Crouse (2005) analyzed patterns of genetic variation within and among island populations of the LKMR, using mitochondrial sequence data (control region; 763 base pairs). Phylogenetic analyses of the mitochondrial sequences revealed that two main lineages exist within the

subspecies, corresponding with eastern and western portions of the range. There was strong genetic separation between rabbit populations in terms of mitochondrial DNA haplotypes (19 base pairs). Mitochondrial DNA variation was low, as is typical for island populations. Apparently, the strong phylogenetic differentiation within the LKMR is due to dispersal barriers. The ramification of the evidence of lack of dispersal among areas is that the LKMR exists not as a single small population, but as two small populations. Thus, for the rabbit, small numbers phenomena may work against the subspecies probability of persistence at multiple spatial scales.

Population variability: Random population fluctuation is evident in the rabbit metapopulation; several subpopulations were so small and contained so few individuals of the same sex they eventually became extirpated (Forys, 1995; Forys and Humphrey, 1999a). For a metapopulation to persist requires that some minimum extent of useable, occupied habitats are available, and configured so that interchange can occur among them. This subspecies is thought to be less fecund than other subspecies, making it relatively more susceptible to demographic and stochastic events (Forys, 1995), because the potential for rebounding from perturbations or capitalizing on opportunities may be relatively low.

A natural feature of metapopulation dynamics is periodic local extinctions (extirpation in patches) and recolonization (immigration from extant patches). The probability a population can persist in isolation depends on its initial size and the capacities of the resource base. In general, small populations cannot persist in isolation from other populations. For a population to persist, adjacent subpopulations are generally required, as they provide necessary sources of genetic diversity and recolonization. Accordingly, there must be a capacity for dispersal among patches (Hanski and Gilpin, 1991).

Status and distribution

Reason for listing: The LKMR was listed because of habitat loss and fragmentation, predation by cats, and vehicular mortality (Service 1990).

Rangewide trends: Environmental changes have resulted in a decrease in the number of populations, a decline in the size of the populations, and reduced connectivity among patches and subpopulations of LKMR. The LKMR occurs in shrinking, more fragmented, and isolated populations. Persistence depends on a positive rate of reproduction along with the ability to disperse, so that immigrants can reverse periodical local extinctions through recolonization. The probability that a successful colonization event will occur is linked to the number of potential dispersers and thus population size. In order to persist in the wild, rates of immigration and reproduction must exceed emigration and mortality. Over time, the number of patches recolonized must equal or exceed the number of patches extirpated. In recent decades, the number of patches occupied by LKMR has declined and the area of occupied range has contracted. With fewer occupied patches and lower potential for interchange between subpopulations, the probability of persistence over a modeled period is reduced.

A population viability analysis for the LKMR was conducted in 1999 (Forys and Humphrey, 1999a). The researchers suggest that the Lower Keys marsh rabbit metapopulations exist in the classic metapopulation structure but are declining due, in part, to low survival. The analysis

predicted that this species might become extinct in 20 to 30 years under the current conditions. The population viability analysis also predicted a high probability of extinction if mortality from either vehicles or free-roaming cats is not controlled. Of the Keys studied, persistence of the population on Big Pine Key was predicted to be greater than on other keys because of larger habitat areas. Forsys and Humphrey (1999a) suggest that management efforts to save the LKMR should focus on developing a plan to reduce cat use of LKMR habitat. However, the researchers acknowledge because controlling cats on privately owned land is a problem, intensive public education on the effects of cat predation may be one of the options.

The LKMR occurs in small, largely disjunct subpopulations that cover a shrinking area. The number of patches of occupied habitat and the rate of occupancy continues to decline. Monitoring of patch occupancy has illustrated these annual declines (Service, 1999; Perry, 2005). Results from rangewide monitoring efforts are available for four periods: 1988-1995 (various investigators; records on file), 2001-2003 (Faulhaber, 2003), winter 2003-2004, and winter 2004-2005. Occupancy rates between these periods declined 6.0, 3.9, and 2.0 percent, respectively. Among all three periods, the net loss of patches between periods averaged 6.3 patches.

Considering only patches with rabbits during one or both of the paired survey periods, patch occupancy declined at 9.5, 7.7, and 4.3 percent, respectively, between sequential periods. The sample size among these monitoring periods was, 84, 104, and 92, respectively. Sample sizes are the number of patches surveyed during sequential periods and found to be occupied during one or both of those periods. For all three comparisons, the average sample size (number of patches occupied in one or both years) was 93.3. The net loss of patches between the three periods averaged 6.7 patches. These rates of decline do not reflect potential effects of Hurricane Wilma in 2005, as the annual rangewide monitoring effort (winter 2005-2006) had not yet been conducted. Additionally, the rates of decline would be slightly greater if not offset by several patches that were occupied due to translocations. These translocations positively affected occupancy rates in the periods subsequent to movement and colonization. They included three patches colonized as of the 2001-2003 period (Faulhaber, 2003), and one patch colonized as of the winter of 2004-2005 period (Perry, 2005).

Considering only results of the unbroken sequence of annual surveys, which includes the last three survey periods (two comparisons of annual transitions in occupancy), an average of 98 occupied patches were tracked among periods, the annual rate of attrition averaged 6 percent, and the net loss of patches averaged six per year. The largest number of occupied patches identified in any study period was during the 2001 to 2003 period, when 105 occupied patches were recorded, including three patches to which rabbits were translocated.

These observations are consistent with the predictions of decline toward rapid extinction in the population viability analysis developed by Forsys and Humphrey (1999a). Patches are being extirpated more than they are being recolonized. Accordingly, the dynamics of remaining occupied patches is driving the population trajectory. For example, based on the observations presented above, assuming an initial population of 100 patches and a fixed loss of six patches annually, all 100 patches would be extirpated (extinction would occur) in less than 18 years.

Assuming all else is equal, given the passage of 6 years since that study, the estimated range of years until extinction would be down to 14 to 24 years. The midrange of this persistence time prediction, 19 years, is close to the 18-year period based on observations from occupancy monitoring over the last several years.

The Service and collaborators have initiated a reintroduction program (Service, 1999). In 2002, 13 LKMR were translocated to Little Pine Key, which resulted in successful establishment (Faulhaber, 2003). In 2004, seven rabbits were translocated to Water Key, which also resulted in successful establishment on that island (Perry, 2005). In both cases, evidence of reproduction has been documented on the newly colonized islands (Perry, 2005). These efforts have served, to a degree, to offset some of the trends discussed above, and ameliorate threats. For example, several patches were recolonized, and portions of the geographical range were reoccupied.

Threats: The LKMR is vulnerable to predation by free-roaming cats, habitat loss and degradation, hurricanes, vehicular traffic, contaminants, dumping and trash accumulation, poaching, fire ants, and exotic vegetation. The greatest threats to the continued existence of the LKMR are predation by cats, habitat loss and degradation, and hurricanes. These threats not only directly affect the viability of local subpopulations, but also reduce the probability of successful dispersal among the increasingly fragmented habitats. Connectivity among suitable habitat patches is necessary for LKMR dispersal among patches (Forys and Humphrey, 1999a), and dispersal is a necessary process if rabbit metapopulations are to remain self-sustainable. In the past, humans often hunted the LKMR; this is not known to be a current threat.

Free roaming cat mortality: These medium-sized predators are especially effective at taking small mammals such as the LKMR, and account for significant predation (Forys and Humphrey, 1999a). Although habitat loss is likely responsible for the original decline of the LKMR, mortality from feral and domestic cats may be the greatest current threat to the persistence of the Lower Keys rabbit (Forys and Humphrey 1999). A detailed study of cat diets in the Keys has not been conducted, but rabbits were a large component of feral cat diets in several studies conducted elsewhere. The number of cats present in the Lower Keys has increased over the past 20 years with the increase in the human residential population. Rabbits appear to be equally susceptible to cat predation, regardless of gender or age. Forys et al. (1996) reported that feral or domestic cats occurred in 14 of 19 rabbit subpopulations newly located during the course of their investigation.

Isolation from free-roaming cats appears to be the most important factor to help this species survive (Forys and Humphrey, 1999a). When different management scenarios were included in Forys and Humphrey's (1999a) PVA model, the persistence of the LKMR was extended to 50 years if all predation by cats was removed. In the absence of controlling cat predation, persistence was not extended appreciably if all vehicular mortality was removed or reintroductions into vacant patches were conducted. For the Boca Chica Key study, cat-caused mortality was 53 percent of total mortality and vehicular mortality accounted for about 33 percent. Lafever and Lopez (2006) findings on Boca Chica Key (NASKW) are consistent with the earlier population viability analysis (Forys and Humphrey, 1999a). Like Forys and Humphrey (1999a), these investigators found that cat predation is the greatest threat to rabbit persistence.

Habitat loss and degradation: LKMR metapopulation exists as small, disjunct subpopulations, which require dispersal among subpopulations, because recolonization of temporarily extirpated subpopulations is periodically required in a metapopulation structure. The destruction and fragmentation of habitat may result in habitat patches that are too small to support the LKMR.

In the past 50 years, more than half the area of the suitable habitat of the LKMR has been destroyed to construct residential housing, commercial facilities, utility lines, roads, or other infrastructure. The dredging of canals and fill in tidal areas for waterfront access further destroyed and fragmented LKMR habitat. Much of the remaining suitable habitat of the LKMR has been degraded by altered hydrological and fire regimes, invasive exotic plants, repeated mowing, dumping of trash, or off-road vehicle use. Habitat fragmentation is an important factor in LKMR demographics (Forys and Humphrey, 1999a). Urbanization has fragmented the sites occupied by this species and has eliminated many of the corridors that allow movement between the increasingly isolated subpopulations. For example, commercial and residential development along U.S. 1 effectively creates a barrier to movement of LKMR between northern and southern Big Pine Key subpopulations. In more urbanized areas where the vegetative cover has been removed and mowed, dispersing marsh rabbits have no cover from cats, and face greater threats from vehicles.

Fire suppression: The lack of fire in both occupied and unoccupied habitat patches may degrade habitat quality because of floristic changes and succession, including woody encroachment. Buttonwood is often present in the LKMR habitat, as a component of, or totally dominating, the woody, upper canopy. Buttonwood appears to occur as a typical component of the flora in some settings, and appears to represent an opportunistic competitor in others. In either case, in the absence of disturbance, buttonwood may dominate the upper canopy and restrict other plants in that stratum and lower strata. In some areas, buttonwood may co-dominate such canopies with other woody species. Elsewhere, buttonwood dominates that layer nearly as a monoculture, and ranges in density from sparse (buttonwood savannah) to dense (closed canopy woodland). Where buttonwood forms a dense canopy, herbaceous cover is sparse due to shading and other forms of competition with the buttonwood.

The physical and ecological factors that control the distribution and abundance of buttonwood are not fully known, particularly in relation to the quality of LKMR habitat. In these cases, a lack of natural disturbance, which has allowed for the reduction of the herbaceous layer and dominance of the buttonwood canopy over time, is indicated. Research conducted in Everglades National Park, (Wade et al, 1980) suggests coastal prairies transform into buttonwood forest in the absence of fire.

Salt marsh is regularly inundated by saline water, whereas coastal prairie rarely is. Nonetheless, salt marsh is also a fire-adapted ecosystem (Wade et al, 1980). In salt marsh as well as coastal prairie, buttonwood from adjacent transition zones may proliferate in the absence of fire. In the Lower Keys, salt marsh transition zones are also interspersed well into upland landscapes. There, as elsewhere, fire is suppressed in the surrounding matrix of habitats, which include pine rockland and hardwood hammock. Accordingly, fire rarely burns through rabbit habitat, including salt marsh-upland transition areas with buttonwood. Fire prescriptions in the current

fire plan for the NKDR only target pine rockland. A prescribed fire regime could prevent late succession woody encroachment in the Florida Keys coastal wet prairie and promote regeneration of forbs and grasses that are important resources for LKMR.

Fire suppression has not been identified as a specific threat. Coastal prairie and marsh-upland transition areas, including "buttonwood transition areas," represent the primary cover type inhabited by LKMR. In the absence of fire, these areas appear to be vulnerable to encroachment by woody vegetation, and conversion to buttonwood woodland, which have been shown to be avoided LKMR habitat, as compared to non-wooded habitat (Perry and Lopez 2005b).

Hurricanes: Hurricanes are a significant environmental factor to the LKMR and can reduce the capacity to resist adverse impacts associated with other threats. Other indirect and delayed effects of hurricanes are unknown. Large amounts of trash, which degrade habitat quality, were concentrated in rabbit habitat by the receding waters following the hurricane. The ability of vegetation to resist hurricane effects will vary by species, plant community, and location. Similarly, the extent and rate at which plant resilience is manifested will vary.

Vehicular Mortality: Mortality of LKMR from vehicular collisions has been documented as an important factor influencing the species (Forys and Humphrey, 1999a). Roads can interfere with movements within the home range and with dispersal preventing essential interchange between subpopulations (Forys and Humphrey, 1999a). Dispersing males are the most vulnerable to vehicular mortality. Dispersal is the means of populating sites where rabbits no longer exist. There is limited vehicular mortality on Big Pine Key with three individuals reported killed since 1990.

Other threats: Nutrients from septic tanks and fertilizers degrade water quality in rabbit habitat. Illegal dumping and litter deteriorates habitat quality. Exotic fire ants are increasing in marsh habitat and they may pose a threat to newborn rabbits.

Big Pine Key HCP: LKMR suitable habitat on Big Pine and No Name Keys is estimated at 1,045 acres of which 892 acres are in public ownership (85 percent) (696 acres-Federal [NKDR], 182 acres-State, 14 acres-Monroe County). To address habitat loss and indirect effects (cat predation) associated with development on Big Pine and No Name Keys, the Service has issued a section 10(a)(1)(B) incidental take permit (ITP) to Monroe County, FDOT, and DCA pursuant to the Act. The ITP exempts take of Key deer, Lower Keys marsh rabbit, and eastern indigo snake on Big Pine and No Name Keys, Monroe County, Florida. The take of these species will be incidental to land clearing for development and recreational improvements.

The associated HCP includes specific development restrictions in LKMR habitat and within a 1,640-foot buffer surrounding this habitat. The distance of 1,640-foot is based on the use of upland areas by this species and the estimated range of domestic cats (Frank, GFC, personal communication, 1996). The HCP provides for incidental take of up to 36 acres of suitable LKMR habitat in the next 20 years. This loss represents 37.5 percent of the at-risk LKMR (96 acres) on Big Pine and No Name Keys. However, the HCP on Big Pine and No Name Keys also requires the compensation for the loss of LKMR habitat at a 3 to 1 ratio. The Service determined this level of incidental take would not jeopardize the survival and recovery of the species.

Summary analysis

Recovery of the LKMR will continue to be challenging due to the lack of available habitat, habitat loss and fragmentation due to road construction and development, and increased mortality due to cats. Recovery potential will increase if active management of populations and habitats is undertaken (Forys, 1995). Since residential and commercial construction affected both occupied and unoccupied sites over the past three decades, opportunities for conservation of the rabbit have been reduced.

ENVIRONMENTAL BASELINE

The Environmental Baseline summarizes the effects of past and present human and natural phenomena on the status of threatened and endangered species and their habitat in an action area. The Environmental Baseline also establishes the base condition for natural resources, human usage, and species usage in an action area

Status of species in the action area

The LKMR is well documented within the action area and a summary of the species information will be provided in this section.

Population: Minimum and maximum LKMR abundance was calculated for 36 occupied habitat patches on Boca Chica, Geiger, and East Rockland Keys (NAS Key West 2006a) (Table 4). A minimum of 77 and a maximum of 163 LKMR were estimated to occupy about 333 acres on the project site and adjacent areas (NASKW 2006a). This represents about one-third of the estimated current population and reflects a LKMR density of about 1 rabbit per 2.0 acres of habitat. This density is about half of the density of 1 rabbit per 1.2 acres of habitat that has been estimated over the entire LKMR range.

Lafever and Lopez (2006) conducted a population viability analysis (PVA) of the LKMR metapopulation on Boca Chica Key (NASKW). Results were similar to those of Forys and Humphrey (1999a), which identified the Boca Chica metapopulation as the most prone to extinction. Lafever and Lopez (2006) estimated the probability of persisting for 10 years, under the current conditions, was 41.6 percent. Like Forys and Humphrey (1999a), these investigators found that control of cat populations on Boca Chica Key would likely have the greatest benefit to LKMR populations than any other management action considered. The PVA conducted by Lafever and Lopez (2006) is discussed in more detail in the next section.

Factors affecting species environment within the action area

The action area is a criss-cross of active runways, approaches, and access roads equipped with lighting and other accessories that accompany a large runway complex. Small and large jet as well as propeller aircraft land and take-off frequently. Service and utility equipment access the area often. Human presence and activity is ubiquitous. **NASKW** currently mows about 14 acres of lawn that could revert to potential LKMR rabbit habitat if not maintained.

Habitat: Vegetation types on Boca Chica Field range from freshwater to coastal. They transition from coastal mangrove through a salt marsh/buttonwood transition zone to tropical hardwood hammocks. The predominant vegetation communities are coastal and include mangrove, buttonwood, and salt marsh. These vegetation types are shown in Tables 1 and 2 in the Description of the Action Area.

Table 4*. Minimum and maximum LKMR abundance estimates for occupied habitat patches on

Patch#	Minimum estimate	Rounded	Maximum estimate	Rounded
1	0.462002087	1	3.388126749	1 (sic)
3	0.417605271	1	1.045302421	1
5	0.325759052	1	0.791153373	1
7	0.536425341	1	1.249870355	1
8	4.25863983	4	9.910418894	10
9	4.121933126	4	9.611021846	10
10	0.611896566	1	1.424757885	1
12	1.446586946	1	3.362369026	3
14	1.652218188	2	3.840327245	4
15	1.118800772	1	2.647806837	3
16	1.196012336	1	2.798333501	3
18	2.52473977	3	5.966484055	6
19	7.61627738	8	17.7278037	17
20	1.39697399	1	3.292113357	3
21	4.465070848	5	10.5093294	11
23	4.555369176	5	11.07880118	11
24	0.851065899	1	2.061623169	2
26	4.784182506	5	10.74911504	11
93	2.005962183	2	4.670995708	5
102	1.72585963	2	4.018674185	4
152	5.802578297	6	13.58627923	13
153	0.938498673	1	2.181395926	2
155	0.388426957	1	0.902838785	1
157	5.445241921	5	12.65662795	13
160	2.278975025	2	5.301457539	5
161	0.240428833	1	0.558839871	1
169	0.41977419	1	0.979044747	1
170	0.214329813	1	0.569204881	1
171	2.255599731	2	5.242794906	5
172	1.984821371	2	4.613412264	5
173	0.822816676	1	2.123834594	2
174	0.966943506	1	2.247511648	2
175	0.074469537	1	0.212792148	1
176	0.096652565	1	0.224663575	1
177	0.203042979	1	0.473041912	1
178	0.119714307	1	0.319754457	1

Total	minimuun 77	maximum 163
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- adapted from NASKW 2006a

Results of previous habitat conversion and restoration have shown the beneficial effects of habitat conversion and restoration. In 1998, NASKW completed a project to eliminate vegetation obstructing both visual and radar lines of sight on the airfield. The project included the removal of 1.53 acres (0.62 ha) of mangroves from a wetland area located adjacent to the airfield runways and, in its place, create a 1.03 acre (0.42 ha) high salt marsh wetland and a 0.5 acre (0.2 ha) freshwater pond.

The project was monitored for 2 years after completion. The second year monitoring report (June 2000) indicated planted species of salt marsh vegetation, including saltmarsh cordgrass (*Spartina alterniflora*), hurricane sedge (*Fimbristylis spathacea*), seashore dropseed (*Sporobolus virginicus*), and sea oxeye daisy exhibited signs of growth and natural regeneration with additional plants appearing in close proximity to the planted specimens. Other native species that were naturally recruiting into the created marsh included sea blite (*Suaeda linearis*), waterhyssop (*Bacopa* sp.), crowngrass (*Paspalum* sp.), morning-glory (*Ipomoea* sp.), and white mangrove (*Laguncularia racemosa*). Several wildlife species were also observed in the vicinity of the pond and created marsh, including common loon (*Gavia immer*), marsh hawk (*Circus cyaneus*), osprey (*Pandion haliaetus*), American egret (*Casmerodius albus*), green frog (*Rana clamitans*), an unidentified brown frog, various unidentified ducks, and evidence of raccoons. While the LKMR was not observed in the created or existing salt marsh during the 2-year monitoring period, rabbit fecal pellets were observed in the existing marsh.

An inspection of this created salt marsh was conducted by both Navy and Service personnel in 2004. During this site visit, rabbit fecal pellets were observed in a portion of the created marsh, that was adjacent to pre-existing habitat and in which the establishment of dense cover was successful, indicating that LKMR used the converted habitats (Fleming 2005). In the remaining portion of the created salt marsh, dense cover was not established and no sign of rabbits was found. In December 2005, rabbit fecal pellets deposited, after the passing of Hurricane Wilma, were observed by NASKW personnel within the created salt marsh.

As mentioned previously, the LKMR is vulnerable to predation by free-roaming cats, habitat loss and degradation, hurricanes, vehicular traffic, contaminants, dumping and trash accumulation, poaching, fire ants, and exotic vegetation. The greatest threats to the continued existence of the LKMR are currently under study, and a summary of the most recent information follows.

Hurricanes: The magnitude of threats from random environmental catastrophes (environmental stochasticity), such as hurricanes, are enhanced due to the characteristics of small, poorly dispersed populations (demographic stochasticity). The 2005 hurricane season was an active one that included Hurricane Wilma, a class three hurricane that passed near Key West on October 24, 2005. Hurricane Wilma produced in a storm surge that covered most of the land area in the Lower Keys. The surge displaced standing water, both fresh and brackish, in virtually all wetland areas. At the time, seven rabbits were radio collared on Boca Chica Key, as part of a research project, and had been located 4 days before the storm. After the storm, five radio

collars were located and two collared rabbits could not be found. On October 27, 2005, four collars were found attached to LKMR determined to be dead due to drowning or other storm effects (Perry 2005b). The fifth radio collar was found with just a bit of fur attached to it and it was assumed the rabbit carcass had been scavenged. A search at that time, however, also yielded signs (tracks and fecal pellets) of surviving rabbits (Perry 2005b).

Patches of occupied habitat on Boca Chica Key were monitored in November and December of 2005, after the passage of Hurricane Wilma, as part of a research project conducted by Texas A&M University (TAMU). Considering the 33 patches occupied during the winter monitoring period (2004-2005) and re-assessed in the post-Wilma period, patch occupancy declined 33.3 percent between periods, a net loss of 11 occupied patches. Monitoring surveys are ongoing. In 2006, the population appears to be rebounding (N. Perry, 2006, pers. comm.)

Vehicular Mortality: Recorded rabbit vehicular mortality totaled four on Naval Air Station Key West between 1992 and 1994 (Forys, 1995). Off-road vehicular activities also affect the rabbit through habitat degradation and direct mortality. At least one radio-collared rabbit was killed by an off-road vehicle on NASKW (Forys, 1995).

Feral Cat Mortality: Two cat and raccoon control efforts have already been conducted in the area. Between 10 November 2005 and 25 January 2006, 17 feral cats were removed, 169 raccoons were euthanized, and 36 raccoons were released in 724 trap nights. Between June 1 and August 1, 2006, 3 feral cats were removed, 66 raccoons were euthanized, and 2 raccoons were released in 261 trap nights. Navy sites are unknown.

Summary analysis

The action area has been greatly disturbed in the past. It is a large runway complex that offers a wide variety of noise and human disturbance. It contains about one-third of the known LKMR population and about 333 acres of suitable habitat. Previous models of the population have predicted a low probability of persistence for the next decade, although previous predictions over a decade ago have failed to occur. Feral cats and hurricanes appear to be among the largest current threats. Some short-term negative effects of hurricanes have been documented; however, no long-term negative effects have been shown. Monitoring of past habitat restoration indicates that restoration is a promising tool for improving habitat conditions for the LKMR population at NASKW.

EFFECTS OF THE ACTION

In the *Description of the Action*, the Service provides an overview of the action area and the proposed clear zone maintenance and restoration of stormwater ditches at NASKW. We then summarized available scientific information on the biology, ecology, and threats facing the LKMR in the Keys. In the *Environmental Baseline*, the Service summarized the effects of the past and ongoing human and natural factors, which resulted in the current status of the Lower

Keys rabbit and its habitat. In this section, we analyze the beneficial, direct, and indirect effects of the proposed action on the species.

Factors to be considered

In this BO, we evaluate whether this project may affect and is likely to adversely affect the LKMR, and, if so, to what extent. In general, we will make this evaluation by estimating probable changes in the quantity, distribution, and quality of potential suitable habitat of this endangered rabbit and by evaluating physical harm that may result. Indirect effects in the form of traffic and cat predation are also important issues.

Specifically, we will calculate an estimate of the known population and habitat parameters in the area to be affected, using the best available information, and then compare pre-project conditions with anticipated post-project conditions, taking into account any effects during the construction phase. We will relate the number of LKMR present in the action area to the specific habitat size and quality.

Proximity of the Action: The action will occur in 130.65 acres of LKMR habitat. About 88 acres are considered to be prime LKMR habitat and the remaining 42 acres are considered to be marginal habitat.

Distribution: LKMR occur throughout the action area.

Timing: LKMR may breed at any time during the year; however, the action will not be performed within LKMR habitat during the two primary breeding months of March and September. However, if prior to the two primary breeding season months, the herbaceous cover had been disturbed, removed, or cleared to the extent that sufficient herbaceous cover is not present to LKMR to build dens or nesting sites, an exception to this will be allowed.

Nature of the effect: Primary effects will be temporary disturbance caused by exotic and woody vegetation removal. There will be short-term effects in marginal habitat caused by mechanized equipment. Intermittent temporary disturbance will be caused by on-going maintenance and monitoring.

Disturbance frequency: Primary effects will occur on a one-time basis outside the primary breeding season, except if prior to the two primary breeding season months of March and September, the herbaceous cover had been disturbed, removed, or cleared to the extent that sufficient herbaceous cover is not present to LKMR to build dens or nesting sites. Disturbance due to on-going maintenance and monitoring will be intermittent, likely once or twice yearly on average. The life of the entire project is dependent on funding and completion of the five phases is anticipated to take 10 years.

Disturbance severity: Disturbance will be severe on about 37.59 acres of habitat converted to salt marsh. The estimated duration of the conversion disturbance is 2 years, with utilization by

rabbits possibly occurring as soon as 1 year. Disturbance on the remaining about 93.06 acres will be minimal, involving removal of exotic and woody vegetation, and will recur intermittently on an as-needed basis.

Analysis for effects of the action

Beneficial Effects: Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Many of the proposed conservation measures listed under Description of the proposed action are beneficial effects.

Habitat Conversion and Restoration: The overarching strategy is for the project to result in no net loss of wetlands or marsh rabbit habitat. However, restoration and conversion of existing habitat should substantially improve the quality and utility of the habitat to the LKMR. Most of the habitat affected by the project is marginal for the LKMR because of an existing canopy or lack of sufficient escape cover. Most of this habitat will likely be restored to prime habitat (NASWK 2006a). In all, about 37.59 acres of various habitats, including mangrove forest, scrub mangrove, and buttonwoods, will be converted to salt marsh. Since there is a current ratio of about one marsh rabbit to 2 acres of prime habitat in the action area, in a best-case scenario this would equate to about 18 additional marsh rabbits as a result of the habitat conversion aspect of the project. In addition, up to 93.06 acres of existing habitat will be improved by exotic removal and restoration (NASWK 2006a). The specifics of the proposed habitat manipulations developed by NASWK are included in Appendix I.

Predator Control: Predators, especially domestic and feral cats, have been identified as a major limiting factor affecting the LKMR. Population viability models predict that marsh rabbits may not persist many more years without predator control. NASWK has already initiated a predator control program. They have contracted Wildlife Services of the U.S. Department of Agriculture to capture and remove cats and raccoons on NASWK. Two removal efforts have been conducted. The first removal effort resulted in the removal of about 17 cats and many raccoons. The second removal effort resulted in the removal of far fewer cats and raccoons, indicating recruitment from outside the area did not occur at a rapid pace.

Lafever and Lopez 2006 conducted a population viability analysis of LKMR given the scenario of the proposed project and predator removal. They showed that removal of predators is a key factor in increasing the probability of long-term LKMR survival. The results of their analysis are presented in Indirect Effects.

Invasive Exotic Removal: Invasive exotic removal will improve habitat where invasive exotics are present by curbing future habitat loss, removing shading of native vegetation, and improving nutrient availability to plant species preferred by the LKMR. Most exotic removal will be either chemical or by hand. Refer to Appendix I for details.

Education: Public education has been an important measure in controlling the invasion of exotic species. Base employees are educated regularly through the NASWK newspaper regarding

measures that need to be taken in order to control the problem and deter future establishment of invasive exotic species.

Off-road Vehicles: Off-road driving is prohibited by direction of the commanding officer on Boca Chica Field, thereby maintaining grassy habitat for the LKMR and other species. Public education and articles in the **NASKW** newspaper have been and will continue to be published in order to enforce this policy.

Long-term Maintenance and Monitoring Program: The proposed action will also include long-term control of woody vegetation, including invasive species, within the 130.65 acres of LKMR habitat that will be impacted. Long-term maintenance and monitoring should produce higher quality foraging, breeding, and escape habitat than is now present for the same reasons as invasive exotic removal, by curbing future habitat loss, removing shading of native vegetation, and improving nutrient availability, thus increasing overall habitat quality. Monitoring should identify those conservation parameters that result in optimum, as well as marginal, benefits to the LKMR. Measures that optimize LKMR habitat will be implemented in future phases and projects.

Direct Effects: Direct effects are those that are the immediate effects of the project on the species or its habitat. Direct effects result from the agency action. Future Federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this BO.

Methods: Specific methods for Phase I/Area A, the RW 07 approach, including mitigation and monitoring, are indicative of measures to be used in the subsequent four phases. Lessons learned from the efforts involving Phase 1/Area A will be used to modify subsequent efforts to reduce impacts to protected resources. Minor adjustments to anticipated impacts will be coordinated with the Service. Specific methodology was provided by the Navy in the Supplemental Information to the PBA (NASKW 2006b) and is reproduced in Appendix I.

Habitat Impacts: Direct and indirect impacts to approximately 102.49 acres of LKMR habitat within Areas B-E are anticipated to be similar to those described in the PBA and as described for Area A, where 28.16 acres will be affected (Table 5).

The proposed action in Area A includes removal of 17.45 acres of mangroves with subsequent conversion to salt marsh using standard construction equipment. Standard construction equipment will also be used for conversion to salt marsh in Areas B-E. Habitat on the remaining 93.06 acres will be cleared of woody vegetation, primarily by hand. The existing grass understory will be protected to the greatest practical extent. The removal of woody vegetation also includes exotic and invasive species, which are known to be used as cover by the LKMR (*i.e.*, lead tree). While the removal of invasive species within LKMR habitat may result in a short-term direct impact, the propagation of tussock grass cover would provide a long-term benefit. The effects will be spread over a 10-year or longer period, depending on funding.

	Area A D	AreaB D	AreaC D	AreaD D	AreaE	
LKMR Habitat Type						Total Acreage
Buttonwoods	8.40	8.80	0	6.20	0	23.4
Exotics	0	5.20	0	0.10	0.50	5.8
Freshwater hardwoods	0	0	0	4.90	0	4.9
Freshwater Marsh	3.00	2.50	0	1.30	0	6.8
Grasslands	0	16.70	0.25	2.55	2.10	21.6
Grassy Salt Marsh	4.80	15.00	4.25	8.55	0.80	33.4
Hammocks	0	0.05	0	2.85	0	2.9
Low Salt Marsh	0.60	0.55	0.05	1.25	0.10	2.55
Mangrove	11.20	10.10	3.10	3.00	1.25	28.65
Mowed Vegetation	0.15	0.35	0	0.10	0	0.6
Scrub Mangrove	0.01	0	0	0.04	0	0.05
Total Acreage	28.16	59.25	7.65	30.84	4.75	130.65
Habitat Converted to Salt marsh	20.14	10.10	3.10	3.00	1.25	37.59

* Table adapted from NASKW 2006b

Note: The difference in the total acreage of LKMR habitat converted to salt marsh in this supplemental information (37.59 acres) and that provided in the PBA (28.01 acres) can be attributed to including freshwater marsh, salt marsh and buttonwood habitat within Area A that have little to no herbaceous understorey.

Habitat disturbance will be severe on about 37.59 acres that will be converted to salt marsh. Fill will be hauled in and graded to salt marsh wetland elevations, and then replanted with natural vegetation to complete the conversion to salt marsh. Most of the converted habitat is not known to be occupied by LKMR and is not normally used by them. Where herbaceous vegetation is successfully established due to raising the elevation of these areas and planting salt marsh grasses, the overall habitat quality within the patches will be increased due to the provision of escape cover and foraging opportunities. Additional salt marsh vegetation may naturally

colonize the sites over time as well. The net ecological benefit of conversion of dense mangroves to salt marsh will be to increase the preferred habitat of the LKMR.

The action also includes the restoration of clogged stormwater drainage ditches. This involves the removal of mangroves and other vegetation from the ditches. LKMR are not known to prefer the areas of the ditches that will be cleared, therefore no negative impacts to LKMR are anticipated. This should facilitate the removal of stormwater from the airfield (especially during hurricane and tropical storm events), thereby reducing the flooding of areas that are utilized by the LKMR and providing a benefit to the species over the long-term and possibly ameliorating drowning mortality that was documented following Hurricane Wilma in 2005.

Human disturbance: Other direct impacts include the presence of man and hand-held vegetation removal equipment in areas where the LKMR are known to reside. The removal of vegetation in occupied LKMR habitat can avert LKMRs (Perry and Lopez 2005b). During removal of overstory vegetation, individuals may be temporarily displaced to adjacent unaffected habitats. Although limited evidence does suggest that the removal of overstory vegetation may reduce habitat usability for LKMRs, the effects may be temporary until herbaceous recovery occurs through conversion of mangroves to saltmarsh or through natural propagation. Herbaceous recovery is anticipated to take 2 to 3 years (Barham, 2006, pers. comm.). Noise will temporarily increase during each phase of the project, however, it is not expected that temporary increases in noise levels will have any significant impact upon the species as the project area is subject to aircraft engine noise daily.

Direct effects from manual control measures (herbicides and hand removal) may include temporary disturbance and/or some displacement of individuals to adjacent cover. Species-level recovery actions for the LKMR include habitat enhancement through the removal of overstory vegetation in transitional areas to promote understory vegetation (USFWS 1999).

Population affected: Previously, the estimated high and low number LKMR in the action area and adjacent lands were presented in Table 4. However, Table 4 does not represent the patches nor the number of rabbits that will be affected by the project. Some patches and associated patches will not be affected at all. We will assume that if the project affects an occupied patch, all rabbits in that patch are affected. Some patches and associated rabbits will be affected in up to three different phases. In order to determine the total number of rabbits that will be affected over the duration of the project, we calculated the number of new rabbits affected in each phase and summed them. "New rabbits affected" and "New Patches" affected are those rabbits and patches that will be affected for the first time by the project in any given phase. Table 6 shows new patches that will be affected in each phase and new individual rabbits affected in each phase, as well as the summed total.

A maximum of 125 and a minimum of 62 LKMR could be affected over the duration of the project. The maximum of 125 represents about 25 percent of the known LKMR population. The minimum of 62 represents about half of that or 12.5 percent of the known population. We will

use the maximum figure later in the document to calculate an expected level of incidental take associated with this project.

Table 6*. New patches and individual rabbits associated with each phase of the project.

	RW07 Approach	RW 07 25	RW 03 21	RW 1313	Taxiways	TOTALS
Phase	1	2	3	4	5	
	D	D	D	D		
New Patches Affected	8, 9, 12, 173, 175	15, 19, 21, 22, 23, 24, 160, 171, 172, 176, 177, 178	16, 153	3, 15, 18, 20, 93, 152, 155, 169, 174		27
New Rabbits Affected	Max:26 Min 11	Max62 Min29	Max:2 Min5	Max35 Min 17	MaxO MinO	Max 125 Min 62

*Table adapted from NASKW 2006

Initially, in Phase I a minimum of 11 and a maximum of 26 LKMR could be affected. NASKW chose this area of the project to begin because of airfield safety concerns and the maximum amount of low quality habitat will be converted to high quality salt marsh habitat in this phase. It is anticipated the additional habitat could in time accommodate individuals displaced in other phases of the project and act as temporary refuge to ameliorate the effects of the subsequent phases.

Interrelated and Interdependent Effects: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no utility apart from the action under consultation. No interrelated or interdependent actions were identified for this project.

Indirect Effects: Indirect effects are those that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur. Indirect effects of actions are often loss of habitat, habitat fragmentation, and include increased traffic generated from businesses, residences, and community infrastructure that is expected to cause an increase in vehicular mortality. Indirect effects may also include people moving into an area who bring pets, usually cats, which prey on listed species in the adjacent habitat. Indirect effects may occur outside of the area directly affected by the action.

In this section, the effects of the proposed project on the LKMR will be evaluated as to population, habitat loss, habitat fragmentation, and indirect mortality, such as vehicular mortality and domestic pet predation.

Habitat loss: Marsh rabbit habitat will be temporarily lost after construction and restoration, until revegetation occurs. This loss may be incurred for a period of 2, and possibly, 3 years in newly created salt marsh habitat until the vegetation regenerates and reaches mature coverage.

In order to compensate for this loss as much as possible, NASKW proposes to perform a major part of the habitat conversion and restoration in the first phase. Estimated total habitat impacts by phase were presented previously in Table 5.

While sizeable areas of mangroves will be removed from the airfield, most marsh vegetation will remain, and additional areas of salt marsh will be created using the above prevalent species of marsh vegetation. Therefore, it is not expected the food sources of the LKMR will be greatly impacted. Indirect impacts to these foraging sources are anticipated to be negligible and temporary. Because additional salt marsh habitat will be created in certain areas within LKMR habitat, foraging locations and food sources should increase over time.

Habitat fragmentation: Restoration of existing habitat and conversion of some habitat type to salt marsh should benefit the LKMR long-term by reducing fragmentation and providing a mosaic of suitable habitat.

Maintenance: The proposed action would also include the long-term control of woody vegetation, including invasive species, within 102.5 acres of LKMR habitat. Species-level recovery actions for the LKMR include habitat enhancement through the removal of overstory vegetation in transitional areas to promote understory vegetation (USFWS 1999). An indirect beneficial effect would be the removal of overgrown woody vegetation within certain habitat types, which may be suppressing the growth of understory grasses by shading and allelopathic (the inhibition of growth in one species of plants by chemicals produced by another species) effects from decaying leaf litter.

Other indirect effects include potential effects associated with altering current practices of mowing certain areas to offset possible negative impacts of temporary loss of foraging habitat and cover. NASKW may decrease mowing intensity of certain maintained areas to increase the value for LKMR to offset, in part, possible negative impacts to the LKMR over the life of the project. Any changes in mowing practices will be coordinated with the Service.

Feral cat mortality: Although we cannot quantify the amount of take of the species from cat predation, we believe this threat could cause a significant adverse effect and studies (Forys and Humphry 1999a; LaFever and Lopez 2006) have shown that LKMR feral cat mortality has the potential to adversely affect survival and recovery. Cat and raccoon removal efforts will be repeated annually accompanied by on-going monitoring.

Other Indirect Effects: Off-road use, which may increase the risk of vehicular mortality, will continue to be prohibited in LKMR habitat, including the action area.

Habitat that lies in close proximity to developed areas normally continues to degrade because of vegetative succession caused by suppression of wildfire in the urban interface. Management of the proposed site includes prescribed fire and other means of habitat management, such as mowing, to maintain its optimum value to the LKMR. Species-level recovery actions for the LKMR include habitat enhancement through the removal of overstory vegetation in transitional areas in order to promote understory (USFWS 1999).

Species response to the proposed action

Research results, including PVA models, have identified the Boca Chica metapopulation as the most prone to extirpation (Forys and Humphrey 1999, LaFever and Lopez 2006). According to LaFever and Lopez 2006, "PVA models are based on demographic and habitat data, incorporate uncertainties using sensitivity analyses based on ranges of parameters, and provide outputs or predictions that are relevant to conservation goals (Boyce 1992, Akçaya and Sjögren-Gulve 2000). The PVA should be used to make relative, not absolute, predictions of extinction risk over short time periods (Beissinger and Westphal 1998), and to rank the impact of various management options on an endangered or target species (Lindenmayer and Possingham 1996)."

LaFever and Lopez (2006) used a PVA model to estimate the probability of the metapopulation persisting for 10 years. Their PVA evaluated several scenarios, including vegetation management alternatives, level of LKMR predator (feral cat) control, and potential impacts to initial abundance of LKMR from Hurricane Wilma.

The vegetation management scenarios considered in the PVA included:

- No Action Alternative (Baseline): Baseline alternative that does not include any clearance of airfield vegetation. There is no associated LKMR impact.
- Alternative I: Under this alternative, all vegetation within the airfield Clearance Zone would be cleared, and the area would be grubbed and re-graded to mowable habitat. Direct effects of this action on the LKMR would include the loss of habitat within the airfield Clearance Zone, and loss of habitat due to drainage ditch maintenance. The potential also exists for direct mortality to occur due to construction equipment. This alternative includes no conversion of mangrove wetlands to salt marsh wetlands.
- Alternative 2: (the Proposed Action). This is the proposed action described in the PBA and this document.

The predator control (feral cat control) parameter included scenarios where 50 percent and 75 percent of cat mortality was reduced, respectively. Impacts from Hurricane Wilma were simulated by including scenarios with 25, 50, and 75 percent reductions in initial abundance of LKMR. The results of the PVA with a 75 percent reduction, due to cat mortality, are summarized in Table 7.

Table 7*. Probability of LKMR persistence(%) over 10 Years with population reductions at NASKW with 75 percent reduction in mortality from cats and various hurricane impacts.

Scenario	Pre-Hurricane Wilma	Post-Hurricane Wilma Impacts (mortality)		
		25%	50%	75%
Baseline	98	97	92	71
Alternative 2 referred	97	96	89	71
Alternative 1	61	60	50	40

* adapted from NASKW 2006

Notes:

Pre-Hurricane Wilma is 0% reduction in initial abundance estimates

Post-Hurricane Wilma scenarios are reduction in initial abundance(%)

Baseline is the No-Action Alternative

Alternative 2 is airfield clearance including the conversion of mangroves to salt marsh (within LKMR habitat)
 Alternative 1 is airfield clearance with no habitat conversion
 All scenarios include 75% feral cat control

The results of this PVA show no significant difference in probability of persistence of the LKMR between the Baseline and Alternative 2 (Proposed Action).

When the PVA model was run with reduced initial abundance of rabbits due to Hunicane Wilma, the baseline scenario probability of persistence with a 50 percent reduction in initial abundance was 92 percent, while probability of persistence for Alternative 2 (with salt marsh conversion and predator control) with the same reduction in abundance was 89 percent (Table 7). This clearly demonstrates the importance of conservation measures such as conversion of mangroves to salt marsh and predator control in increasing persistence for the LKMR. The model showed a change of less than 4 percent for the probability of persistence between the baseline and Alternative 2 under all scenarios of decreased initial abundance (*e.g.*, 25, 50, and 75 percent).

LaFever 2006 found the other proposed conservation measure, feral cat control, unequivocally improves viability (Figure 3). The Alternative 2 probability of terminal extinction risk decreased from 71.3 percent to 11.3 percent and 0.8 percent with decreases in cat mortality of 50 percent and 75 percent respectively. Alternative 2 with feral cat control was predicted to have a minimal impact on LKMR viability over the No Action alternative. His results showed a cat control program is essential to minimize impacts from the airfield clearance project on the LKMR. He also found a cat control program was integral for the long-term recovery of the marsh rabbit population on Boca Chica Key.

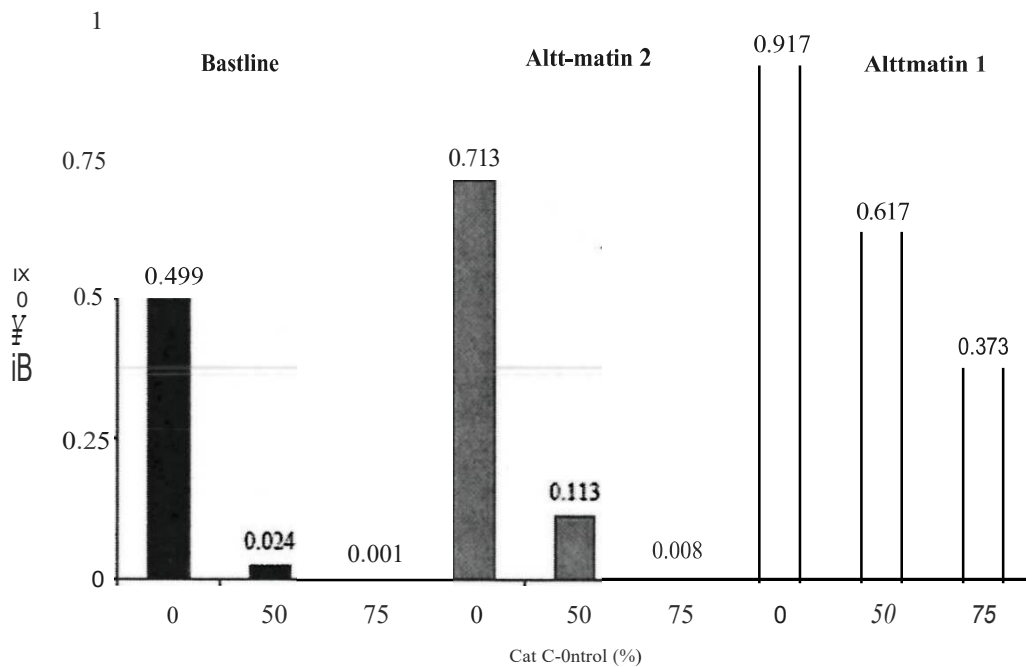


Figure 3 (Lafever 2006). Terminal extinction risk (probability of quasi-extinction in 10 years) for the Lower Keys marsh rabbit on Boca Chica Key, Florida, under several management scenarios.

Cat control has already occurred and PVA analysis of the population indicates probability of persistence may improve with the conversion of mangroves to salt marsh. Habitat conversion and improvement are anticipated to enhance marginal habitat conditions for about one-fourth (125) of the total **LKMR** population, represented by the Boca Chica metapopulation. The LKMR will likely be impacted by the project, primarily by human disturbance during restoration, enhancement, and maintenance. The proposed conservation measures will likely reduce the potential impacts. Creation of about 37.59 acres of new salt marsh habitat could potentially result in an increase in the LKMR population of 18 or more animals. Forsyth, 1995 believed recovery potential would increase if active management of populations and habitats is undertaken.

Lafever (2006) found under current conditions without cat control, the terminal extinction risk in 10 years was 49.9 percent. With the project as proposed, including 75 percent cat control, Lafever (2006) predicted the terminal extinction risk decreased to 0.8 percent in 10 years. As did Forsyth and Humphrey (1999), Lafever (2006) and Lafever and Lopez (2006) found control of cat populations on Boca Chica Key would likely have the greatest benefit to marsh rabbit populations than any other management action considered.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Cumulative impacts are evaluated as an integral part of the proposed action and each phase will be evaluated sequentially, incorporating improvements and/or avoiding deficiencies identified into the next phase.

No cumulative impacts that are reasonably certain to occur in the action area of this BO have been identified.

CONCLUSION

After reviewing the status of the Lower Keys rabbit, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion the restoration and maintenance of clear zones and stormwater drainage systems, located at Boca Chica Field, NASKW, along with related habitat loss and indirect effects, will not jeopardize the continued existence of the endangered Lower Keys rabbit.

No critical habitat has been designated for this species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass,

harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by NSAKW, so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption of section 7(o)(2) to apply. NASKW has a continuing duty to regulate the activity covered by this incidental take statement. If NASKW (1) fails to assume and implement the terms and conditions, or (2) fails to require a contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to a permit or contract document, the protective coverage of section 7(0) 2 may lapse. In order to monitor the impact of incidental take, NASKW must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR '402.14(1) (3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of six of the endangered Lower Keys rabbit individuals in the form of kill, harm, and harass resulting from the disturbance of up to 135 acres of occupied habitat. The actual numbers may be difficult to detect because in general these species have small body sizes, or are found in habitats that make detection difficult. However, the take of this species can be expected because of habitat conversion, the removal of overstory vegetation, an associated temporary loss of cover, and maintenance including prescribed fire and mowing over the life of the project. Six individuals were determined by multiplying a maximum of 125 individuals affected by the project by 5 percent, the estimated project-related reduction in population persistence predicted by the 10-year PVA over the baseline no action alternative.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the species, or destruction or adverse modification of critical habitat because none exists, when the reasonable and prudent measures are implemented.

REASONABLE AND PRUDENT MEASURE

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Lower Keys rabbit:

- 1) Phase the project over ten or more years and monitor restoration and other conservation measures between phases, as identified in the project proposal, and improve subsequent procedures in future phases based on monitoring results.
- 2) Hand clear existing woody vegetation where practicable.
- 3) Create about 37.59 acres of salt marsh wetlands and restore existing habitat.
- 4) Control predators such as house cats, feral cats, and raccoons in and near the action area.
- 5) Establish "no mowing" areas to preserve habitat.
- 6) Ban off-road vehicles from the area.
- 7) Avoid construction during breeding season, except if prior to the two primary breeding season months of March and September the herbaceous cover had been disturbed, removed, or cleared to the extent that sufficient herbaceous cover is **not** present to LKMR to build dens or nesting sites.
- 8) Eradicate invasive exotic vegetation.
- 9) Educate military personnel and the public about marsh rabbits.
- 10) Employ erosion control measures.
- 11) Maintain and manage the action area long-term.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, NASKW must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The Navy proposes to monitor the success of the salt marsh conversion in accordance with federal, state, and local regulatory agency requirements. Prior to initiation of the proposed action, the Navy will apply for the applicable environmental permits. These required permits include those associated with Section 401 of the Clean Water Act (CWA), Section 404 of the CWA and all coastal permits associated with the Coastal Zone Management Act (CZMA).

The Navy will implement the following plant monitoring for the converted salt marsh wetlands:

- 1) All exotic vegetation, as identified above will be removed from all wetland areas within the project area. All exotic vegetation will be removed from the wetlands in a manner that will minimize impacts to existing wetland vegetation. These areas shall be maintained free from exotics for the life of the permit.
- 2) Salt marsh wetland conversion shall be considered successful when the following conditions have been met for a 3-consecutive year period in the areas converted to salt marsh wetlands:
 - a) Plant cover in the converted salt marsh is at least 80%, and consists of wetland vegetation listed in Florida Administrative Code Rule 62-340 [Delineation of the Landward Extent of Wetlands and Surface Waters]. Percent cover shall be reported for the aggregate of those wetland species, relative to the total area, including a measure of percent cover by non-wetland species, bare ground and water. A list of wetland species included in the aggregate will be included;
 - b) Invasive, exotic species shall be limited to 5% or less of the total cover and their density naturally static or declining; and
 - c) The hydrology of the system is adequate to ensure the viability of the converted salt marsh wetlands.
- 3) The Navy will submit to the regulatory agencies annual monitoring reports that describe in detail the progress of the salt marsh wetland conversion. The reports will consist of (1) photographs taken at permanent photo stations established within each salt marsh conversion area, and (2) annual statistical monitoring of vegetation sampling of the salt marsh conversion areas done by any mutually agreed upon method. Reports shall describe the percent survival, percent cover of listed herbaceous species. Data for listed nuisance or exotic species, as stated above will be tabulated separately from the herbaceous species. A listed species is one listed in Florida Administrative Code Rule 62-340. Data shall be taken at the end of the summer growing season.
- 4) Semiannual narrative reports will be prepared and submitted to the regulatory agencies detailing the progress of the wetland conversion. The reports shall include photographs taken from the photo stations, if applicable, a description of problems encountered and solutions undertaken and anticipated work for the following 6 months.
- 5) The Navy proposes that if after three years of monitoring, it is determined, based on visual inspection by Navy and regulatory agency staff and review of the annual and semi-annual reports, that the conversion areas are meeting the success criteria, continued monitoring of the conversion areas may be terminated.
- 6) If the monitoring data reveal a failure to meet success criteria within 3 years of completion of each wetland conversion area, the Navy will make a determination of the probable cause of failure based upon monitoring data, site reviews, record drawings and

review of any pertinent meteorological and hydrographic circumstances. The Navy will propose a remedial plan to achieve the success criteria.

- 7) The Navy will conduct fecal pellet surveys for short and long term monitoring of the LKMR population on NASKW. The Navy may also use telemetry surveys if appropriate. LKMR monitoring data will be included in the semiannual monitoring reports submitted to the regulatory agencies.

Systematic line transects will be used within known rabbit habitat to tally numbers of fecal pellets observed and record vegetation structure and composition. The results of this survey will be used to produce an index of fecal pellet abundance within patches and throughout Boca Chica Field. The process for this methodology uses systematic line transects described in Appendix I.

- 8) Education and outreach can enhance responsible management and increase awareness of activities regarding protection of listed species and critical habitat. NASKW will implement education and outreach activities to its personnel about:
 - The adverse effects of off-road vehicle use in LKMR habitat, and
 - The effects free-ranging cats may have on the LKMR

In addition, NASKW will implement the following actions:

- 1) NASKW will provide a Fire Management Plan and a Fire Prescription to the Service for approval prior to conducting a prescribed fire,
- 2) NASKW will identify opportunities to place brush piles within the action area to provide additional cover for rabbits, including those that may be displaced.
- 3) If, during the course of clearing or maintaining habitat, including the removal of exotic vegetation, a rabbit flushes from the site, all work will cease and an intensive search of the area will be conducted for a LKMR nest. Prior to conducting a prescribed fire for maintenance, a thorough walk-thru of the prescription area shall be conducted and if a LKMR is flushed, a search shall be conducted for a LKMR nest. If a nest with young is found, no further work will be conducted within 50 yards of the nest for 3 weeks. If no occupied nest is found, work may proceed immediately. Similarly, if, during the burning process, a LKMR flushes, a search of the immediate area will be conducted, while exercising prudent safety precautions. If a nest is located, the burn shall be halted, if possible, and delayed for 3 weeks,
- 4) All clearing and, when feasible, maintenance shall be conducted outside the two primary LKMR breeding months of March and September,

- 5) Feral and domestic cat and raccoon monitoring and control shall be conducted annually, or on a schedule agreeable with the Service, for the life of the proposed project, and
- 6) Where feasible, the Navy will alter current mowing practices of areas adjacent to, or near, occupied patches affected by the action to increase cover and foraging opportunities for LKMR over the duration of the project. Intensive mowing of these areas may be reinstated, if deemed necessary, at any time after project completion.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office in Miami, Florida at (305-526-2610) and the NKDR, 28950 Watson Boulevard, Big Pine Key, Florida 33043; (305-872-2239). Additional notification must be made to the Ecological Services Sub-Office at Big Pine Key (305-872-2753). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; (1 -800-282-8002) . Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes take in the form of kill, harm, and harass as described in the above analysis will be incidental. If , during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. NASKW must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the proposed action or the reasonable and prudent alternatives.

CONSERVATION RECOMMENDATIONS

No additional conservation recommendations have been identified.

REINITIATION NOTICE

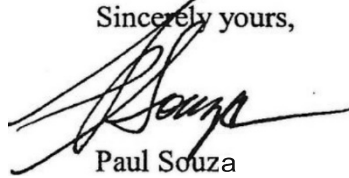
This concludes formal consultation on the action of the Department of the Navy. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Navy involvement or control over the action has been retained (or is authorized by law) and if:

- 1) The amount or extent of incidental take is exceeded;
- 2) New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
- 3) The action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or

For this biological opinion, the incidental take would be exceeded when the take exceeds six individuals, which is what has been exempted from the prohibitions of section 9 by this opinion.

The Service appreciates the cooperation of **NASKW** during this consultation. For further coordination, please contact Allen Webb, Project Planning Supervisor, for our South Florida Office at 772-562-3909 extension 285.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Paul Souza", written over a light blue horizontal line.

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:

Corps, Miami, Florida (Paul Kruger)

DEP, Bureau of Beaches and Coastal Systems, Tallahassee, Florida

EPA, Miami, Florida

FWC, Bureau of Protected Species Management, Tallahassee, Florida

NOAA Fisheries, Miami, Florida (Jocelyn Karazsia)

Service, Atlanta, Georgia (Joe Johnston) electronic copy

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APPENDIX I

Area A/Phase I: "The description of the proposed action provided below relates specifically to Area A, the RW 07 approach. Similar actions involving Areas B through E are anticipated. The completion of efforts involving Area A will provide a baseline from which to adaptively manage efforts involving Areas B through E. Lessons learned from the efforts involving Area A will be used to modify subsequent efforts so as to reduce impacts to the LKMR and its habitat. Minor modifications to the proposed action following completion of Area A will be coordinated with the Service. Substantial modifications will result in the Navy's re-initiation of consultation.

The proposed project involving Area A is to complete the restoration of the Type I & Type II Clear Zones (Clear Zones) at the approach end of RW 07 and restore the airfield drainage systems in this area of Boca Chica Field. The project proposes grubbing within areas to remove stumps, roots and debris within seven (7) work areas within the Clear Zones. The areas will require earthwork grading (both filling and cutting) to elevations ranging from 1.4 to 2.6 (NGVD) to support a high salt marsh habitat. Once proper grades have been established, the areas will be planted with high salt marsh vegetation in order to expedite coverage in LKMR habitat. The plant material will either be nursery-purchased, harvested from donor areas located on Navy property located on Boca Chica & Geiger Key, or a combination of the two. The restoration and enhancement of the drainage system will include the changes in substrate elevation and the construction of new drainage ditches and new culverts. Additionally, some existing culverts will be replaced and existing drainage ditches will be restored by the removal of sediment and vegetation within the footprint of the conveyance. Three upland spoil berms from the mangrove/salt marsh area north of the Type I Clear Zone will be removed in Area A. Some additional vegetation removal will be required to support the construction of new drainage ditches and grading work. Work in Area A will also include removal and reconstruction of existing roadway pavements at several locations and modifications to, or protection of, existing utilities.

The specific elements of the proposed project within the Type I and Type II Clear Zones in Area A include: (1) removal of stumps, earthwork grading and conversion to salt marsh within LKMR habitat (15.69 acres), (2) conversion of 3.81 acres of wetlands to maintainable salt marsh wetlands outside of LKMR habitat, (3) conversion of 2.46 acres of mangrove wetlands to salt marsh outside of LKMR habitat to offset the conversion of LKMR habitat (patch 22) to maintainable wetlands, and (3) installation of three culverts. The proposed action also includes future long-term control of woody vegetation within LKMR habitat (28.16 acres).

Elements of the proposed project outside the Type I and Type II Clear Zones include: (5) construction of new drainage ditches, (6) installation of two new culverts with aprons and wing walls, and replacement of two damaged or undersized culverts, (7) removal of 0.85 acres of berms along existing drainage ditches, (8) removal of 18-24 inches of sediment and vegetation within a 0.11 acre drainage ditch, and (9) removal of 4.45 acres of additional woody vegetation within LKMR habitat with subsequent conversion to salt marsh.

Standard construction equipment will be used in completing the work as described above with the exception of the long-term maintenance within LKMR habitat. As described, selected areas

of primarily mangrove wetlands will be converted to salt marsh wetlands. Suitable fill material (e.g., lime rock, marl and organic mud) will be used to raise site elevations to provide a favorable tidal regime for high salt marsh, as well as to effectively discourage future recolonization of mangroves. Planting of appropriate salt marsh species, including Gulf cordgrass (*Spartina spartinae*), knot grass (*Paspalum distichum*), seashore dropseed (*Sporobolus virginicus*), salt grass (*Distichlis spicata*), glassworts (*Salicornia sp.*), saltwort (*Batis maritima*), key grass (*Monanthochloe littoralis*), and sea oxeye (*Borrichia sp.*), will expedite the establishment of the salt marsh community. All salt marsh species will be planted from 2 inch plugs at a 2 foot spacing with the exception of *Spartina spartinae*, which will be planted from 4 inch pots at a 3 foot spacing. Plant materials will be provided from a nursery, existing vegetation removed on-site as part of the conversion, from two donor sites, or a combination of these. The donor sites are located on Navy property on Geiger Key and are currently identified as unoccupied LKMR habitat patches 11 and 13. Maintenance of the converted sites will begin immediately after the planting is complete and will involve watering, weeding and fertilizing plants as necessary for a minimum of 1 year or until the final inspection and acceptance of the plantings. No vehicles or construction equipment will be allowed in these areas once they have been planted. If structures such as a piping system used to water the plants are required, the structure will be established prior to planting and will be removed by hand after the maintenance phase.

Subsequent long-term maintenance within LKMR habitat will involve the manual control of woody vegetation on an "as needed" basis with a minimum control of every 6 months. Control methods will include spot treatment using herbicides and hand removal. Once restored, heavy equipment will be excluded from LKMR habitat. Prescribed fire may be used for long-term control of woody vegetation in LKMR habitat following further evaluation of its merits; although is not included in this action at this time. Should the Navy decide to pursue the use of prescribed fire in LKMR habitat in the future, the Navy will reinitiate consultation with the Service."

Mitigation Area A / Phase 1: "The description of conservation measures provided below relates specifically to Area A, the RW 07 approach. Similar measures are currently proposed for Areas B through E. The completion of efforts involving Area A will provide a baseline from which to adaptively manage efforts involving Areas B through E, including the conservation measures described below. Therefore, lessons learned from the efforts involving Area A will be used to modify subsequent efforts so as to reduce impacts to the LKMR. Minor modifications to the conservation measures will be coordinated with the Service. Substantial modifications will result in the Navy's re-initiation of consultation.

Conservation measures will be taken throughout the entire process of converting mangroves to salt marsh and restoring the drainage systems at the approach end of RW07. LKMR habitats, adjacent to the work areas, will be cordoned off and posted with warning signs to prevent damage from construction equipment and disturbance from unauthorized personnel. The fencing used to cordon off sensitive habitats will either be staked in the ground to prevent LKMR from traversing into the work areas or raised to allow for dispersal to adjacent habitats, depending on the location. Erosion, sediment and turbidity control measures such as turbidity screens, silt

fences, sediment traps and hay bales will be used during all work phases of project. The clumps of *Spartina* identified within the work areas that provide enough cover for rabbits to hide will be harvested or cut manually prior to construction. All contractor and sub-contractor employees who will work within the project area shall attend an Environmental Awareness Training Session provide by the NASKW Environmental Department prior to working within the project area. The purpose of this training is to make the trainees aware of the sensitive environment they will be working within, which includes endangered species habitat. This mandatory training will inform the trainees of all pertinent environmental permit conditions and Service terms and conditions with which they must comply.

The planting plans are to provide guidelines for planting herbaceous vegetation during the process of converting areas to high saltmarsh. Any field conditions that require changes in the site planting will be submitted to the Service for approval. Areas will be prepared for planting as early as possible during the optimum growing season (mid April through mid September). Planting will start immediately after the areas have been fine graded, disked, re-surveyed, and approved by the Navy.

Plant material, furnished through a nursery, will be true to name as established by the American Joint Committee on Horticultural Nomenclature Publication Standard Plant Names. All nursery grown plants will comply with all required inspection, grading, standards, and plant regulations as set forth in the Florida Department of Agricultural Grades and Standards. The minimum grade for plants shall be sound, healthy, vigorous, shaped within normal habit of growth, of proper color, and densely foliated when in leaf. They should also have healthy, well-developed root systems and should be free of disease and insect pests, eggs, or larvae. If donor sites are used to furnish some of the plants, no more than 20 percent of each species will be removed from each site and in a manner that maintains existing ecological value of the habitat. Plants will be harvested manually so as to not disturb the vegetation to remain. The appropriate permits will be required for all plants taken from the donor sites.

The monitoring and maintenance of plants will begin immediately after each plant is planted to ensure survival until plants are established. All plants will be guaranteed for 1 year after the planting has been accepted by the Navy and establishment of 100 percent of plants will be required. Plants will be watered, weeded, fertilized, cultivated, and otherwise maintained during this time period. The areas will be maintained to control the establishment and prevent the spread of nuisance and exotic vegetation by manual removal and/or use of approved chemical/herbicide applications. Plants will also be maintained to control and prevent the spread of nuisance insects and their larvae.

Florida Invasive Plant Species will be removed including but not limited to: latherleaf (*Colubrina asiatica*), Brazilian pepper (*Schinus terebinthifolius*), Australian pines (*Casuarina* spp.), Seaside mahoe (*Thespesia populnea*), melaleuca (*Melaleuca quinquenervia*), beach naupaha (*Scaevola sericea*), sapodilla (*Manilkara zapota*), umbrella tree (*Scheffiera actinophylla*), lead tree (*Leucaena leucocephala*), bowstring hemp (*Sansevieria hyacinthoides*), sisal hemp (*Agave sisalana*), date palm (*Phoenix sp.*), and life plant (*Kalanchoe pinnatum*).

Techniques used for treating the target species will be in accordance with all Department of Defense, Federal, State and local laws using recognized industry methods. These methods include: minimizing negative impacts to protected and other wildlife species; minimizing negative impacts to non-target vegetation; properly disposing of chemical containers; and protecting natural areas from unnecessary damage.

All herbicides used shall be registered with the EPA and applicable State lead agency for the use intended. Each herbicide intended to be used must be approved by NASKW prior to use and will be applied in compliance with all label directions, specified rates and in a manner that will minimize non-target damage. Care will be taken to minimize over-spray and spray drift."

Monitoring Area A/ Phase 1: "The Navy will monitor the success of the salt marsh conversion in accordance with federal, state, and local regulatory agency requirements. Prior to initiation of the proposed action, the Navy will apply for the applicable environmental permits. These required permits include those associated with Section 401 of the Clean Water Act (CWA), Section 404 of the CWA and all coastal permits associated with the Coastal Zone Management Act (CZMA).

The Navy will implement the following plant monitoring for the converted salt marsh wetlands:

- I) All exotic vegetation, as identified above will be removed from all wetland areas within the project area. All exotic vegetation will be removed from the wetlands in a manner that will minimize impacts to existing wetland vegetation. These areas shall be maintained free from exotics for the life of the permit.
 - a) Salt marsh wetland conversion shall be considered successful when the following conditions have been met for a 3-consecutive year period in the areas converted to salt marsh wetlands:
 - b) Plant cover in the converted salt marsh is at least 80%, and consists of wetland vegetation listed in Florida Administrative Code Rule 62-340 [Delineation of the Landward Extent of Wetlands and Surface Waters]. Percent cover shall be reported for the aggregate of those wetland species, relative to the total area, including a measure of percent cover by non-wetland species, bare ground and water. A list of wetland species included in the aggregate will be included;
 - c) Invasive, exotic species shall be limited to 5% or less of the total cover and their density naturally static or declining;
 - d) The hydrology of the system is adequate to ensure the viability of the converted salt marsh wetlands.
- 2) The Navy will submit to the regulatory agencies annual monitoring reports that describe in detail the progress of the salt marsh wetland conversion. The reports will consist of (1) photographs taken at permanent photo stations established within each

salt marsh conversion area, and (2) annual statistical monitoring of vegetation sampling of the salt marsh conversion areas done by any mutually agreed upon method. Reports shall describe the percent survival, percent cover of listed herbaceous species. Data for listed nuisance or exotic species, as stated above will be tabulated separately from the herbaceous species. A listed species is one listed in Florida Administrative Code Rule 62-340. Data shall be taken at the end of the summer growing season.

- 3) Semiannual narrative reports will be prepared and submitted to the regulatory agencies detailing the progress of the wetland conversion. The reports shall include photographs taken from the photo stations, if applicable, a description of problems encountered and solutions undertaken, and anticipated work for the following six months.
- 4) The Navy proposes that if after two years of monitoring, it is determined, based on visual inspection by Navy and regulatory agency staff and review of the annual and semi-annual reports, that the conversion areas are meeting the success criteria, continued monitoring of the conversion areas may be terminated.
- 5) If the monitoring data reveal a failure to meet success criteria within 3 years of completion of each wetland conversion area, the Navy will make a determination of the probable cause of failure based upon monitoring data, site reviews, record drawings and review of any pertinent meteorological and hydrographic circumstances. The Navy will propose a remedial plan to achieve the success criteria.

The Navy will conduct fecal pellet surveys for short and long term monitoring of LKMR population on NASKW. The Navy may also use telemetry surveys if appropriate. LKMR monitoring data will be included in the semiannual monitoring reports submitted to the regulatory agencies.

Systematic line transects will be used within known rabbit habitat to tally numbers of fecal pellets observed and record vegetation structure and composition. The results of this survey will be used to produce an index of fecal pellet abundance within patches and throughout Boca Chica Field. It is assumed increased incidents of fecal pellets correlate to an increase in rabbit numbers, which is supported by Fors (1995). The process for this methodology uses systematic line transects as described below:

1. Transects begin 0 to 20 meters from a corner edge of a LKMR habitat patch, at a random start point.
2. Measures are taken from the start point and successive points along transects, spaced at 30-meter intervals. (Editors's note: Spacing was modified for 30 to 50 meters to correlate with range wide fecal pellet surveys.) Each point is marked using a Global Positioning System (GPS). Transect lines are also spaced at 30-meter intervals. At each point fecal pellets are counted and classified, and at every other point vegetative

parameters are measured. However, vegetative parameters are collected at all points that have fecal pellets.

- a. Fecal pellets are separated by age class (juvenile, sub-adult and adult) as well as pellet age (new (fresh), old, and unknown) and counted within a 1-meter radius of the sample point.
 - b. Vegetative parameters that are collected include; ground cover, effective height, vertical obstruction, canopy cover, and species composition within a 2-meter radius of point.
3. Pellets observed between points along transects are recorded along with the age class (juvenile, sub-adult and adult). These points are referred to as incidental points. Vegetative parameters are not collect at these points.

The baseline index and monitoring program provided by this methodology will be used to evaluate management of LKMR habitat on Boca Chica Key; i.e. overstory clearing and feral cat control. Vegetative parameters that are taken will be used to characterize each mapped LKMR habitat patch and monitor impacts of habitat enhancement on vegetative structure. This study will also be used to gain further insight into LKMR habitat associations, including parameters associated with reproductive activity, likely improving guidelines for habitat enhancement. Rabbit distribution will be produced through the use of a Global Positioning System (GPS) that will mark each transect point, and then will be incorporated into a GIS database. This data will provide the dispersion of rabbits before, during, and after construction. This survey will be conducted during construction as well as used for long-term management (two times a year, approximately 6 months apart)."

Attachment 2 - LKMR Master Habitat Patch Ledger

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List of LKMR habitat patches and status in 2015 following completion of the Airfield Vegetation Conversion Project (AVCP) and a complete assessment of all documented LKMR habitat patches on NASKW. For all patches listed, it is assumed to maintain routine LKMR habitat management actions (LKMR population monitoring, vegetation monitoring, predator control, exotic plant control, and signage). Also, control native hardwoods and exotic vegetation in all designated LKMR habitats.

Non-specific management actions applicable to all patches:

- LKMR population monitoring
- Vegetation monitoring for hardwood encroachment in LKMR habitat
- Control native and exotic hardwoods and exotic vegetation in LKMR habitat
- Predator control as applicable
- Regulatory signage to prevent unauthorized access and inadvertent mowing as applicable

Patch ID	Acres	LKMR Utilization	Patch Description	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	Management Actions Priority (High / Ongoing / Low)
1	12.99	YES	Narrow buttonwood transition zone adjacent to hammock, includes some hammock along edges. Interior hammock dense and not LKMR habitat.	Combined previous Patch 1 and 2 into a single patch #1 as there is no barrier to LKMR movement and effectively a single patch. Access road was removed in 2013 by AVCP mitigation work.	yes	Site has a history of damage from Off Road Vehicles (ORV's) from the adjacent neighborhood. Maintain Navy "no trespass" signage at road ends in neighborhood. Inform Navy security of trespass issues.	Ongoing
3	4.20	YES	Significant habitat changes from the AVCP. Areas to south include dense hardwoods and mangrove.	Remapped as part of the AVCP.	no	Site is located on the airfield; comply with airfield mowing and maintenance plan.	Ongoing
4	2.51	YES	Beach berm habitat, buttonwoods w/ Sporobolus understory & some Borrchia; open marsh area w/ a few buttonwoods, grasses.	Remapped in 2015 to eliminate large wet / submerged areas.	yes	Prevent human activities from damaging habitat. Area popular sun bathing beach, and vegetation impacts were observed in 2015.	Low
5	5.35	YES	Disturbed area, buttonwood with low marsh matrix. Disturbed berm of buttonwood included.	Remapped to include additional cover to west. Include areas of low salt marsh within larger area.	yes	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Site is secured behind Navy fence, access by general public and Navy operations is difficult.	Low
7	3.67	YES	Freshwater marsh area, impounded, scattered buttonwood and dense around perimeter. Disturbed areas to south.	Minor adjustments to edges to remove dense hardwood areas.	yes	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent.	Low

Patch ID	Acres	LKMR Utilization	PatchDescription	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	ManagementActions Priority (High / Ongoing / Low)
8	10.56	YES	A mosaic of thick buttonwoods, intertidal marsh, andSpartina; also some mangroves along a drainage ditch.	<u>Buttonwoodsare displacing LKMRgrasslands.</u> Portions of hardwoods removed along runway07 approach in 2014 as part of AVCP project.	no	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat. Habitat signage to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads. Restoration of east/west drainage ditch to allow for drainage and prevent flooding.	High
9	15.62	YES	Mosaic of low marsh, patches of Borrichia/Sporobolus, Spartinaclumps, buttonwood "islands" & hammock.	<u>Buttonwoodsare displacing LKMRgrasslands.</u> North 1/2 area AVCP Runway 07 project. grasslands. Remaining area heavily woodedwithbuttonwood, needs control.	no	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat. Restoration of east/west drainage ditch to allow for drainage and prevent flooding. Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads. Conduct routine LKMR non-specific management actions. Site is located onthe airfield; comply with airfield mowing and maintenance plan.	High
10	1.66	YES	Former restoration site, Spartina is dominant cover, forming dense stands.	<u>Buttonwoodsare displacing LKMRgrasslands.</u> Expanded patch slightly to incorporatesuitable vegetativecover	yes	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat. Site is secured behind Navy fence, access by general public and Navy operationsis difficult.	High
11	2.37	Potential	Narrow strip of Spartina spartinae, Borrichiafrutescens and buttonwoods along Old Boca ChicaRoad.	Minor adjustments to edges to remove dense hardwood areas.	yes	Site is within public road ROW and accessible to the general public. Habitat signage needed to prevent inadvertent impacts and trespass from the public. Site is vulnerable to free ranging domestic cats. Include site in USDA cat control program.	Low
12	3.32	YES	Wet area with mangrove, buttonwoods. Spartina grassland with intertidal marsh and buttonwoods.	Hardwoodvegetation removed in 2014 as part of AVCP project.	no	Conduct routine LKMR non-specific management actions. Site is located onthe airfield; comply with airfield mowing and maintenance plan.	Ongoing

Patch ID	Acres	LKMR Utilization	PatchDescription	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	ManagementActions Priority (High / Ongoing / Low)
13	9.23	YES	Mosaic of high and low saltmarsh with dense buttonwoods and mangroves along perimeter. Dense Spartina fields present, bisected by mosquito ditches. Adjacent to neighborhood.	Minor adjustments to edges to remove dense hardwood areas.	yes	Site is located along public road and accessible to the general public. Habitat signage needed to prevent inadvertent impacts and trespass from the public. Site is vulnerable to free ranging domestic cats. Include site in USDA cat control program.	Low
14	8.38	YES	Patches of dense Borrchia and saltmarsh with buttonwood forest on perimeter. Site is a permitted mitigation area for the AVCP.	<u>Buttonwoods are displacing LKMRgrasslands.</u> AVCP - restoration area, restored old fill piles and antenna pads to saltmarsh and mangrove habitat.	yes	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat. Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Mowing is ongoing at adjacent facility.	High
16	3.12	Potential	Saltmarsh vegetation and areas of dense mangrove and buttonwoods. Bisected by drainage ditches.	<u>Buttonwoods are displacing LKMRgrasslands.</u> Drainage ditches cleared in 2013 by AVCP.	no	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat.	High
17	0.96	YES	Beach berm habitat with grassy areas along perimeter. large riprap shoreline stabilization area supports LKMR.	Revised patch to eliminate heavily forested areas behind beach berm.	yes	Conduct routine LKMR non-specific managementactions.	Low
18	10.90	YES	Mosaic of saltmarsh with dense grassland areas and dense buttonwoods and mangroves. Significant habitat changes from the AVCP.	Remapped as part of the AVCP. <u>Buttonwoods are displacing LKMRgrasslands.</u>	No	Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Hardwoods are displacing areas of high quality LKMRgrasslandhabitat. Site is located on the airfield; comply with airfield mowing and maintenance plan.	High
19	27.79	YES	Mosaic of low hardwood hammock, freshwater hardwoods, and grasslands.	Area subject to invasive exotic vegetation, especially Leadtree, due to altered hydrology and higher elevations.	No	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways.	Low
20	10.15	Potential	Hardwood hammock and saltmarsh areas created by AVCP. Significant habitat changes from the AVCP.	Remapped as part of the AVCP.	No	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Site is located on the airfield; comply with airfield mowing and maintenance plan.	Ongoing

Patch ID	Acres	LKMR Utilization	PatchDescription	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	ManagementActions Priority (High / Ongoing / Low)
21	22.24	Potential	Mosaic of buttonwood forested areas and grassland areas. Significant habitat changes from the AVCP.	Remapped as part of the AVCP.	No	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Site is located on the airfield; comply with airfield mowing and maintenance plan	Ongoing
23	30.90	Potential	Low open salt marsh created by AVCP. Significant habitat changes from the AVCP.	Remapped as part of the AVCP.	No	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Site is located on the airfield; comply with airfield mowing and maintenance plan	Ongoing
24	13.45	Potential	Low open salt marsh created by AVCP. Significant habitat changes from the AVCP.	Remapped as part of the AVCP.	Yes	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Site is located on the airfield; comply with airfield mowing and maintenance plan	Ongoing
26	13.57	YES	Mosaic of high and low saltmarsh with scattered to dense buttonwood. Mangrove along perimeter and in drainagefeatures.	Increased extent of high saltmarsh to the north based on vegetation, cleaned up roads and general improvements to mapping.	yes	Habitat restoration through road removals, bunker removals, and fill removal projects. Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Habitat signage to prevent inadvertent impacts from Navy operations.	Ongoing
60	18.28	Potential	Beach berm habitat along old Boca Chica Road, habitat is linear and follows roadsides.	Revised in 2015 to improve mapping resolution, remove wet and inundated areas, combined with Patch 6 Invasiveexotic plants, <i>Colubrinaasiatica</i> , along roadsides on sandysoils.	yes	Exotic control to prevent <i>Colubrina asiatica</i> from displacing native habitats.	High
71	2.46	Potential	Beach berm habitat along old Boca Chica Road, habitat is linear and follows roadsides.	Revised in 2015 to improve mapping resolution. Invasiveexotic plants, <i>Colubrinaasiatica</i> , along roadsides on sandysoils.	yes	Exotic control to prevent <i>Colubrina asiatica</i> from displacing native habitats.	High

Patch ID	Acres	LKMR Utilization	PatchDescription	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	ManagementActions Priority (High / Ongoing / Low)
93	14.56	YES	Mosaic of low hardwood hammock and buttonwood scrub with scattered saltmarsh	AVCP along taxiway only, interior ditches cleaned.	No	Habitat signage needed to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads and taxiways. Site is located on the airfield; comply with airfield mowing and maintenance plan	Ongoing
102	6.99	YES	Mosaic of low hardwood hammock and buttonwood scrub with scattered saltmarsh	Revised in 2015 to improve mappingresolution.	Yes	Conduct routine LKMR non-specific managementactions.	Low
152	15.62	Potential	Salt marsh buttonwood scrub, several ponds and mosquito ditches	Remapped significantly in 2015 to remove flooded mangrove areas to the west.	yes	Habitat restoration through fill removal work and removal of old power lines. Hardwood control to prevent buttonwood encroachment in select areas where saltmarsh grasses are prevalent. Habitat signage to prevent inadvertent impacts from navy operations.	Ongoing
155	2.83	YES	Buttonwood along roadsides with flooded marsh located between roads.	The portion to the east was converted to saltmarsh by the AVCP.	no	Conduct routine LKMR non-specific managementactions.	Ongoing
156	3.08	Potential	Disturbed area of buttonwood scrub with sparse saltmarsh vegetation.	Removal of exotic vegetation in recent years evident. Limited ground cover.	No	Conduct routine LKMR non-specific managementactions.	Ongoing
157	5.57	YES	High saltmarsh with dense grasslands composed of Spartina and other grasses and Borrichia.	Revised in 2015 to improve mappingresolution. Combined to patch 161 due to lack of barrier, narrow trail separating.	Yes	Relocation of narrow gravel road that bisects patch to north to prevent habitat fragmentation. Coordinate with NASKW PWO and Security on design. Hardwood control to preventbuttonwood encroachment in select areas where saltmarsh grassesare prevalent. Habitat signage to prevent inadvertent impacts from Navy operations. Landscape debris and vehicular damage observed in 2015.	High
160	6.96	YES	Saltmarsh with patches of tall, thick Borrichia and dense upland grasslands.	<u>Buttonwoods and other hardwoods are displacing LKMRgrasslands.</u> Hardwoods removed over most of patch by AVCP.	No	Hardwood control to preventbuttonwood encroachment in select areas where saltmarsh grassesare prevalent. Habitat signage to prevent inadvertent impacts from Navy operations. Area is easily accessible from roads.	High
169	1.75	YES	Mosaic of saltmarsh and mangroves. Significant habitat changes from the AVCP.	Area is low and floods regularly.	No	Conduct routine LKMR non-specific managementactions.	Ongoing

Patch ID	Acres	LKMR Utilization	PatchDescription	Field and Mapping Notes 2015	Patch Re-mapped in 2015 ?	Restoration / Management Actions	Management Actions Priority (High / Ongoing / Low)
170	3.77	YES	Buttonwood saltmarsh in remote area.	Re-mapped from dense wooded areas to open salt marsh to north	yes	Conduct routine LKMR non-specific managementactions.	Ongoing
172	2.26	YES	Mowed upland area that was formerly dense stand of leadtree.	Currently mowed to maintain exoticvegetation	No	Conduct routine LKMR non-specific managementactions.	Ongoing
173	9.03	Potential	Mosaic of saltmarsh and mangroves. Significant habitat changes from the AVCP / Runway 07 pilot project.	The majority of this area was converted to high and low saltmarsh by the AVCP.	No	Conduct routine LKMR non-specific managementactions.	Ongoing
174	6.00	Potential	Mosaic of saltmarsh and mangroves. Significant habitat changes from the AVCP / Runway 07 pilot project.	The entire area was converted to high and low saltmarsh by the AVCP.	No	Conduct routine LKMR non-specific managementactions.	Ongoing
177	0.74	Potential	Mangroves and buttonwoods w/ Salicornia and a few grasses; low quality habitat	Revised to improve map resolution. Deleted innudated areas. patch has filled disturbed areas, but restoration opportunities limited.	yes	Conduct routine LKMR non-specific managementactions.	Ongoing
178	1.73	Potential	Buttonwoods and mangroves, including a mangrove-covered "spit".	Revised to improve map resolution. Minimally LKMR habitat, roadside buttonwood scrub.	Yes	Conduct routine LKMR non-specific managementactions.	Ongoing
210	1.29	Potential	Wooded area along roadside, dense buttonwoods with Borrchia and limited Spartina understory	Expanded to west to include appropriate vegetation	yes	Site is vulnerable to free ranging domestic cats. Include site in USDA cat control program.	Ongoing
300	16.14	Potential	Restored saltmarsh areas, AVCP mitigation site completed in 2013	These are restoration sites that form a mosaic of LKMR habitat, combined into a single patch.	yes	Residence adjacent to site has history of dumping and mowing LKMR habitats on Navy lands. Additional signage and fencing recommended to prevent encroachments. Site is vulnerable to free ranging domestic cats. Include site in USDA cat control program.	Ongoing
306	1.59	Potential	Restored saltmarsh areas, AVCP mitigation site completed in 2013	Mitigation site, high salt marsh, buttonwood and mangroves.	yes	Site has a history of unauthorized access for fishing in borrow pit, increase signage. Site is vulnerable to free ranging domestic cats. Include site in USDA cat control program.	Low
307	1.89	Potential	Low salt marsh with buttonwood scrub and mangroves.	Added in 2015 based on vegetativecover.	yes		

Attachment 3 - 2015 LKMR Monitoring Report

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**MONITORING OF LOWER KEYS MARSH RABBITS ON NAVAL AIR STATION
KEY WEST**

FINAL ANNUAL MONITORING REPORT - 2015

CONTRACT #: N62467-04-RP-00172

OPTION YEAR 4



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EXECUTIVE SUMMARY

The Lower Keys marsh rabbit (LKMR, *Sylvilagus palustris hefneri*), a subspecies of marsh rabbit endemic to the Lower Florida Keys, is listed as endangered by the U.S. Fish and Wildlife Service (USFWS). It is currently estimated that approximately 60% of the total LKMR population throughout the Lower Keys occurs on Navy lands. Therefore, management of the LKMR on Navy properties is critical to the long-term survival of the LKMR. In order to comply with U. S. Fish and Wildlife Service Biological Opinion requirements, Naval Air Station Key West (NASKW) maintains a monitoring program for LKMR populations and habitats.

LKMR populations are monitored through fecal pellet counts on 49 habitat patches on Navy property on and near Boca Chica Field. Researchers counted and classified LKMR fecal pellets on random sample plots, estimated ground cover, and recorded vegetation characteristics. The results of the 2015 monitoring show 61% of LKMR patches had stable or increasing pellet density, and a decline in overall pellet density was observed. There was no significant association between the number of LKMR pellets and vegetative cover types or target herbaceous plant species.

Current methods of LKMR monitoring have inherent limitations and a tendency to underestimate rabbit occupancy. We propose revised survey methods for future LKMR surveys that incorporate increased sample plot size, non-random plot placement, and an emphasis on qualitative observations of LKMR habitat utilization to better identify LKMR habitats.

To assess the effectiveness of the proposed revised LKMR monitoring methods, three occupied LKMR patches were sampled with the revised survey methods to compare the difference in LKMR pellet density between old and new methodologies. Using the revised survey methods, all three patches had a greater average pellet density: 200%, 96%, and 155%, respectively. Implementation of the revised methods will undoubtedly increase efficiency, accuracy, and better illustrate population trends and vegetative associations of the LKMR.

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INTRODUCTION

The Lower Keys marsh rabbit is a federally endangered subspecies of marsh rabbit endemic to the Lower Florida Keys (USFWS 1990). The LKMR typically occupies areas with dense cover (Layne 1974) including salt-marsh and buttonwood transition zones. Current ranges are fragmented into distinct patches from Big Pine Key south to Boca Chica Key that intermittently function as a larger metapopulation. This function is increasingly threatened by habitat loss, fragmentation (e.g., roads) and degradation (e.g., woody encroachment). Recent research has indicated the LKMR could be extinct in as few as 30 – 40 years (Forys and Humphrey 1999, LaFever et al. 2008) without management of remaining habitat.

The U.S. Fish and Wildlife Service (USFWS) estimates there are 2,116 acres of suitable, potential LKMR habitat comprised of 229 discrete habitat patches within the range of the subspecies in the Lower Keys. Of this total, NASKW properties (on and adjacent to Boca Chica Key) support approximately 329 acres comprised of 46 discrete habitat patches, or approximately 15% of the total LKMR habitat area and supporting an estimated 60% of the range-wide LKMR population. Consequently, the U.S. Navy has played a key role in the management of LKMR through habitat and population improvements, predator control, and annual population monitoring. Previous efforts have included successful translocations of LKMR to unoccupied habitat (Faulhaber 2003, Perry 2006), habitat conservation and restoration in key areas, and improvement of metapopulation dynamics. This report provides the U.S. Navy with annual estimates of LKMR population size and distribution information critical to overall population monitoring.

Study Area

The Florida Keys consists of tropical vegetation with distinct wet (May–November) and dry seasons (December – April). The elevation averages 2-m above sea-level with a maximum of 4-m above sea-level. Small changes in elevation create distinct vegetative communities from mangroves on the terrestrial-water interface to brackish marshes in tidally influenced zones and up to pine and mixed forests at the highest elevations. LKMR habitat patches

located on Boca Chica, Geiger, and East Rockland keys were surveyed (Figure 1) as part of an annual monitoring protocol conducted by the U.S. Navy and Texas A&M Institute of Renewable Natural Resources (IRNR). The majority of the surveyed LKMR patches were located on Boca Chica Key (250 ha), an island located on the western LKMR range (Figure 1, Attachment 1).

These patches included areas impacted in both the completed Runway 07 Approach End Clearance Project (R7AECF) and the ongoing Airfield Vegetation Conversion Project (AVCP, Figure 2). The U.S. Navy began tree and woody vegetation removal at Naval Air Station Key West (NASKW) in designated areas adjacent to Runway 07 (R7AECF) in 2005. The U.S. Navy trimmed vegetation approximately 228 m to either side of the runway midline. This area included LKMR habitat patches 8, 9, 12, and 173, which were cleared of 37%, 59%, 100%, and 78% of woody vegetation, respectively. Further land conversion began in 2011 (AVCP, Areas 2, 3, 22, 23) impacting 15 additional LKMR patches (Figure 2, Table 1). The AVCP includes various vegetation alteration activities on NASKW including vegetation removal, material excavation and regrading, soil importation, and planting of native vegetation.

METHODS

A 30 x 30-m grid was placed over 49 LKMR habitat patches located on NASKW. LiDAR-derived elevation data were used to classify LKMR patches on Boca Chica, Geiger, and East Rockland keys (Figs. 3 – 5). Previous research suggests a minimum of 25 samples are needed to obtain reliable LKMR estimates for larger patches (Schmidt 2009). Twenty five grid points were randomly selected within each LKMR patch using the 30 x 30-m grid. For patches with <25 available grid points within the patch boundaries, all points were sampled (31 of the 49 patches had <25 points). Researchers searched a 1m² circular plot centered on each selected point and counted all LKMR fecal pellets present (pellets/m²). Fecal pellets were separated by age class (i.e., juvenile and adult) as well as pellet age (i.e., fresh and old). A diameter of 6.7 mm or larger was used to classify pellets as “adult” whereas smaller pellet diameters were considered “juvenile” (Forys 1995). Pellets classified as “fresh” were

described as shiny, consolidated, and dark brown in coloration. All other pellets not exhibiting these characteristics were classified as “old”. At each point, ground cover was estimated as proportion of each rock, soil, woody vegetation, or herbaceous vegetation.

To assess vegetative characteristics of LKMR habitats, researchers recorded the presence or absence of target herbaceous species within each sample plot, including cordgrasses (*Spartina spartinae*, *S. patens*, *S. bakeri*), sea-oxeye daisy (*Borrchia frutescens*, *B. arborescens*), splitbeard bluestem (*Andropogon ternarius*), seashore dropseed (*Sporobolus virginicus*) and Gulf Coast spikerush (*Eleocharis cellulose*), were noted as they are known to be important for LKMR shelter or food. Incidental LKMR fecal pellet data, LKMR sightings, and animal signs also were recorded on field sheets while conducting annual LKMR surveys.

The outlined protocol is identical to methods used in previous years to allow direct comparison among years. The mean annual pellet densities per patch and pooled mean annual pellet density for all patches were calculated. The mean pellet densities in treatment (vegetation conversion) and non-treatment (no vegetation conversion) patches were also analyzed. A correlation analysis was performed between pellet sum ($n > 0$) and the proportion of each cover type and Kruskal-Wallis test was calculated to detect for significant difference in the pellet sum ($n > 0$) according to the presence or absence of each target vegetative species.

In order to compare the ongoing monitoring methods to proposed methods utilizing non-random sample plots of larger size, revised sampling methods were performed on three patches to gauge the revised methods ability to detect LKMR pellets in patches known to have rabbits. New points were placed at locations known to contain rabbit pellets and appropriate habitat. At each point, a circular sampling point (10m², 3.6m diameter) was established using a tape rotated around the center point and the same data were recorded. The larger sample points (increased from 1m² to 10m²) represents a 900% increase in survey area, therefore a reduced number of sample points can be used compared to previous methods.

RESULTS AND DISCUSSION

General Trends in LKMR Populations

Annual LKMR surveys of the 49 patches were conducted (October 25 – 31, 2015) on Boca Chica, Geiger, and East Rockland Keys (Table 2). A summary of LKMR occupancy and average pellet count included 12 patches (24%) increasing, 16 patches (33%) decreasing, and 18 (37%) patches that remained the same between 2014 and 2015. The remaining three patches (6%) were omitted; patch 22 was omitted due to concerns of UXO, patch 82 was blocked by a recently excavated creek, and patch 171 was omitted as a result of the NASKW Airfield Vegetation Conversion Project, however data from patch 171 was included in Tables 1 and 2, and Figure 6, due to the historical presence of this patch in prior survey years.

Pellet densities were higher in 2012 than all other years: 2006, 2007, 2008, 2009, 2010, 2011, 2013, 2014, and 2015 (Figure 6). Overall, mean pellet densities increased from 2006 to 2012, and have declined since 2013 (Figure 6).

Mean pellet density in non-treatment patches increased 41% in 2015. Mean pellet densities for non-treatment patches increased substantially in 2010 – 2012 ($\bar{x} = 4.98$ pellets/patch) in comparison to the first 4 study years ($\bar{x} = 1.84$ pellets/patch). Consequently, 2013 – 2015 mean pellet density ($\bar{x} = 1.31$ pellets/patch) represents a decline to the observed means in 2006 – 2008. Declines in mean pellet densities for treatment patches were most evident in 2012 – 2015 (Tables 1 & 2); thus, negatively impacting calculated mean annual pellet densities for those years (Figure 6).

Incidental Pellet Observations

Of the 49 total patches, 25 patches (51%) included notations of incidental pellets outside of the formal sample plots. Of these 25 patches, nine (18%) had observations of incidental pellets when no pellets were recorded in the formal sample plots. Of the patches where no

incidental pellets were noted, only two (4%) had pellets counted at their sampling points (Table 2).

There were 58 notations of incidental pellets ranging from one to 1300 pellets with a mean of 90.4 pellets per incidental observation. In comparison, 58 sampling points contained patches ranging from one to 300 pellets with a mean of 30.2 pellets. Based on these data, it appears that pellet counts from opportunistic, incidental observations are valuable indicators of LKMR presence in a habitat patch.

Airfield Vegetation Conversion Project

The Airfield Vegetation Conversion Project caused changes in spatial associations as LKMR moved to other non-treatment patches and used individual patches differently (e.g., moved to patch edges). Temporary patch abandonment and spatial changes in habitat use may explain low pellet densities in treatment patches and increases in non-treatment patches as rabbits moved from altered treatment patches to adjacent non-treatment patches. This observation may explain the total increase in mean pellet densities of non-treatment patches as well as rebounding pellet densities in patches 23, 24, and 71 where the native vegetation has had sufficient time to establish and increase. Total and treatment mean pellet density may have also been adversely affected by the elimination of patch 171. Previous years' samplings consistently showed significant numbers of pellets therefore increasing previous mean pellet densities. A running 5-year average was included for the overall average calculations as to not mask the global pellet density trends as excluding a historically pellet dense patch may falsely suggest an overall decline. **Our analysis indicates that although the Airfield Vegetation Conversion Project impacted mean pellet density over all patches in 2012 – 2015, mean pellet density did not actually decline when controlling for treatment- impacted patches.**

Revised Survey Methods

The inherent limitations of the current LKMR sampling method (e.g. small plots, random placement) and tendency to underestimate rabbit patch occupancy prompted us to emphasize

incidental pellets noted in patches outside of the formal sampling plots. Opportunistic, incidental observations of LKMR pellets within a habitat patch is a better predictor of patch occupancy compared to statistical sampling methods. Several habitat patches were shown to support LKMR, despite the sample plots not detecting their presence. This phenomenon was observed in patches 1, 4, 8, 9, 15, 102, 152, and 173 where no pellets were counted in sample plots, however incidentals pellets were noted in the patch.

To assess the effectiveness of the proposed revised LKMR monitoring methods, three occupied LKMR patches (4, 157 and 160) were sampled with the revised survey methods to compare the difference in LKMR pellet density between old and new methodologies. Using the revised survey methods, all three patches had a greater average pellet density: 200%, 96%, and 155%, respectively (Figure 7). Implementation of the revised methods will undoubtedly increase efficiency, accuracy, and better illustrate population trends and vegetative associations of the LKMR.

LKMR Habitat Characteristics

The vegetative characteristics of LKMR habitat was evaluated in sample plots where LKMP pellets were detected (N = 42). The 42 sampling points with LKMR pellets averaged 56.1% herbaceous vegetation, 2.3% woody vegetation, 33.1% exposed soil and 8.6% exposed rock. Of the 42 sampling points with LKMR pellets, 29% had cordgrass, 29% had silver sea-oxeye, 29% had seashore dropseed, 10% had Gulf Coast spikerush and 5% had splitbeard bluestem. These observations confirm the known habitat preference of the LKMR and their affinity for habitats composed of dense wetland grasses, forbs and herbaceous species.

Weather Observations

Precipitation totals for 2014 and 2015 were below historical means (-3 cm and -9 cm, respectively). Similarly, breeding season precipitation for 2014 (May -107%, June -53%, July -22%) and 2015 (May -5%, June -4%, July -7%) were below historical means (FCC 2016 and NWS 2016). Two consecutive years of less than ideal precipitation patterns likely

affected the abundance and quality of forage, especially during the reproductive season, therefore accounting for some of the drop in pellet density. Lower pellet densities may also be a result of significant flooding from super-moon and lunar perigee tides that occurred in the months before sampling. Tide readings for the month of October 2015 average 0.22 m above predicted levels (NOAA 2016). Flooding can displace LKMR from habitat patches into less suitable areas and may wash away pellets.

Predator Control

Predation on LKMR by native and exotic mammals, primarily free-ranging domestic cats (*Felis catus*) and raccoons (*Procyon lotor*), is a significant factor limiting LKMR populations on NASKW and other portions of the range (Schmidt et. al. 2010, Forsys and Humphrey, 1999). Free-roaming domestic cat predation was attributed to 50% of adult LKMR mortality based on radiotelemetry and was determined to be a significant factor limiting population viability (Forsys and Humphrey, 1999). Raccoons have also been implicated as significant LKMR predators and in particular a serious threat to nesting and neonate rabbits.

Predator control efforts on NASKW have indicated that raccoons are far more abundant than free ranging domestic cats. To address concerns regarding LKMR predation, the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) was contacted in September 2005 to trap and remove the cats from NASKW properties. In 2010–2014, WS removed a total of 28 cats and 285 raccoons on Navy properties in and adjacent to LKMR habitats (Table 3, USDA 2015).

SUMMARY and CONCLUSIONS

Based on the year 2015 monitoring event and summary analysis of prior monitoring from 2006 to the present, the following summary conclusions regarding the LKMP population monitoring effort can be made:

- Annual LKMR surveys of 49 documented habitat patches were conducted annually from 2006 to 2015 at Naval Air Station Key West. LKMR pellet density over all patches increased through 2012, and then decreased in 2013 through 2015. The cause for the decrease in observed pellet density not known, and could be normal population fluctuations or the result of other factors. Mean pellet density did not appear to actually decline when patches impacted by the Airfield Vegetation Conversion Project were analyzed separately.
- The Airfield Vegetation Conversion Project resulted in the alteration and temporary displacement of LKMR habitat, and had a disruptive effect on LKMR population distribution. LKMR appeared to have relocated out of Airfield Vegetation Conversion Project affected habitat patches, and as habitat re-vegetate, the LKMP population will continue to re-distribute itself into suitable habitats.
- In order to better assess LKMR patch occupancy and pellet density, revised survey methods are proposed. These methods incorporate larger sample plots placed in LKMR habitat non-randomly. In addition, qualitative observations of LKMR pellet density in a habitat patch will supplement quantitative measures so that patch occupancy is accurately determined. A pilot study comparing the old and revised methods indicated increase efficiency, accuracy, and improved tracking of LKMR population trends.
- Weather events including extreme flooding caused by “King Tides” may have an adverse impact on LKMR populations by altering habitat occupancy patterns and degrading habitat conditions.
- Predator control conducted by NASKW is likely beneficial to LKMR populations.

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Table 1. Summary of both the Runway 07 Approach End Clearance Project and Airfield Vegetation Conversion Project by patch number, points cleared, points/patch, and mean pellet density, Naval Air Station Key West, Boca Chica Key, Florida, 2015.

Patch Number	Points/Patch (#)	Mean Pellet/m ²
1	25	0.00 [†]
2	9	0.00
3	20	2.00 [†]
8	25	0.00 [†]
9	25	0.00 [†]
11	11	0.00
12	15	0.00
13	25	0.08 [†]
16	1	0.00
23	25	0.84 [†]
24	24	0.04 [†]
71	8	9.13
153	2	0.00
155	14	0.00.
156	15	0.00
171	15	12.87 [‡]
173	25	0.00 [†]
174	25	0.00
175	5	0.00
[†] = patch contained incidental pellets [‡] = 5 year average (2005-2014)		

Table 2. Mean pellets/m² for all Lower Keys marsh rabbit habitat patches on Naval Air Station Key West, Florida, 2006-2015 and the 2015 patch status. Occupied patches had either rabbit pellets or sightings, while potential patches had neither.

Patch	Key	Area (ha)	Status	Year									
				2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	East Rockland	2.58	Occupied	ns	0.97	0.85	0.19	0.04	0.80	0.08	3.00	2.64	0.00 [†]
2	East Rockland	0.92	Potential	ns	0.00	1.31	0.78	0.00	0.00	1.78	0.00	0.11	0.00
3	Boca Chica	1.70	Occupied	ns	0.00	0.61	0.61	1.25	0.30	0.00	0.00	7.00	2.00 [†]
4	Boca Chica	1.73	Occupied	ns	1.44	1.16	0.69	1.39	1.70	0.52	0.00	0.00	0.00 [†]
5	Geiger	1.08	Potential	ns	0.00	2.40	0.61	3.36	0.00	5.55	0.00	0.00	0.00
6	Boca Chica	0.51	Potential	ns	1.11	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00
7	Boca Chica	1.64	Occupied	0.00	0.14	0.02	1.77	2.28	1.06	1.17	2.78	0.67	1.68 [†]
8	Boca Chica	4.28	Occupied	1.09	3.33	0.68	1.13	2.68	10.96	2.12	5.04	1.04	0.00 [†]
9	Boca Chica	6.33	Occupied	0.45	1.20	0.48	0.54	12.20	11.32	8.04	16.76	1.04	0.00 [†]
10	Geiger	0.44	Occupied	ns	0.00	0.96	1.66	17.20	18.80	91.60	8.00	3.00	15.00 [†]
11	Geiger	0.96	Potential	ns	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
12	Boca Chica	1.34	Potential	1.16	4.50	0.51	0.79	13.20	4.73	11.07	0.00	3.07	0.00
13	Geiger	3.74	Occupied	ns	0.00	0.00	0.04	1.72	1.80	0.40	0.00	2.08	0.08 [†]
14	Boca Chica	1.38	Occupied	1.87	16.07	6.46	7.03	9.59	0.00	7.67	13.82	0.71	4.47 [†]
15	Boca Chica	2.49	Occupied	0.02	0.91	2.09	0.84	0.72	3.44	0.28	0.60	0.00	0.00 [†]
16	Boca Chica	1.27	Potential	0.15	0.02	0.00	1.11	7.43	4.71	1.93	2.14	0.00	0.00
17	Boca Chica	1.01	Occupied	ns	0.00	0.90	0.98	3.08	12.83	0.00	0.00	0.42	0.50 [†]
18	Boca Chica	4.41	Occupied	0.56	0.26	0.65	2.15	7.56	4.92	5.52	6.68	1.76	2.12 [†]
19	Boca Chica	11.25	Occupied	4.62	8.58	5.32	5.85	20.76	6.72	21.60	5.56	10.00	2.56 [†]
20	Boca Chica	4.11	Occupied	1.39	2.97	5.24	2.80	7.60	1.84	0.56	4.64	0.00	2.04 [†]
21	Boca Chica	9.60	Occupied	1.98	4.13	2.82	2.05	14.36	7.36	4.80	1.64	0.00	16.30 [†]
22	Boca Chica	1.40	ns	0.00	0.41	0.18	2.37	0.14	0.43	1.36	0.00	0.00	ns
23	Boca Chica	10.86	Occupied	0.84	0.13	0.44	1.28	0.24	1.40	0.00	0.00	0.00	0.84 [†]
24	Boca Chica	2.03	Occupied	4.76	3.56	0.80	2.75	3.04	9.04	ns	0.92	0.00	0.04 [†]
26	Boca Chica	5.14	Occupied	ns	1.61	0.21	0.60	2.08	2.76	3.14	1.23	0.80	0.04
60	Boca Chica	5.75	Potential	ns	0.00	0.97	1.01	2.96	0.76	4.80	0.00	0.00	0.00
71	Boca Chica	1.00	Occupied	ns	0.00	0.60	4.78	6.75	10.13	0.00	0.00	0.00	9.13
82	Boca Chica	2.15	ns	ns	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	ns

Patch	Key	Area (ha)	Status	Year									
				2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
93	Boca Chica	5.89	Occupied	1.58	0.36	1.81	4.14	6.24	18.40	0.12	2.92	1.13	0.08 [†]
102	Boca Chica	2.83	Occupied	0.01	0.33	0.27	0.79	2.24	1.32	3.72	0.00	0.32	0.00 [†]
152	Boca Chica	12.80	Occupied	0.12	0.02	0.09	0.19	0.00	0.00	0.24	0.20	0.00	0.00 [†]
153	Boca Chica	0.29	Potential	ns	15.13	0.16	14.49	35.50	38.00	0.00	0.00	0.00	0.00
155	Boca Chica	1.15	Potential	0.00	0.00	0.02	0.55	0.00	0.00	0.00	0.00	0.50	0.00
156	Boca Chica	1.25	Potential	0.00	0.00	0.08	0.00	0.00	1.80	0.00	0.80	0.00	0.00
157	Boca Chica	1.91	Occupied	3.20	6.43	2.07	1.10	10.32	8.27	19.68	10.45	5.32	8.68 [†]
160	Boca Chica	2.82	Occupied	1.70	3.77	6.14	10.80	10.88	4.76	2.12	3.80	6.54	6.38 [†]
161	Boca Chica	0.31	Potential	12.56	21.02	27.18	27.28	10.33	5.33	16.33	20.00	27.00	0.00
169	Boca Chica	0.71	Potential	8.33	1.05	0.00	3.14	0.71	6.71	0.00	0.43	2.14	0.00
170	Boca Chica	0.89	Potential	ns	0.41	1.53	1.91	0.18	5.09	0.00	0.00	1.27	0.00
171	Boca Chica	1.39	ns	0.82	2.34	3.78	9.58	28.80	6.13	8.00	2.53	18.87	12.87 [‡]
172	Boca Chica	1.74	Occupied	7.36	2.58	6.86	4.10	6.39	1.22	2.28	2.83	0.00	3.9 [†]
173	Boca Chica	3.66	Occupied	0.01	0.18	0.01	0.83	0.08	0.04	5.08	0.00	0.00	0.00 [†]
174	Boca Chica	2.43	Potential	0.38	0.25	0.59	3.18	4.12	2.12	0.00	0.00	0.00	0.00
175	Boca Chica	0.47	Potential	1.14	1.97	0.00	12.29	4.80	3.20	0.00	0.00	8.20	0.00
176	Boca Chica	0.20	Potential	0.00	0.00	0.00	0.48	0.00	7.50	2.00	0.00	0.00	0.00
177	Boca Chica	1.28	Potential	0.00	2.02	0.00	1.91	0.00	0.67	38.67	0.00	0.00	0.00
178	Boca Chica	0.70	Occupied	0.00	0.00	0.00	1.27	3.43	8.86	31.00	0.00	0.00	0.00 [†]
210	Geiger	0.23	Potential	ns	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
211	Geiger	0.09	Potential	ns	0.00	0.00	0.00	0.00	0.00	29.00	0.00	0.00	0.00
ns = not surveyed				† = patch contained incidental pellets				‡ = 5 year average (2005-2014)					

Table 3. A summary of USDA predator control efforts, 2010-2015, including the number of harvested feral cats and raccoons.

Year	Cats Removed (#)	Raccoons Removed (#)	Trap Nights (#)
2010	11	39	704
2011	5	67	780
2013	5	82	868
2014	7	97	1550
2015	5	59	640
Total	33	344	4542



Figure 1. Lower Keys marsh rabbit habitat managed by the Naval Air Station Key West facility on Boca Chica, East Rockland, and Geiger Keys, Florida, USA.

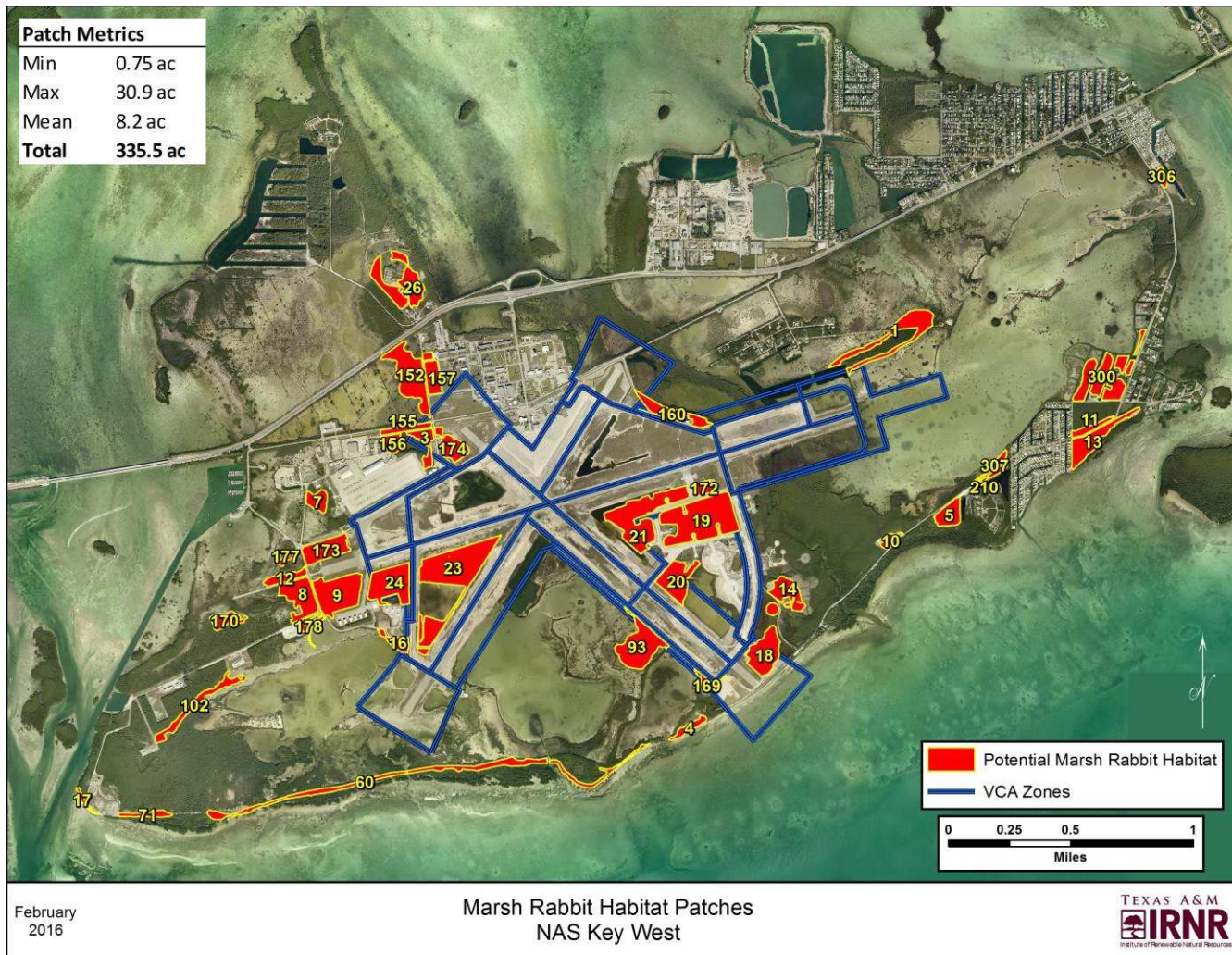


Figure 2. Airfield Vegetation Conversion Project and the vegetation conversion areas (VCAs) where brush was cleared on Naval Air Station Key West, Boca Chica Key, Florida, USA.



Figure 3. High-resolution digital elevation model (0.25 m horizontal, < 3 cm vertical) showing Lower Keys marsh rabbit patches by elevation (meters) for U.S. Navy-owned lands within the Lower Keys marsh rabbit range on Boca Chica, East Rockland, and Geiger keys, Florida, USA.

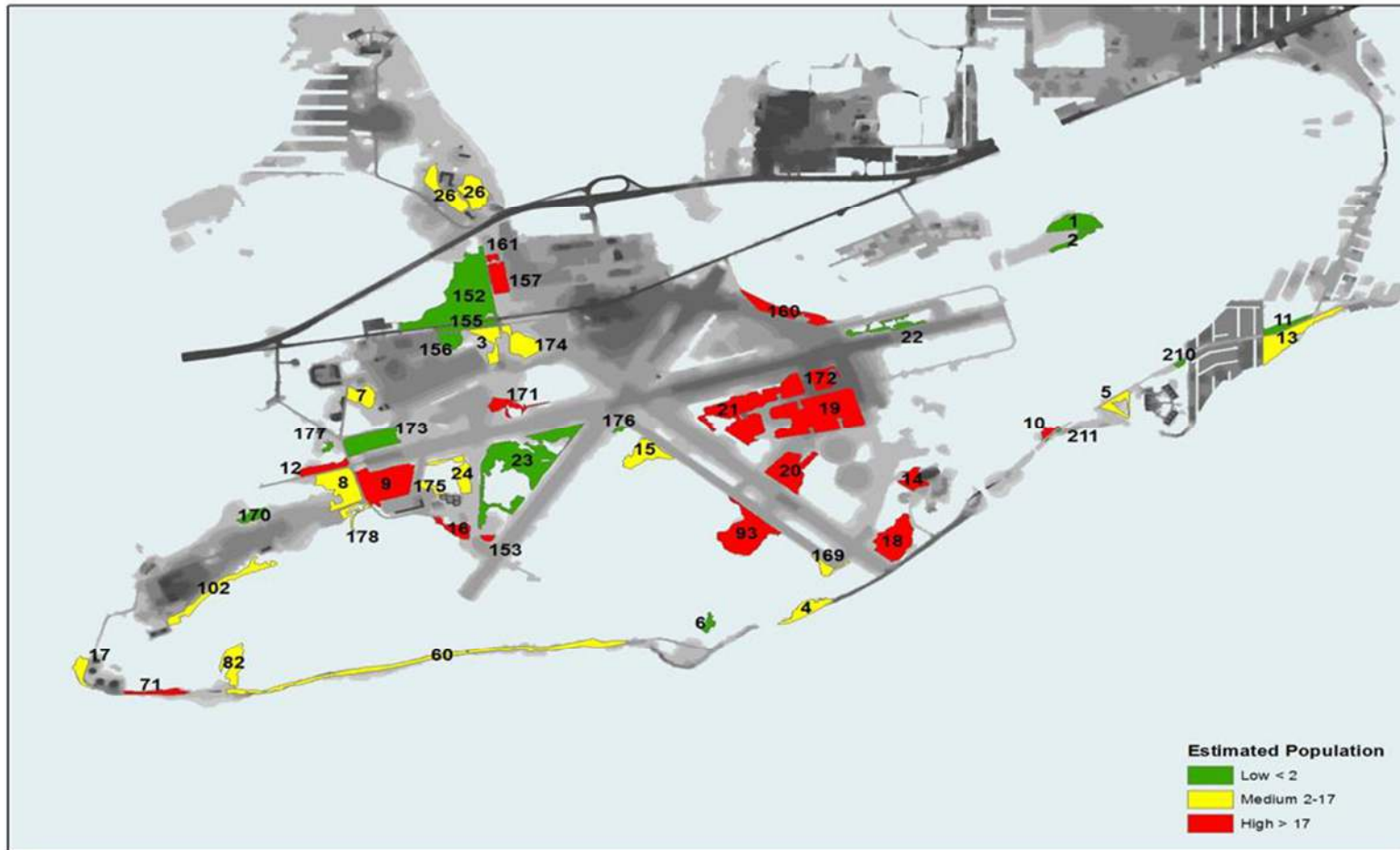


Figure 4. Estimated Lower Keys marsh rabbits (LKMR) population (low, medium, high, pellets/patch) for U.S. Navy-owned lands within the LKMR range on Boca Chica, East Rockland, and Geiger keys, Florida, USA.

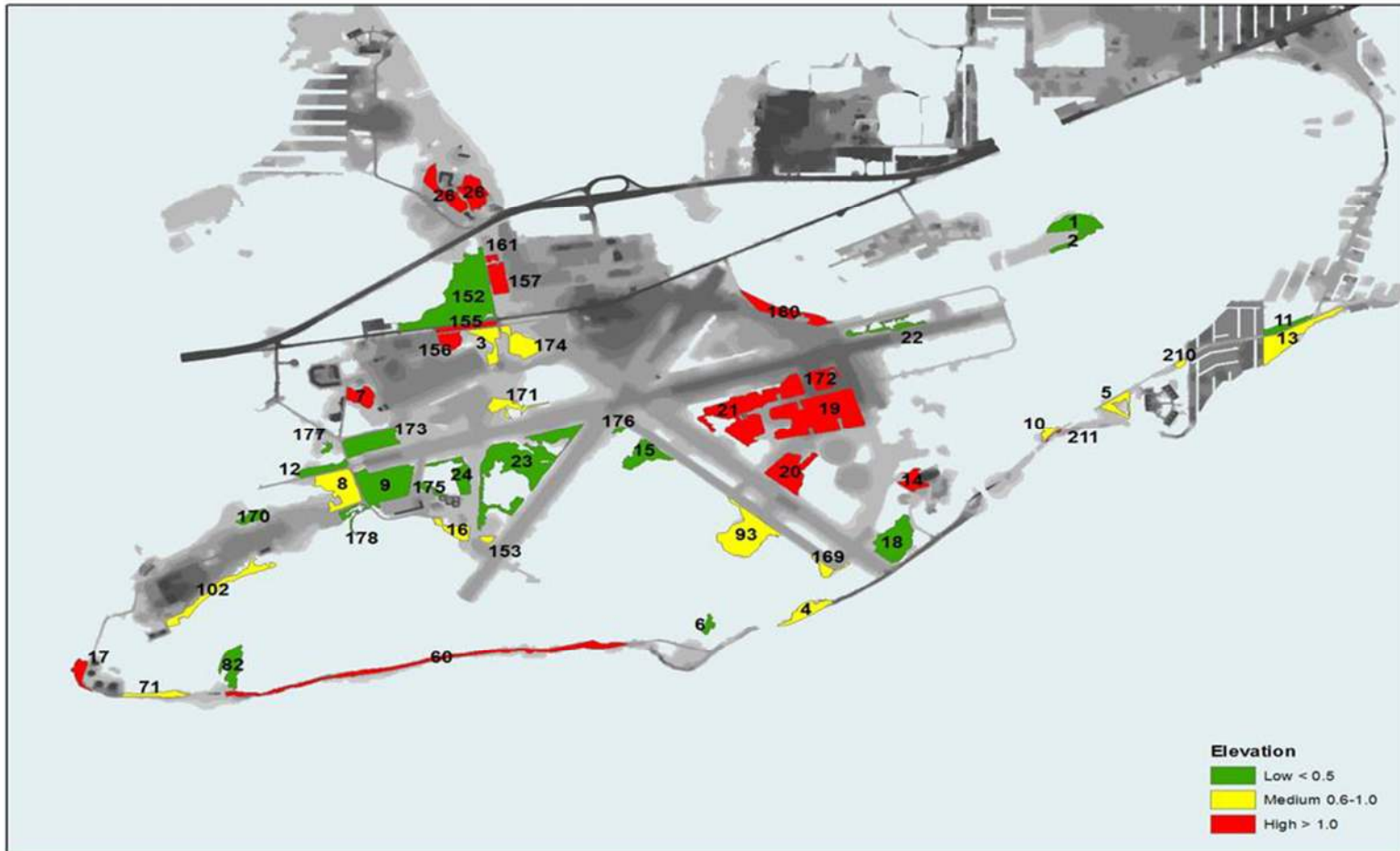


Figure 5. Lower Keys marsh rabbit (LKMR) patch elevation (low, medium, high) using high-resolution digital elevation model (0.25 m horizontal, <3 cm vertical) for U.S. Navy-owned lands within the LKMR range on Boca Chica, East Rockland, and Geiger keys, Florida, USA.

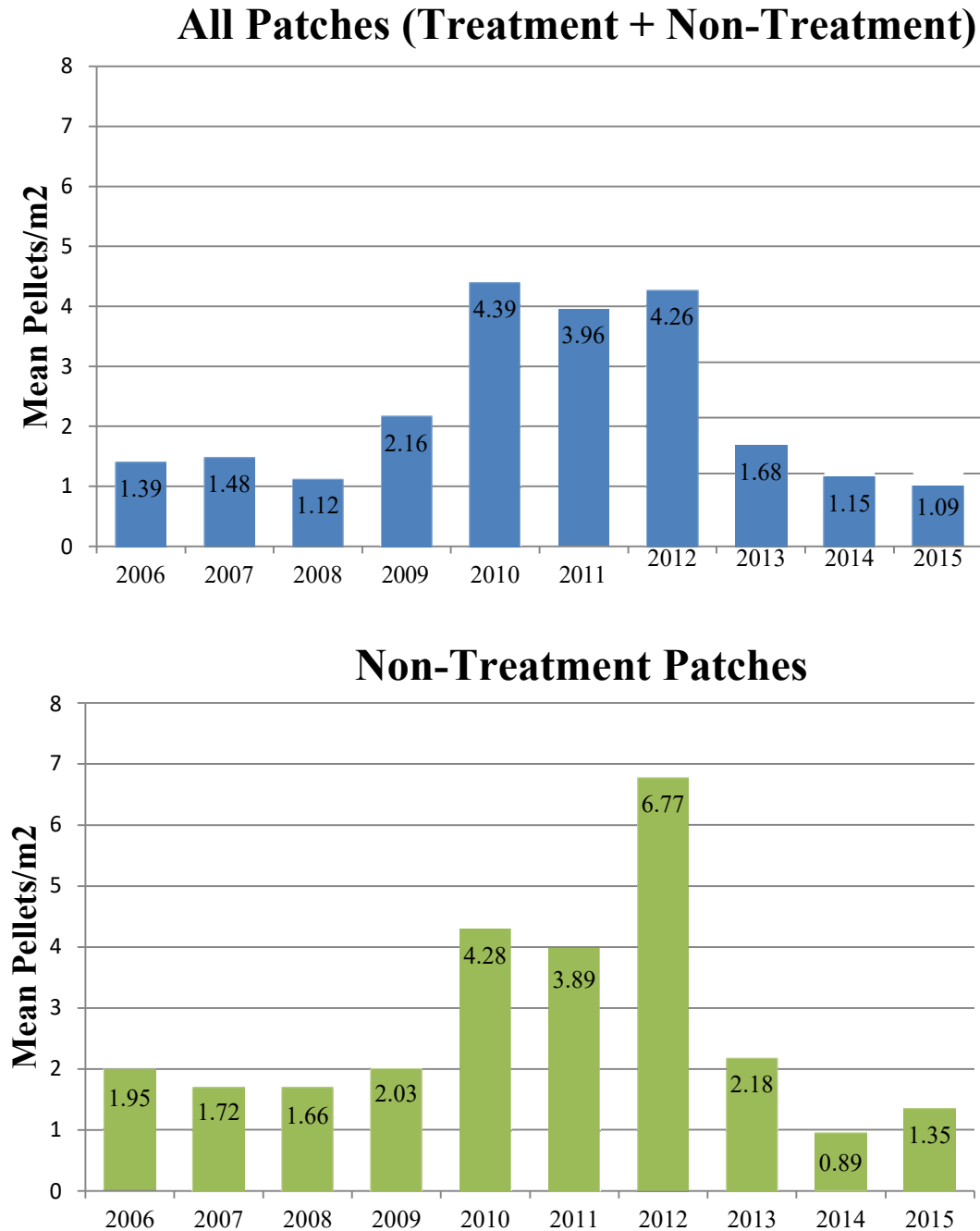


Figure 6. Observed Lower Keys marsh rabbit pellets (mean pellets/m², 5% trimmed means) for all patches (treatment + non-treatment) and non-treatment patches on Naval Air Station Key West, Boca Chica, East Rockland, and Geiger keys, Florida, USA, 2006-2015

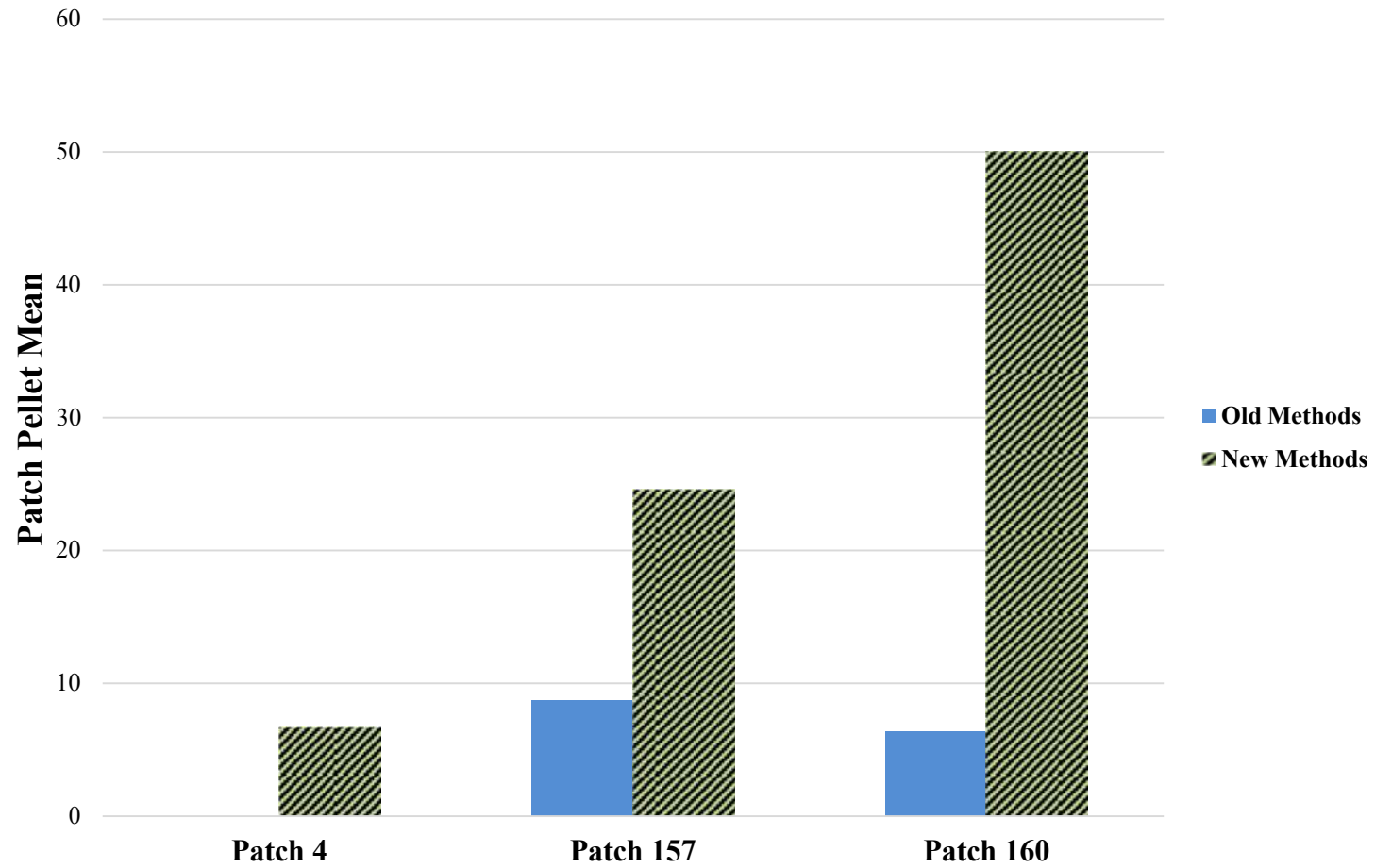


Figure 7. Comparison of 2015 patch mean pellet density using old and new methods and three different patches.

Attachment 1 – Reference Photographs



Photo of optimal occupied LKMR habitat with dense wetland grasses and scattered hardwoods.



Photo of optimal occupied LKMR habitat with dense wetland grasses and scattered hardwoods.



Photo of occupied LKMR habitat with significant encroachment of hardwood vegetation.



Photo of occupied LKMR habitat with low, open grasslands and encroachment by hardwoods including mangroves.



Photo of occupied LKMR habitat with low, open grasslands and encroachment by hardwoods including mangroves.

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Attachment 4 – LKMR Patch Assessment Form

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Lower Keys Marsh Rabbit Habitat Patch Assessment Form

Complete this form for each LKMR habitat patch evaluated

Patch ID:

Date Inspected:

Inspectors:

Duration and Extent of Inspection (minutes spent and notes on patch limits evaluated):

LKMR Fecal Pellet Assessment (Absent, Low, Medium, High, use LKMR pellet cover estimation chart):

Hardwood Density in Grasslands (estimated % cover, use veg cover estimation chart):

Infestation by Invasive Exotic Vegetation (estimated % cover, use veg cover estimation chart):

Indication of Human Disturbance (note any encroachment, ORV use, dumping):

Observations of LKMR predators (cats, dogs, raccoons, introduced reptiles):

Restoration & Management Opportunities (note any potential for restoration or management):

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Attachment 5 – LKMR Sample Habitat Restoration Projects

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Patch 157 Road Restoration Plan
Restore access, road to re-connect LKM R habitat
and reduce fragmentation.
6 DDOs require restoration area
Remove rock road, restore to LKM R habitat
Relocate road to north if needed for access

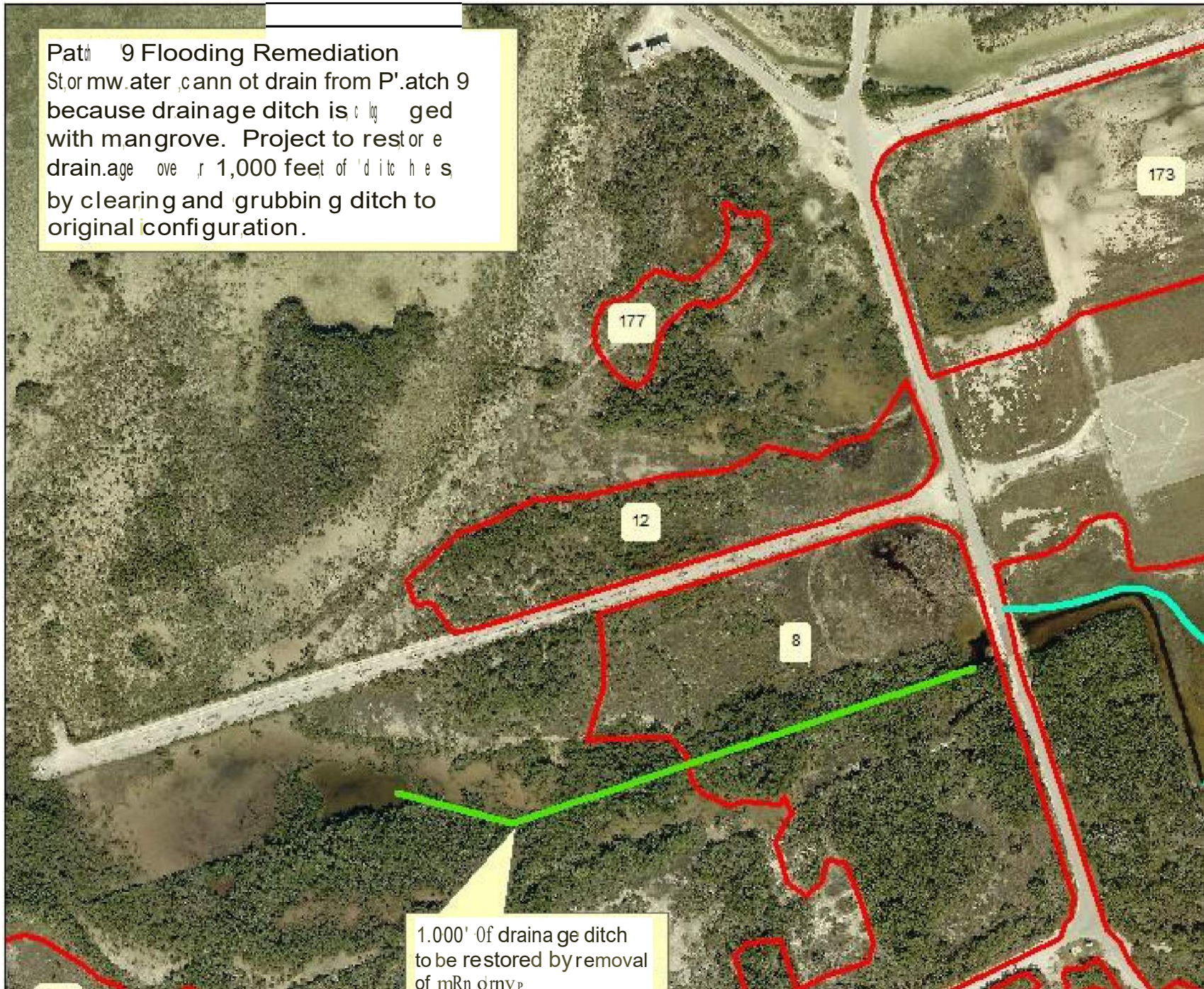


Relocate road (if needed)

157

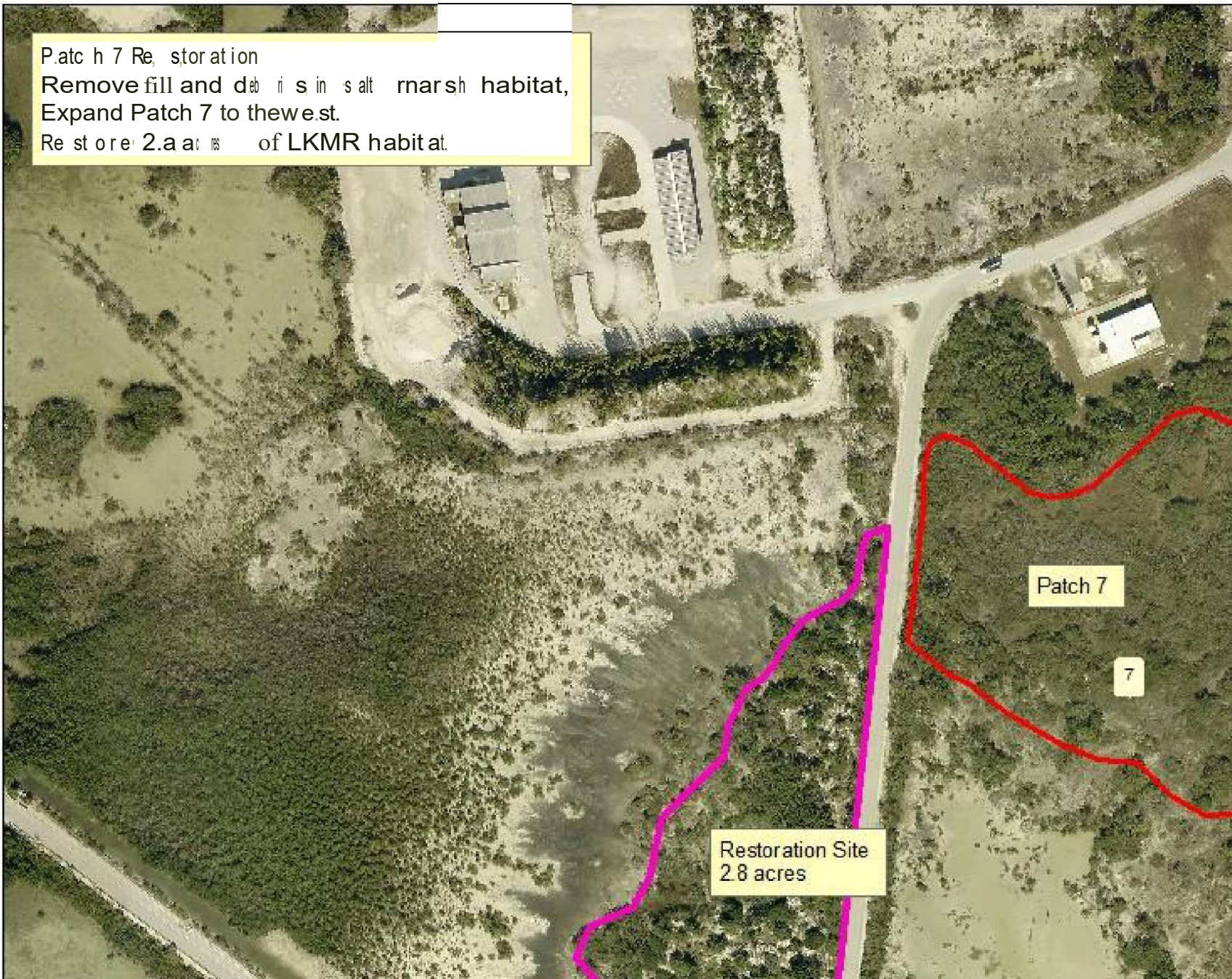
Restore

Patch 9 Flooding Remediation
Stormwater cannot drain from Patch 9 because drainage ditch is clogged with mangrove. Project to restore drainage over 1,000 feet of ditches by clearing and grubbing ditch to original configuration.



1,000' of drainage ditch to be restored by removal of mangrove.

Patch 7 Restoration
Remove fill and debris in salt marsh habitat,
Expand Patch 7 to the west.
Restore 2.8 acres of LKMR habitat.

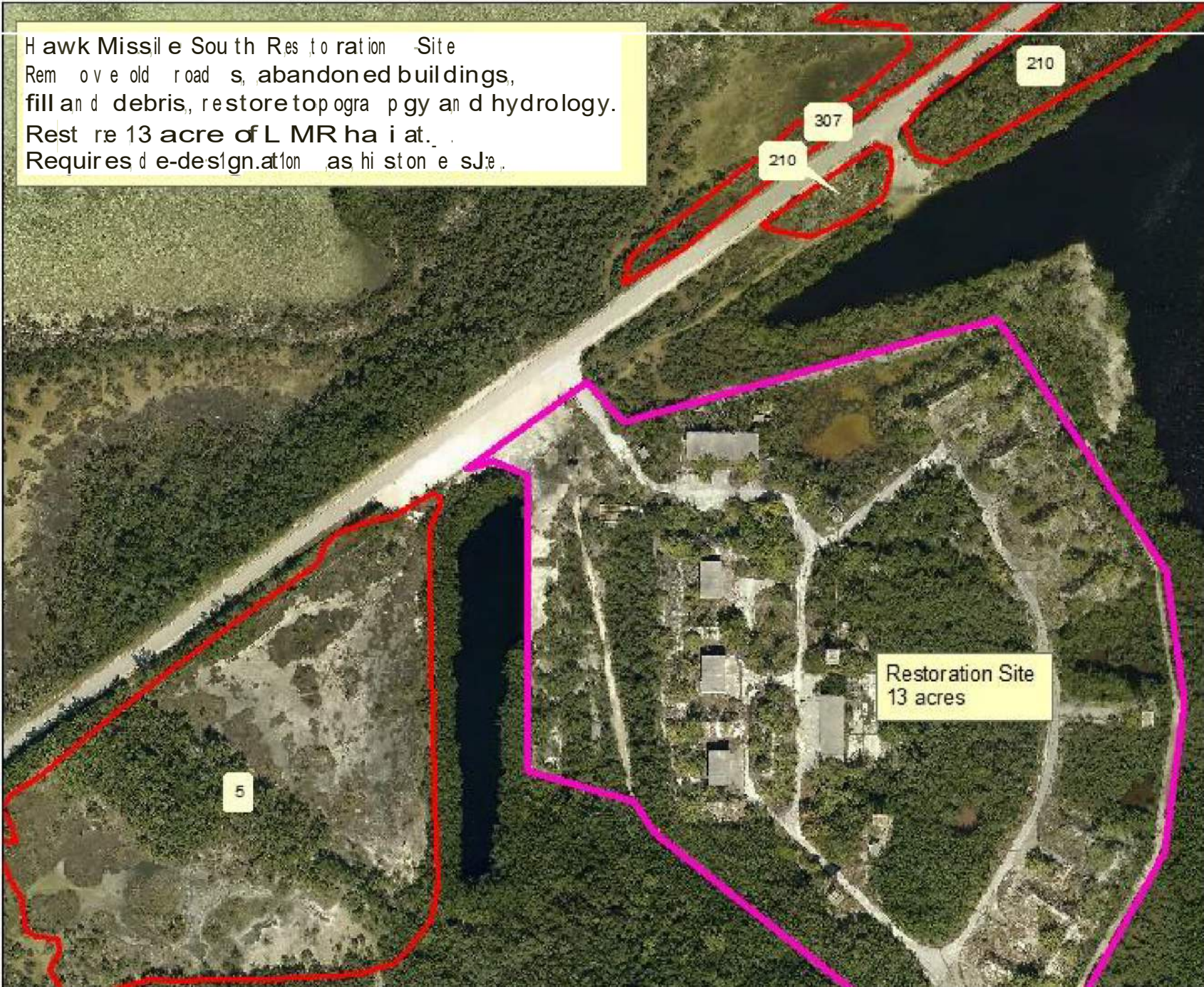


Patch 7

7

Restoration Site
2.8 acres

Hawk Missile South Restoration Site
Remove old roads, abandoned buildings,
fill and debris, restore topography and hydrology.
Restore 13 acre of LMR habitat.
Requires detailed design as historic site.



5

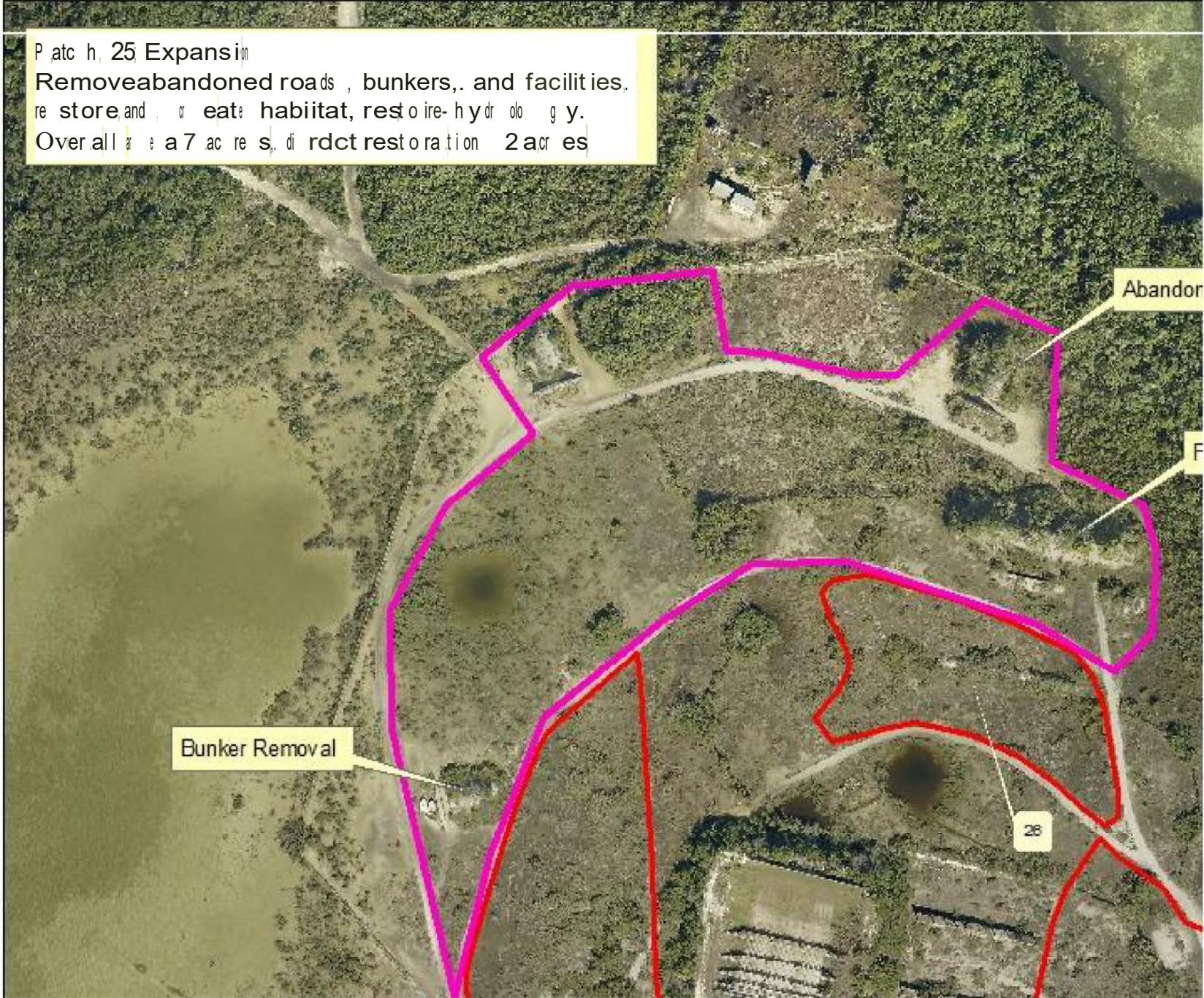
210

307

210

Restoration Site
13 acres

Part of h, 25 Expansion
Remove abandoned roads, bunkers, and facilities.
Restore and create habitat, restore hydrology.
Overall area 7 acres, direct restoration 2 acres



Abandon

F

Bunker Removal

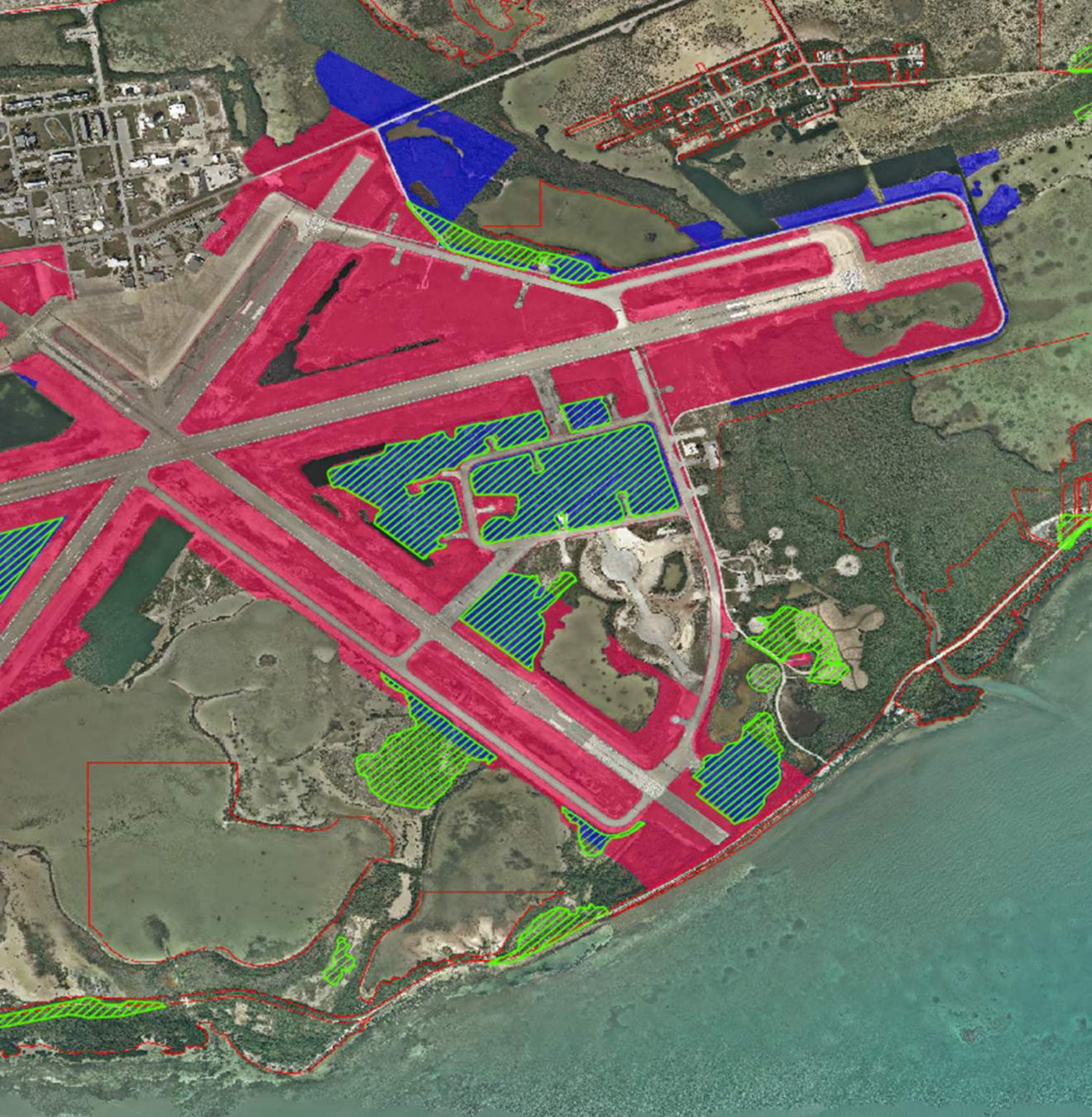
28

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Attachment 6 – Boca Chica Field Mowing Plan

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Figure 1



Legend


-  Proposed LKMR Habitat
-  Base Boundary
- Airfield Ground Maintenance Level**
-  I - 492 Acres (Mowed)
-  II - 277 Acres (Unmowed)

Aerial Photography 2013


Level I Grounds Maintenance (492 acres) - Mowing of grassland and any woody vegetation shall be cut to grade and herbicide treated.

Level II Grounds Maintenance (277 acres) - Existing woody vegetation shall be cut to grade and herbicide treated.

Coordinate System: UTM 17N



Projection: Transverse Mercator
Datum : NAD83
Sheet Size: 44" W x 34" H
Scale: 1:4,800




PREPARED BY:


Date: 5/29/2014
Naval Facilities Engineering Command Southeast
Asset Utilization Branch, AM4
Contact: SE GeoReadiness Center: (505) 293-2181

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Attachment 7 – 2015 USDA / APHIS Predator Control Report

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United States
Department of
Agriculture

February 5, 2015

Animal and
Plant Health
Inspection
Service

John Woolard
Biological Science
Technician
2025 SW Kanner Hwy.
Stuart, FL 34997

**UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
WILDLIFE SERVICES (WS)
ANNUAL STATUS REPORT
FOR FERAL CAT AND RACCOON REMOVAL
NAVAL AIR STATION KEY WEST, BOCA CHICA KEY
JANUARY 1, 2015 – SEPTEMBER 30, 2015**

T – 772-260-9669

Naval Air Station Key West (NASKW), FL, first reported observing feral cats on the base in September 1992. United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) was contacted in September 2005 to trap and remove the cats from the base. Feral cat predation is suspected to be a primary cause in the declining population of the Lower Keys marsh rabbit (LKMR). Raccoons have also been implicated as significant predators to the LKMR; particularly a threat to nesting and neonate rabbits. Our objective is to reduce the numbers of feral cats and raccoons on Boca Chica Key.

Wildlife Services employees use 12" x 12" x 30" box traps, baited with a combination of lures and attractants. Trap sites were selected (1) to best cover the geographical extent of Boca Chica; (2) to target habitat that has been suitable for feral cats and raccoons; and (3) to remove predators from areas occupied by LKMRs. All of the raccoons and cats were euthanized humanely and disposed of according to Wildlife Services policies.

ACCOMPLISHMENTS:

- Wildlife Services personnel spent 20 days at Boca Chica during 2015
- 640 trap nights (# of traps X # of nights traps were set)
- 5 Feral cats were removed (2 males, 3 females)
- 59 Raccoons were removed (32 males, 27 females)

USDA APHIS Wildlife Services employees continue to work diligently using an integrated methods approach to remove as many feral cats and raccoons as possible from Boca Chica Key. Trapping effort will shift as necessary to accommodate as many areas as possible.

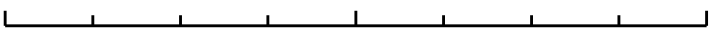


0.5

1

Miles

(points where multiple animals were trapped are indicated by a number over the point)



UNITED STATES DEPARTMENT OF AGRICULTURE
WILDLIFE SERVICES

DAMAGE CONTROL

AS OF: 2/21/16 NON PRIVATE PROPERTY: NAVAL AIR STATION KEY WEST (BOCA CHICA)

TOTALS

TRAP NIGHTS :	640	CATS TO DATE :	5
		MALE:	2
		FEMALE:	3
		TRAP:	5
		SHOOT:	0

RACCOONS TO DATE:	59
MALE:	32
FEMALE:	27
TRAP:	59
SHOOT:	0

IGUANAS TO DATE:	0
MALE:	
FEMALE:	
TRAP:	0
SHOOT:	0

DATE:	TARGET SPECIES	CAT M/F	RACCOON M/F	LONGITUDE	LATITUDE	TRAP	SHOOT	TRAPS SET	TRAPS CHECKED	TRAPS REMOVED
TO VIEW SCROLL UP AND DOWN										
3/31/2015								50		
4/1/2015	RACCOON		FEMALE	24.57503	-81.67541	X		50	50	
4/1/2015	RACCOON		MALE	24.57113	-81.67408	X				
4/1/2015	RACCOON		FEMALE	24.57039	-81.67236	X				
4/2/2015	RACCOON		FEMALE	24.57473	-81.6751	X		50	50	
4/2/2015	RACCOON		MALE	24.57041	-81.67357	X				
4/3/2015	CAT	FEMALE		24.58045	-81.7013	X		50	50	
4/3/2015	RACCOON		FEMALE	24.57644	-81.70476	X				
4/3/2015	RACCOON		MALE	24.56614	-81.71069	X				
4/3/2015	RACCOON		MALE	24.57293	-81.67445	X				
4/3/2015	RACCOON		FEMALE	24.57301	-81.67428	X				
4/3/2015	RACCOON		MALE	24.5727	-81.67362	X				
4/4/2015	RACCOON		MALE	24.56641	-81.70935	X		50	50	
4/4/2015	RACCOON		FEMALE	24.58121	-81.67958	X				

4/4/2015	RACCOON		MALE	24.56959	-81.67252	X				
4/5/2015								50	50	
4/6/2015	RACCOON		FEMALE	24.58575	-81.69454	X		50	50	
4/6/2015	RACCOON		MALE	24.56994	-81.70463	X				
4/6/2015	RACCOON		FEMALE	24.5676	-81.70787	X				
4/6/2015	RACCOON		MALE	24.5679	-81.70775	X				
4/7/2015	RACCOON		MALE	24.58056	-81.70316	X		50	50	
4/7/2015	RACCOON		FEMALE	24.57346	-81.70561	X				
4/7/2015	RACCOON		MALE	24.56871	-81.70426	X				
4/8/2015									50	50
9/21/2015								30		
9/22/2015	RACCOON		MALE	24.56997	-81.67243	X		30	30	
9/22/2015	RACCOON		MALE	24.5674	-81.67236	X				
9/22/2015	RACCOON		FEMALE	24.568	-81.67314	X				
9/22/2015	RACCOON		MALE	24.56944	-81.67322	X				
9/22/2015	RACCOON		FEMALE	24.58107	-81.67927	X				
9/22/2015	RACCOON		FEMALE	24.58184	-81.68165	X				
9/22/2015	RACCOON		MALE	24.58575	-81.68775	X				
9/22/2015	RACCOON		MALE	24.58369	-81.68674	X				
9/23/2015	RACCOON		MALE	24.58594	-81.69088	X		30	30	
9/23/2015	RACCOON		FEMALE	24.58412	-81.68693	X				
9/23/2015	RACCOON		FEMALE	24.57476	-81.67526	X				
9/23/2015	RACCOON		MALE	24.5729	-81.6741	X				
9/23/2015	RACCOON		FEMALE	24.57242	-81.67279	X				
9/23/2015	RACCOON		MALE	24.57225	-81.67284	X				
9/23/2015	RACCOON		MALE	24.57133	-81.67444	X				
9/24/2015	RACCOON		FEMALE	24.58412	-81.68693	X		30	30	
9/24/2015	RACCOON		MALE	24.58056	-81.67756	X				
9/24/2015	RACCOON		FEMALE	24.57133	-81.67444	X				
9/24/2015	RACCOON		FEMALE	24.5674	-81.67236	X				
9/24/2015	CAT	Female		24.58107	-81.67927	X				
9/24/2015	RACCOON		MALE	24.56837	-81.69942	X				
9/24/2015	RACCOON		FEMALE	24.56779	-81.7065	X				
9/25/2015	RACCOON		MALE	24.56843	-81.70506	X		30	30	

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**APPENDIX C—ESA-
LISTED CORALS**

C**CRITICAL HABITAT FOR ESA-LISTED CORALS**

Appendix C details background information and management actions undertaken by NAS Key West that provide a conservation benefit to corals listed under the Endangered Species Act and provides maps of areas excluded from critical habitat designation.

ESA-Listed Coral Critical Habitat

Background

Federal agencies are required by the Endangered Species Act (ESA) to manage federally listed threatened and endangered (T&E) species and their habitats in a manner that promotes conservation of T&E species and is consistent with plans for recovery of such species. Section 7 of the ESA requires all federal agencies to enter into consultation with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries (also known as the National Marine Fisheries Service, or NMFS) whenever actions are proposed that may affect listed species or species proposed for listing. The ESA also provides for designation of critical habitat of listed species. The ESA was revised via the National Defense Authorization Act of 2004, Public Law 108-136, to recognize INRMP conservation measures and species benefits that could obviate the need for critical habitat designation.

Seven species of coral species listed as threatened under the ESA occur or potentially occur in the waters adjacent to NAS Key West:

- Boulder Star Coral (*Orbicella franksi*)
- Elkhorn Coral (*Acropora palmata*)
- Lobed Star Coral (*Orbicella annularis*)
- Mountainous Star Coral (*Orbicella faveolata*)
- Pillar Coral (*Dendrogyra cylindrus*)
- Rough Cactus Coral (*Mycetophyllia ferox*)
- Staghorn Coral (*Acropora cervicornis*)

The Navy conducted comprehensive benthic marine surveys for several NAS Key West maritime areas in 2006 and 2013, and identified three of the listed coral species. *Orbicella faveolata* was found at Fleming Key Bay, Trumbo Point, Truman Harbor, and the Boca Chica Weapons Hammock Area. *Orbicella annularis* was also identified at Fleming Key Bay and Truman Harbor. *Orbicella franksi* may have been identified on the Mole Pier at Truman Harbor in 2006, but the sighting was accompanied by a notation of questionability (CSA International, Inc. 2007; HDR 2013). These results are consistent with a Coral Relocation Plan for Truman Harbor in 2004 (cited in Borneman, E., E. Koch and K. Koch, 2004). *Acropora palmata*, *A. cervicornis*, *Dendrogyra cylindrus*, and *Mycetophyllia ferox* are present within the Florida reef track. However, surveys at NAS Key West have not observed colonies of these four species. The Florida Keys National Marine Sanctuary and NOAA Protected Resources Division (PRD) hold a database of known anecdotal *Acropora* sightings in the lower Florida Keys. This data does include two colonies of staghorn coral located approximately 2,500 feet to the southeast of the runway 31 approach. These colonies were discovered in 2002.

To determine if an INRMP provides a benefit to a federally-listed species, the following three criteria are considered:

Criteria 1. Conservation Benefits of the Plan

The cumulative benefits of the management activities identified in a management plan, for the length of the plan, must maintain or provide for an increase in a species' population, or the enhancement or restoration of its habitat within the area covered by the plan. A conservation benefit may result from reducing fragmentation of habitat, maintaining or increasing the population, insuring against catastrophic events, enhancing and restoring habitat, buffering protected areas, or testing and implementing new conservation strategies.

NAS Key West will ensure that all proposed actions comply with Section 7 of the Endangered Species Act which requires at a minimum, informal consultation with the National Marine Fisheries Service when proposed actions may adversely affect the species.

Criteria 2. Implementation of the Plan

The plan provides assurances that the management plan will be implemented. Persons charged with plan implementation are capable of accomplishing the objectives of the management plan and have adequate funding for the management plan. NAS Key West environmental staff has the authority to implement the plan and have obtained all the necessary authorizations or approvals. An implementation schedule (including completion dates) for conservation efforts affecting elkhorn and staghorn corals, or their habitat, is in the plan.

NAS Key West personnel will take all appropriate actions necessary to secure funding for implementation of the plan; however, all actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under federal law. Nothing in this INRMP is intended to be, nor must be construed to be, a violation of the Anti-Deficiency Act (31 U.S.C. 1341 et seq.).

Criteria 3. Conservation Effectiveness

The plan provides assurances that the conservation effort will be effective. The following criteria are considered when determining the effectiveness of the conservation effort: (1) biological goals (broad guiding principles) and objectives (measurable targets for achieving the goals), (2) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for those parameters by which progress will be measured are identified, (3) provisions for monitoring and adaptive management, (4) provisions for reporting implementation progress and effectiveness (typically at the annual INRMP review), and (5) a duration sufficient to implement the plan and achieve the benefits of its goals and objectives.

Management Actions Providing a Conservation Benefit

1. Erosion Control

The long-term management concept for soil conservation is to identify and understand the suitability and sustainability of a soil unit for a proposed action. U. S. Department of Agriculture (USDA) Natural Resources Conservation Service soil surveys have been reviewed to determine constraints on soil management units, and may also be used to determine appropriate management practices. The USDA soil survey for Monroe County (1995) also provides information about potential erosion hazards; groundwater contamination; productivity of cultivated crops, trees, and grass; and the protection of water quality, wetlands, and wildlife habitat.

Erosion management strategies implemented at NAS Key West include:

- Using best management practices (FDOT and FDEP 2007; FDEP 2008, NASKW 2016), and the principles of soil conservation and erosion management (Smoot and Smith, 1999), to control soil erosion from all natural resources operations.
- Stabilizing and protecting disturbed areas that are highly susceptible to erosion as soon as practicable;
- Minimizing runoff velocities;
- Protecting waterways and stabilizing drainage ways that may be particularly susceptible to sedimentation;
- Retaining sediment within construction sites and reducing exposure time.
- Updating the Storm Water Pollution Prevention Plan (SWPPP) to include control measures for shoreline areas.
- Reducing mowing and increasing grass height and coverage, where practicable.
- Evaluating and mapping erosion control problem areas.
- Controlling potential erosion problems through:
 1. vegetative and structural protective covers (e.g., permanent seeding, groundcover);
 2. sediment barriers (e.g., straw bales, silt fence, brush);
 3. sediment detention ponds and basins (e.g., sediment traps and basins);
 4. pond and shore-bank protection (e.g., rip-rap);
 5. pervious surface walkways in areas of high pedestrian traffic where practicable;
 6. water conveyances (e.g., slope drains, check dam inlet and outlet protection) to control runoff;

7. timely repair of bare and eroded areas.

2. *Clean Marina*

The Clean Marina Program is a proactive partnership designed to benefit boatyards, marinas and boaters to help keep Florida's coast and waterway resources clean. This program consists of Awards & Recognition, Incentive Grants, Education and Awareness, and Clean Marina Designation.

There are 10 criteria that must be met to receive designation as a "Clean Marina":

1. Compliance with environmental regulations and submerged land lease and using Marina Environmental Measures as determined from the self-assessment checklist and designation review.
2. Available resource person at the marina who will provide customers with environmental information, and who can be contacted for inquiries about the Clean Marina Program and environmental issues pertinent to the marina.
3. Adequate and well-managed trash/garbage containers.
4. Post for viewing, or otherwise publish, a set of environmental policies used by the marina.
5. Water and land of the marina must be clean without signs of oil, sewage or litter.
6. Marinas will encourage boaters not to discharge sewage into the waters of their facilities.
7. Raw sewage discharge is prohibited.
8. Marinas will provide clean restroom facilities and access to drinking water.
9. Docks and grounds shall be well maintained for safety and appearance.
10. All marina personnel are regularly trained on marina environmental policies and procedures.

The Florida Department of Environmental Protection (DEP), together with the Clean Boating Partnership, recognized NAS Key West's Boca Chica Marina every year since 2001 as a designated Clean Marina. Boca Chica Marina was the first federal facility to receive this designation in the State of Florida.

3. Stormwater

NAS Key West stormwater discharge is regulated by the U. S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) and the state of Florida's Stormwater Multi Sector General Permit (MSGP). Stormwater is managed at NAS Key West according to the Stormwater Pollution Prevention Plan (SWPPP; NASKW 2016). The SWPPP contains engineering and management strategies designed to improve the quality of stormwater runoff. A Stormwater Pollution Prevention Team (SWPPT) was formed to determine the adequacy of the SWPPP, ensure implementation of BMPs, perform inspections and required record keeping, and carry out the annual update and certification of the SWPPP. The three major components of the SWPPP are stormwater monitoring, BMP implementation, and site compliance evaluations. Industrial activities at NAS Key West have been reviewed and the following sectors (as defined by the state of Florida "multi-sector generic permit for stormwater discharge associated with industrial activity" rule) have been identified at NAS Key West: hazardous waste treatment, storage or disposal facilities (sector K), bulk oil storage vehicle/equipment maintenance (sector P), and air transportation facilities vehicle and equipment maintenance (sector S). These sectors are formally defined in the NPDES General Permit for Industrial Activities dated 22 September 2006.

4. Wastewater Treatment

The Public Works Department (PWD) Utilities and Energy Management Branch has overall administration, management, and compliance responsibilities of the wastewater program at NASKW. In October 2015, the Navy entered into a contract with Florida Keys Aqueduct Authority (FKAA) to provide wastewater utility service for NASKW. FKAA has ownership and responsibility for the wastewater utility systems and treatment plant. There are a total of five (5) wastewater utility systems. The locations are Boca Chica Field, Naval Branch Health Clinic, Sigsbee Park, Truman Annex and Trumbo Point including Fleming Key.

Critical Habitat

This INRMP is a management tool used by NAS Key West personnel to ensure that the potential impacts of planned Navy actions on threatened coral species, or their habitats, is recognized at an early stage and to provide guidance for diminishing or eliminating any potential deleterious impacts. As discussed previously in this Appendix, and detailed in the main text of the INRMP, NAS Key West has implemented numerous management actions and projects that conserve threatened corals and their habitats. A realistic implementation schedule for future work has been developed and is specified in the INRMP, and funding for many projects has already been secured and implementation begun. Measurable objectives and metrics have been established, as have provisions for monitoring and evaluating conservation effectiveness. As a result of these measures, benefit is provided to federally-threatened coral populations and their habitat, and provisions are in place for the long-term conservation of these species. It is therefore the Navy's determination that this obviates the need for critical habitat designation in the

areas shown in Appendix C, Figures C-1 thru C-14. Areas appropriate for exclusion from critical habitat designation include those designated as “restricted” under Navigation and Navigable Waters, Title 33 Code of Federal Regulations (CFR) Part 334.610. Additionally, the Navy has requested exclusion from critical habitat designation all additional near shore areas pursuant to section 4(b)(2) of the ESA, but also believes these areas (Appendix C, Figures C-1 thru C-14) to be appropriate for exclusion pursuant to section 4(a) (3) (B) (i) of the ESA.

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- Florida Department of Transportation and Florida Department of Environmental Protection (FDOT and FDEP). 2007. Florida Erosion and Sediment Control Designer and Reviewer Manual, Prepared by HydroDynamics Incorporated, Parker, Colorado, in cooperation with the University of Central Florida, Orlando, Florida.
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Figure C-1.



Figure C-2.



Figure C-3.



WATERWARD LIMITS OF NAVY CONTROL/OWNERSHIP
MEDICAL CLINIC AREA

Figure C-4.

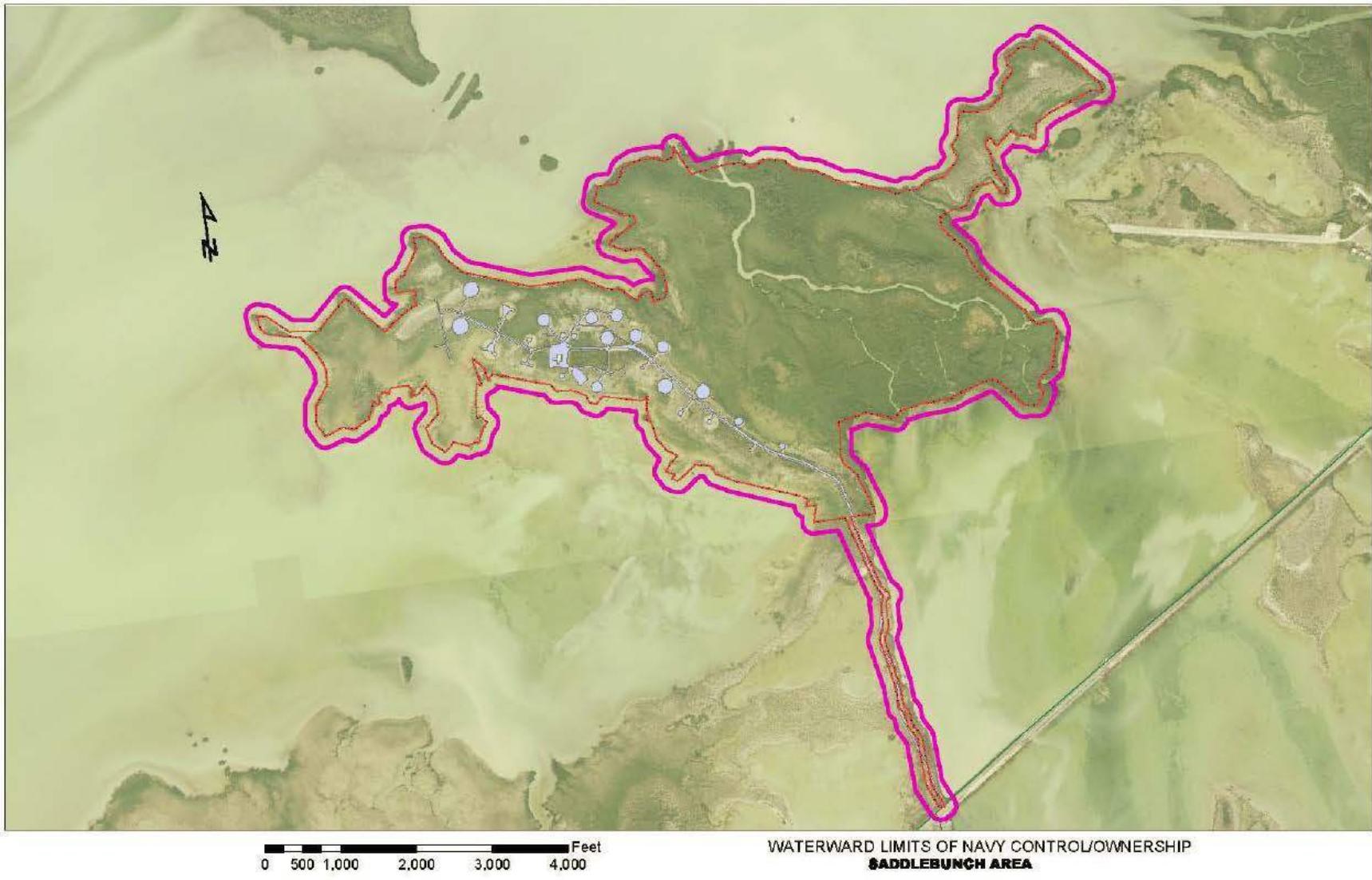


Figure C-5.



Figure C-6.



Figure C-7.



Figure C-8.

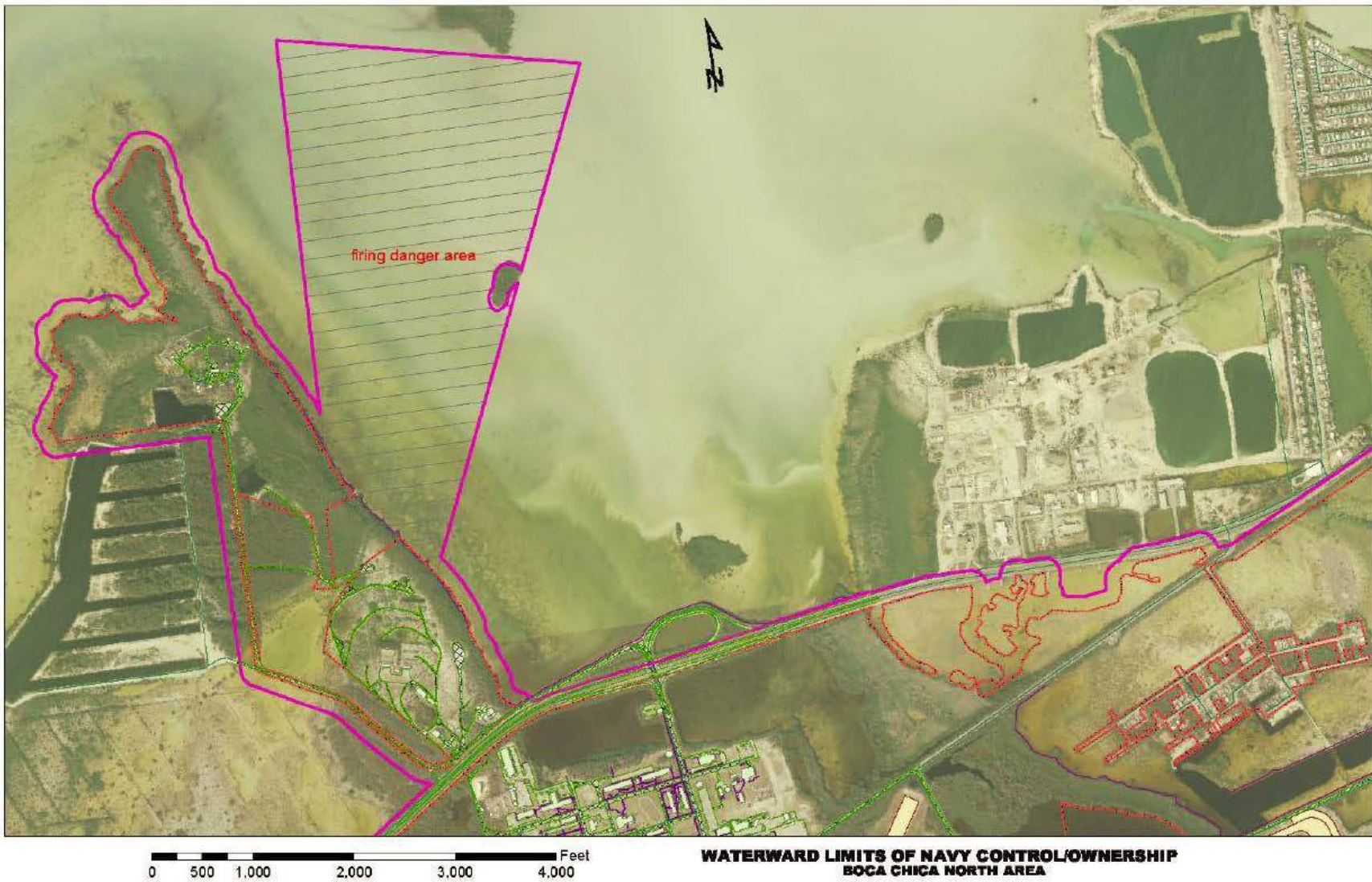


Figure C-9.

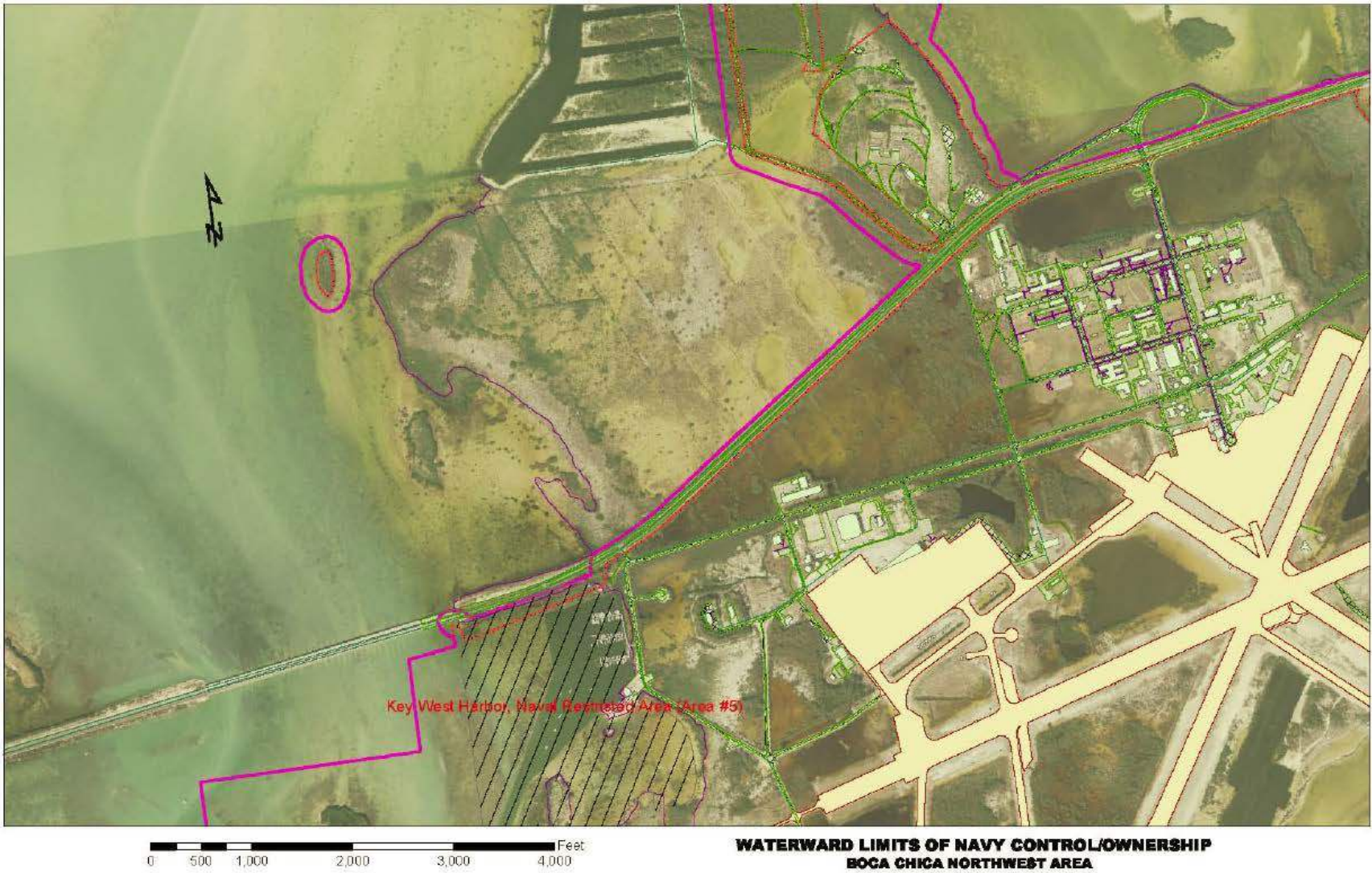
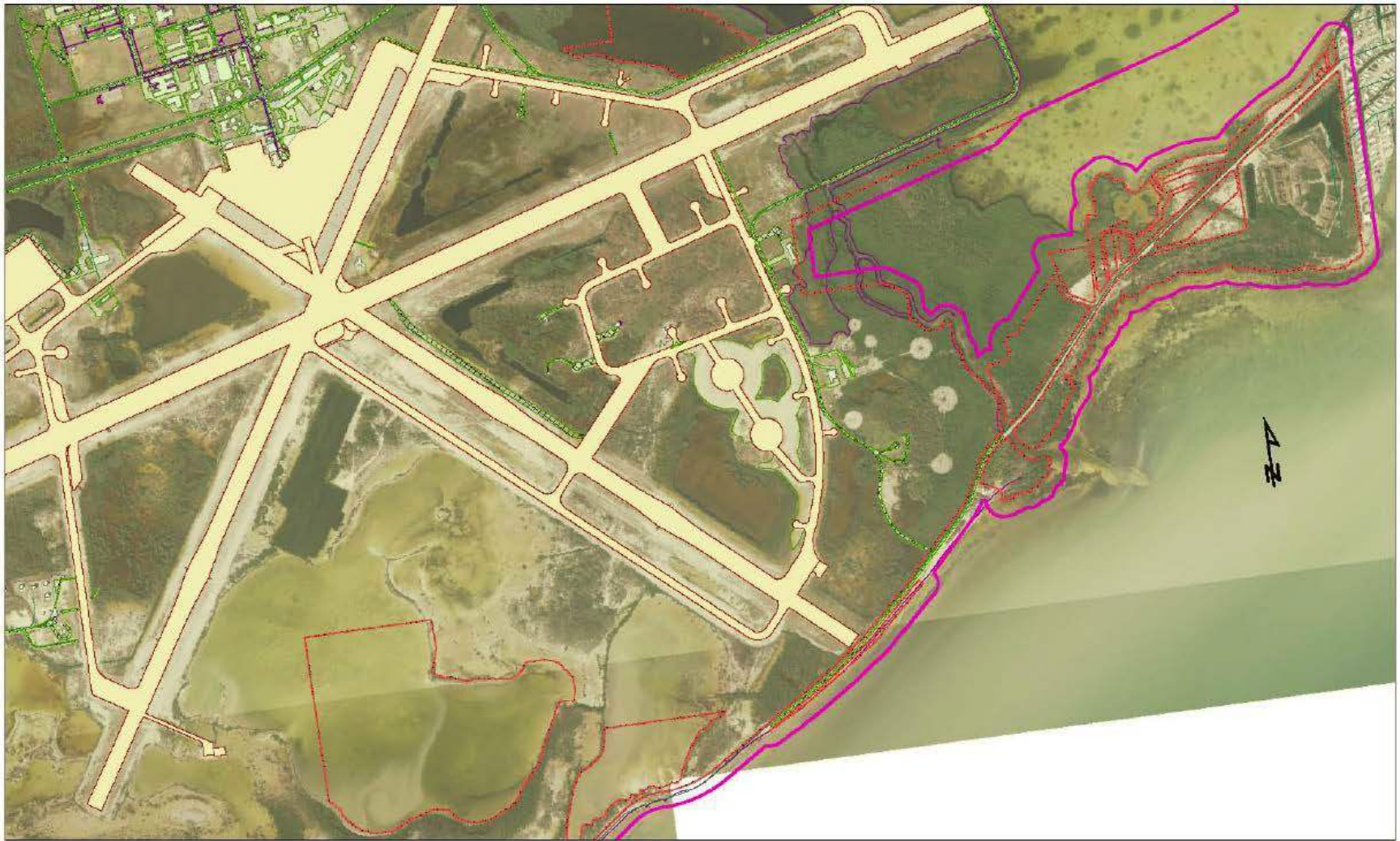


Figure C-10.



Figure C-11.



**WATERWARD LIMITS OF NAVY CONTROL/OWNERSHIP
BOCA CHICA SOUTHEAST AREA**

Figure C-12.



0 500 1,000 2,000 3,000 4,000 Feet

WATERWARD LIMITS OF NAVY CONTROL/OWNERSHIP
BOCA CHICA SOUTHWEST AREA

Figure C-13.



0 500 1,000 2,000 3,000 4,000 Feet

**WATERWARD LIMITS OF NAVY CONTROL/OWNERSHIP
BOCA CHICA WEST AREA**

Figure C-14.

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**APPENDIX D– BASH
PLAN**

D

Bird Aircraft Strike Hazard (BASH) Plan

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DEPARTMENT OF THE NAVY

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NASKWINST 3751.1D
N3
19 Oct 15

N1>.VAL AIR STATION KEY WEST INSTRUCTION 3751.1D

Sub j: BIRD/ANIMAL l>.IRCR.AFT STRIKE HAZI>RD (BASH) REDUCTION PROGRAM

Ref: (a) OPNAVINST 3750.GR
(b) NASKW Integrated Natural Resources Management Plan
(c) CNXC Bl>.SH Implementing Guidance dtd 7 Jul 11
(d) CNIC Bird/Animal Aircraft Strike Hazard (BASH) Manual
(e) FAA Advisory Circular 150/5200-32A
(f) PAA Advisory Circular 150/5200-33B
(g) USDA/CNIC Work/Financial Plan

i::ncl: (1) NASKW Bird/Animal Aircraft Strike Hazard Reduction Plan

1. Purpose. To issue enclosure (1), per reference (a) through (g), which provides guidance for bird and animal aircraft strike hazard reduction in areas where flying operations are conducted.

2. Cancellation. NASKWINST 3751.1C.

3. Background

a. Bird strikes have plagued naval aviation since its early beginnings. The Navy's first loss of life due to a bird strike occurred in 1914, coincidentally the same year it obtained its first aircraft. Since 1981, Naval Aviators have reported over 16,550 bird strikes, which resulted in over 440 aircraft mishaps, 250 foreign object damaged (FOD) engines and 372,000,000.00 in damage costs. Additionally, ten aircraft were destroyed along with one fatality. The Naval Safety Center's review of recent Navy BASH incidents found that the lack of an effective installation BASH program was a consistent contributing factor. The BASH program manages risk by addressing specific aviation safety hazards associated with wildlife near airfields through coordination among all the entities supporting the aviation mission. The BASH program should also strive to effectively minimize secondary **consequences of strikes, such as damage to aircraft, environmental cleanup due to aircraft crashes, and impairment of**

training. The program encompasses all actions that identify, reduce, or eliminate bird or other animal hazards to aviation. Specifically bird avoidance and bird control (including harassment, ground maintenance, habitat modification and depredation). Success of the program, therefore, can be measured by the steady reduction and low recurrence rate of actual wildlife-to-aircraft strike events. Such success will be gained by the persistent application of dedicated resources, focused leadership support, execution of time-tested practices and procedures, effective monitoring programs, and institutionalized BASH training across this command.

b. Per reference (c), the goals of the guidance contained in this instruction are to increase the reporting and identification of strike events and to reduce BASH incidences at Naval Air Station Key West (NASKW). These goals can be accomplished by reducing the quality and attractiveness of the Boca Chica Airfield as habitats for identified problem wildlife, manage wildlife populations to minimize the potential for aircraft strikes, and through coordination with aircraft custodians and shore-based air operations personnel to improve the reporting and communications on both wildlife management and aircraft strikes.

4. Responsibility. The NASKW Air Operations Officer (OPSO) is responsible for execution oversight of this program, and serves as the central point of contact for BASH coordination and planning with other departments, tenant organizations, and the local community. The Public Works Officer (PWO), Environmental Director, and Natural Resources Manager have periodic calendar duties as well as an advisor role regarding animal activities. Tenant commands shall coordinate their efforts with NASKW through the Bird Hazard Working Group (BHWG).

5. Objectives. A bird/animal aircraft strike hazard (BASH) exists at the airfield and in the vicinity of NASKW due to resident and migratory bird species and other wildlife. Bird activity is especially high at NASKW due to its unique location on the Florida Keys and its natural stop for the fall and spring migration. Daily and seasonal bird/wildlife movements create various hazardous conditions to aviation. This program shall:

a. Establish the Bird Hazard Working Group, also called the BASH Committee, and designate responsibilities to its members.

b. Establish procedures for identifying and reporting local hazardous bird activity.

c. Identify high hazard situations and establish Bird Watch Conditions (BWC).

d. Provide for dissemination of information on bird hazards and recommend procedures for avoidance to all local and transient aircrews.

e. Establish aircraft and airfield operating procedures to avoid high hazard situations.

f. Establish guidelines to decrease the airfield attractiveness to birds and other wildlife.

g. Provide active and passive procedures for dispersing and hazing birds when they pose a hazard.

h. Identify criteria and procedures for depredation.

i. Establish procedures to alter or discontinue flying operations during hazardous conditions.

j. Establish procedures for reporting damaging and non-damaging bird strikes.

k. Establish procedures for the collection of bird remains for proper identification and data collection.

6. Action. This plan is based on known hazards from both resident and seasonal wildlife, particularly bird populations. Implementation of specific portions of this plan is continuous, while other parts will be implemented as required by bird and animal activity.

NASKWINST 3751.1D
19 Oct 15

7. Administration. This plan shall be reviewed and updated annually by the BHWG. Recommended changes should be submitted to the OPSO.



S. P. MCALEARNEY

Distribution:
NASKWNOTE 5216 (Lists A and C)
VFA-106
VFA-122
VFC-111
Aviation Safety Officer
Natural Resources Manager

NASKWINST 3751.1D
19 Oct 15

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NAVAL AIR STATION KEY WEST, FLORIDA
BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH) REDUCTION PLAN



AIR OPERATIONS DEPARTMENT

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NASKW BIRD/ANIMAL AIRCRAFT STRIKE HAZARD REDUCTION PLAN

1. SITUATION

1.1. General. Boca Chica Field (N24°,34.55' W81°,41.33') located at NASKW, occupies a total of 3,912 acres in Monroe County, Florida. The airfield is located entirely on Boca Chica Key and is situated between the Atlantic Ocean and Gulf of Mexico. Tidal pools, drainage ditches, fresh/salt water ponds, mangrove trees, and multiple environmentally protected areas surround the airfield's runways and taxiways. Boca Chica Key consists of consolidated limestone and has a mean elevation of five feet. The air station is drained down through the porous limestone into several lagoons and drainage ditches. There are approximately 3,000 acres of undeveloped land on Boca Chica Field, consisting mainly of mangrove swamps, salt marsh flats and buttonwood zones. There are two ponds located on the airfield as well. These ponds have a salinity composition of one part per 1000th of salinity, making them in all practical purposes, fresh water. Black and Red Mangroves dominate the mangrove swamps which have almost no under-story. Salt marsh flats are characterized by low herbaceous vegetation. Buttonwood and white mangrove are the typical woody plant in the buttonwood zone. Tropical hardwood low hammock vegetation and stands of Australian pine grow on the upland unimproved lands.

1.1.1. Refuse Transfer Station. The City of Key West's refuse transfer station is located on Rockland Key, 2 miles north of the airfield. This waste transfer station is fully enclosed; however, the putrescible waste odor occasionally attracts birds. The former Stock Island landfill, located three miles northwest of the airfield, and the former Boca Chica waste water treatment plant, located one mile north, are no longer used and also occasionally attract birds.

1.1.2. Land Out-leases. There are no agricultural (farming) activities on or around the naval air station other than the normal maintenance requirements of the field.

1.1.3 Endangered and Threatened Species. NASKW personnel are prohibited from harassing or killing endangered or threatened species or species of special concern. Endangered and threatened animals, reptiles, and amphibians on or around NASKW include: Key Largo Woodrat, Silver Rice Rat, Key Largo Cotton Mouse, West Indian Manatee, American Crocodile, Indigo Snake, Sea Turtle, Key Ringneck Snake, Brown Snake, Crowned Snake, and Ribbon Snake. Endangered and threatened bird species that exist on NASKW airfield are: Bald Eagle, Roseate Tern, Least Tern, White-crowned Pigeon, and Peregrine Falcon. Bird species of special concern includes: Osprey.

2.1 Purpose. No single solution exists to this BASH problem, and a variety of techniques and organizations are to be involved in the control program. This plan is designed to:

a. Establish a BHWG with representatives from Public Works, Environmental, Aviation Safety, Airfield Services, and Air Traffic Control.

b. Oversee procedures to identify high hazard situations and establish BWC.

c. Oversee aircraft and airfield operating procedures to avoid high-hazard situations.

d. Oversee guidelines to decrease airfield attractiveness to birds and other wildlife.

e. Oversee the guidelines for dispersing birds when they occur on the airfield.

3.1. Implementation. This plan will be implemented upon receipt and remain active year round. This plan contains two phases of operation. Phase I concentrates on bird control and dispersal and is in effect year round; Phase II is an increased hazard awareness and is used in conjunction with Phase I

procedures and concentrates on risk management through bird avoidance using scheduling and airfield operating restrictions. Phase II is normally implemented during the fall and spring bird migration periods when aircraft-bird interaction is increased.

4.1. Responsibilities and Tasking

4.1.1. OPSO. The OPSO is responsible for execution oversight of this program, and serves as the central point of contact for BASH coordination and planning with other departments, tenant organizations, and the local community. The OPSO will develop and maintain a BHWG, to meet semi-annually (OCT, APR) or as hazards warrant to discuss bird abatement procedures and monitor effectiveness of such procedures. The OPSO will Chair the BHWG.

4.1.2. Airfield Manager (AFM) shall:

a. Monitor base-wide compliance with the BASH Plan and report all aircraft bird/animal strikes and hazards per reference (a) of this instruction.

b. Maintain and review a file of all Bird Strike Hazard Reports occurring at air station as well as other pertinent BASH material.

c. Liaise with all aviation activities at NASKW to continue to develop and maintain awareness of this plan.

d. Continue to develop an information and education program at NASKW to disseminate bird hazard information to tenant and transient aircrews.

e. Coordinate with aircrews, ground crews and maintenance for collecting non-fleshy remains (feathers) after bird/animal strikes. Remains should be forwarded to the United States Department of Agriculture (USDA) Wildlife Biologist and thence to the Smithsonian Institution for documentation and identification.

f. Establish an annual BASH program self-assessment process; incorporating appendix A-3 of Reference d. Document the self-assessment in the April BHWG minutes.

4.1.3. Air Traffic Control Officer shall:

a. In the absence of the AFM, carry out his or her duties as per this instruction.

b. Supervise the Air Traffic Control Supervisor of BASH related duties as per this instruction.

b. Attend the BHWG meetings to advise members of hazardous situations at the field relating to bird and animal activity.

d. Keep air traffic controllers apprised of hazards discussed at BHWG meetings and ensure information is passed to aircrews.

4.1.4. Air Traffic Control Tower Supervisor shall:

a. Declare and issue bird watch conditions, via the Automated Terminal Information System (ATIS) and ground/tower radio frequencies, whenever bird activities are observed. See Appendix A and Appendix B for operational guidelines and Bird Hazard Condition Plan.

b. Shall authorize tower controllers to issue bird watch conditions in his/her absence.

c. Notify the Flight Planning Office to ensure current Bird Watch Conditions are posted; ensuring all aircrews are aware of the potential bird hazards at NASKW.

d. Notify ground crews and initiate bird dispersal/abatement procedures when potentially hazardous bird activities are observed.

e. Report all bird strikes and significant wildlife activity to the AFM.

f. Fill out BASH Form Appendix E and forward it to the AFM.

g. Solicit BASH Pilot Reports (PIREPS) from crews when safely airborne.

h. Attend the BHWG to advise other members concerning Air Traffic BASH safety concerns.

4.1.5. Airfield Services Division Officer shall:

a. Establish and have available a Bird Detection and Dispersal Team (BDDT) with at least two members per shift who are properly trained in the use of pyrotechnics and vehicle "hazing" techniques, in order to conduct bird dispersal activities. See Appendix C for guidelines.

b. When hazing is conducted, maintain a log marked "Bird Hazing Log" noting:

- (1) Time and date.
- (2) Location (runway, taxiway, ramp etc.).
- (3) Number of animals/birds.
- (4) Means of dispersal (i.e., vehicle siren, 15MM Screamer, etc.).
- (5) Effectiveness.
- (6) Weather conditions.
- (7) Other pertinent information.

c. During conditions of MODERATE and SEVERE bird watch conditions, utilize vehicular hazing and pyrotechnics for bird dispersal if requested by air traffic control.

d. Establish a bird specimen recovery team in order to gather evidence following any bird strike. Refer to Appendix F for procedures in recovery.

e. Establish a "Bird Specimen Recovery Kit" as per Appendix F, to be maintained and retained by the Field Services Division.

f. Attend the BHWG.

4.1.6. The Public Works Department and the Environmental Department (Natural Resources Manager) shall work closely with each other due to the overlapping of BASH related tasks. Habitat manipulation is the easiest and the long-term solution to reduce the attractiveness of the installation to raptors, gulls, egrets, sea-birds and other wildlife. The overall objective would be to provide a nearly uniform natural environment with no unique features, and little edge effect that either rabbits or raptors could use. Due to the unique location of NASKW, this uniform natural environment is impossible. However, certain tasks can be done to reduce this attractiveness at NASKW.

4.1.7. Public Works Officer shall:

a. Attend the BHWG to monitor and advise the other members concerning short-term and long-term projects related to habitat manipulation.

b. Manage the habitat in conjunction with the Environmental Department, at NASKW to reduce and/or remove the attractiveness of the installation to birds and other hazards to aviation.

c. Correct environmental conditions in conjunction with the Environmental Department, that decreases BASH potential as practicable. All applicable laws and environmental regulations shall be carefully considered and complied with in accordance with Navy doctrine and civil law.

4.1.8. Natural Resources Manager shall:

a. In conjunction with the PWO, will manage the habitats at NASKW to reduce and/or remove the attractiveness of the installation to birds and other hazards to aviation.

b. Attend the BHWG to monitor and advise the other members concerning environmental matters.

c. Maintain and update BASH maps of surrounding areas used to identify bird and animal habitats and specific BASH hazards. Provide these maps to ATC Flight Planning and the AFM for educating local and transient aircrews of bird hazard locations.

d. Initiate surveys and writes environmental impact assessments and statements as required by Navy instruction and civil laws.

e. Conduct regular bird and animal surveys and forward information to the BHWG.

f. Develop and publish the Wildlife Hazard Mitigation Plan.

g. Correct environmental conditions, or provide recommendations to the PWO that decrease BASH potential as practicable. All applicable laws and environmental regulations shall be carefully considered and complied with in accordance with Navy instruction and civil law.

h. Develop a long-range program in conjunction with all base improvements and modifications in an attempt to make the airfield as unattractive to birds and animals as feasible.

i. Provide any additional information on migratory, local and seasonal bird activities through contact with the U.S. Fish and Wildlife Service, local ornithologists, and other agencies to the BHWG and immediately to the Air Traffic Control Officer if the situation/hazard warrants. Recommend implementation of Phase II BWCs during migratory seasons.

4.1.9. United States Department of Agriculture (USDA) Wildlife Biologist (WB). The primary objective of the USDA WB, when assigned, is to establish and continue an Integrated Wildlife Damage Management program (IWDM); incorporating direct assistance toward the execution of this BASH Reduction Plan and to provide technical recommendations to the BHWG. Although the specific duties and responsibilities of the USDA WB are outlined in the USDA and CNIC Work/Financial Plan (Appendix H), the following NASKW objectives will be adhered to:

- a. To supplement and enhance the overall Natural Resource program for NASKW.
- b. To monitor wildlife activity while evaluating the effectiveness of IWDM program efforts.
- c. To facilitate the acquisition and renewal of an annual migratory bird depredation salvage permit and state depredation permits, as needed.
- d. To assist in wildlife-strike reporting and monthly briefings on the status of the BASH program.
- e. To assist with the review and revision of the installation BASH Plan to ensure updated, effective techniques are in place to reduce the threat of wildlife strikes to aircraft.
- f. To assist in the collection, preparation and shipment of wildlife strike remains to the Smithsonian Institution for positive identification.
- g. Serve as a member of the installation BHWG.
- h. To train NASKW personnel that may be part of the installation Bird Detection and Dispersal Team (BDDT) in the use of pyrotechnics.
 - 1. To train BDDT on use of active scare techniques, as well as placement of static wildlife deterrent devices.
- m. To provide training to local flying units detailing bird and animal strike hazards.

4.1.10. The BHWG is organized to implement and monitor the BASH Plan. It allows NAS Departments that are affected by bird/animal problems the opportunity to meet and discuss possible solutions and concerns. The following individuals are assigned to the BHWG:

Air Operations Officer (Chairman)
Airfield Manager

NASKW Aviation Safety Officer
VFC-111 Aviation Safety Officer
VFA-106 Aviation Safety Officer
Air Traffic Control Facilities Officer
Control Tower Supervisor
Airfield Facilities Division Officer
Environmental Director
Natural Resource Manager
Public Works Officer
USDA WB (when assigned)

4.1.10.1. The BHWG shall:

- a. Execute and update the BASH Plan.
- b. Monitor base-wide compliance to the BASH Plan.
- c. Collect, compile, and review data on all bird strikes.
- d. Identify and recommend actions to reduce bird hazards.
- e. Recommend operational changes as required.
- f. Determine venues for annual review training of BASH policies and procedures.
- g. Ensure information is being presented to local and visiting aircrews.

4.1.10.2. The BHWG shall meet semi-annually (Apr and Oct) or as required when BASH issues arise.

4.1.11. Administration. All tasked individuals and organizations shall develop standard operating instructions (OIs) and/or checklists to ensure completion of assigned tasks.

5.1. Review Responsibility. The Airfield Manager is responsible for the periodic review and updating of this BASH Plan as changes in wildlife and the environment occur.

APPENDIX A**ATC, FIELD SERVICES AND AIRCREW BASH CONCEPT OF OPERATIONS**

General. The Bird Watch Condition (BWC) Plan establishes basic procedures to be used in the case of immediate BASH conditions at the airfield as well as procedures for a post-bird strike. The purpose of this plan is to disseminate time critical information to aircrews in and around the airfield to avoid bird strikes. In the event of a bird strike, this plan addresses the procedures of recovering and reporting in order to establish a database to learn from.

1. Air Traffic Control Responsibilities

a. Bird Watch Conditions (BWC) Reports (see Fig. A-1). The following terminology will be used by ATC for rapid communications to disseminate bird activity information at the field when a significant BASH condition exists. The location and altitude should be given along with the following BWC code. The following terms should be used by tower and ground controllers as well as ATIS broadcasts:

(1) BWC Severe. Severe bird activity observed on or immediately above the active duty runway or other specific locations which may represent a hazard to safe flying conditions. This area shall only be operated in at pilot request after he has been advised of the highly hazardous condition.

Dispersal may be requested by the tower for ground crews. Harassment of birds shall be done only when there are no aircraft in the local vicinity to avoid possible bird strikes. This condition shall be added to ATIS broadcast at the field.

(2) BWC Moderate. Moderate bird activity in the local vicinity constitutes a probable hazard to safe flying operations. This BWC requires increased vigilance by all agencies and extreme caution by aircrews. This condition should be added to ATIS broadcast at the field.

(3) BWC Low. Use this condition to report normal

activity on and around the airfield. This condition may be omitted from ATIS broadcast.

BWC	BIRD ACTIVITY
1. SEVERE	15+ LARGE BIRDS 30+ SMALL BIRDS
2. MODERATE	5-15 LARGE BIRDS 15-30 SMALL BIRDS
3. LOW	SPARSE BIRD ACTIVITY

(Fig. A-1)

b. The BWC Decision Tree (Fig A-2) should be used as a guide tempered with judgment and common sense. During periods of elevated bird watch conditions (moderate or severe) re-evaluate the bird hazard frequently by re-running this decision tree.

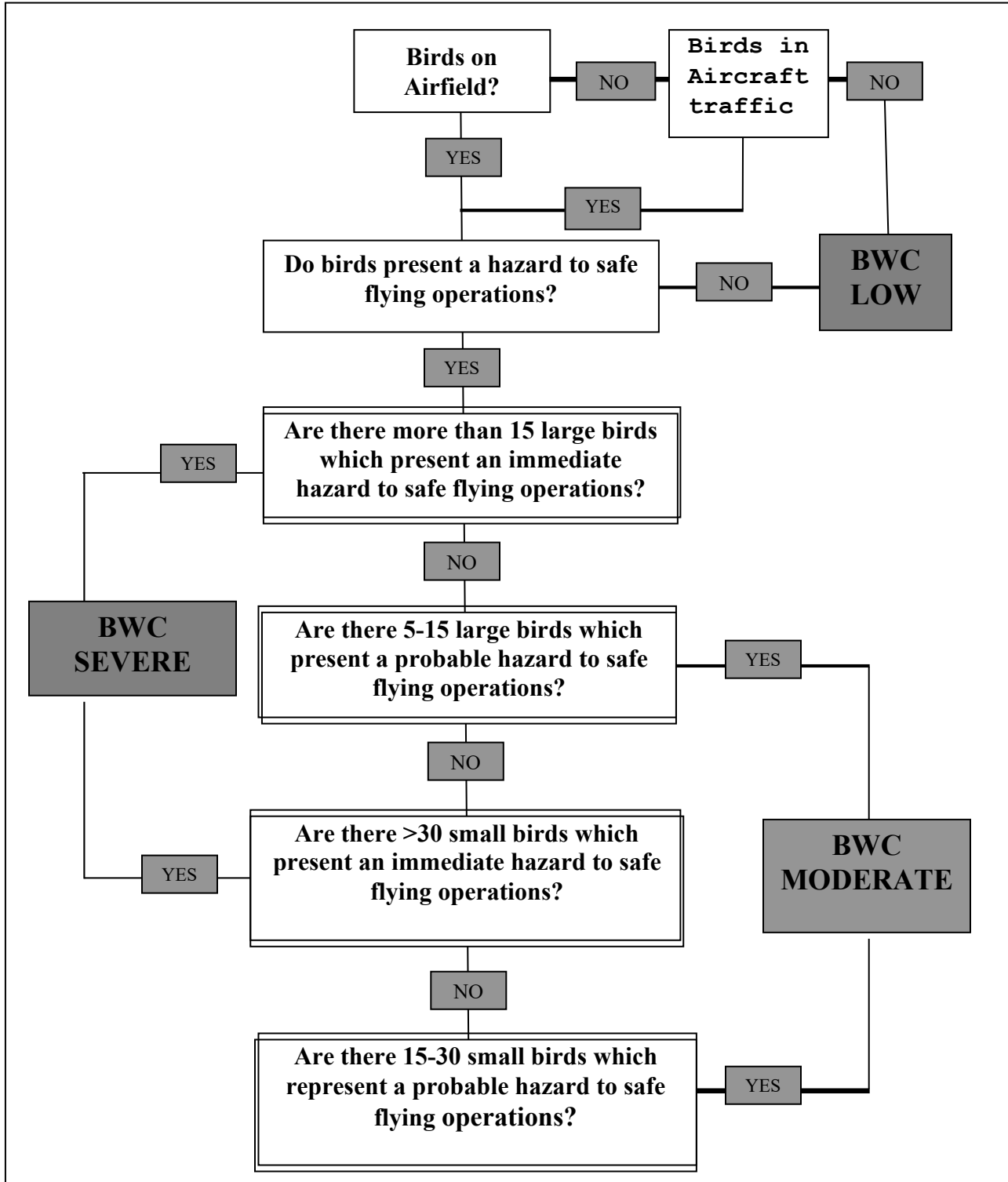
c. Authority. During normal flight operations the authority to declare a BWC is vested with the NAS Control Tower Supervisor.

d. BWC reporting. Declaration of any BWC shall be based on any of the following:

(1) Visual observations of bird activity on the airfield by NAS Tower.

(2) Observations relayed to the tower by any of the following personnel: aircrew members, airfield facilities, weather observers, LSO's, ground electronics maintenance, airfield lighting technicians, crash crews, arresting gear maintenance, sweepers, mowers, security police, transient line, and any other personnel driving on the airfield.

(3) If bird activity is observed by RADAR.



(Figure A-2)

e. Downgrading BWC. The task of downgrading the current BWC will be the responsibility of the Tower Supervisor based on available information and when it is believed a hazard no longer exists.

f. Communication. BWC will be disseminated as follows:

(1) During periods of flight operations, BWC's will be included in the Automated Terminal Information Services (ATIS) messages and updated as conditions progress.

(2) The Control Tower will issue appropriate warnings whenever issuing taxi, takeoff or landing clearances.

(3) The Control Tower Supervisor shall notify the Flight Planning Supervisor of the current BWC and any changes to it. The Flight Planning Supervisor shall post the current BWC in the flight planning office to alert crews of the hazard. The Flight Planning Supervisor shall notify the Weather Forecaster/Briefer as well.

2. Aircrew Responsibilities, Procedures and Recommendations.

a. While in flight, if an aircrew observes or encounters any hazardous bird or animal activity, the aircrew shall advise the local controlling authority when safely flying. The following information should be included or solicited:

- (1) Callsign
- (2) Location
- (3) Altitude
- (4) Time of sighting
- (5) Type of bird
- (6) Approximate number of birds
- (7) Behavior of birds (soaring, direction of flight

etc.)

b. Ultimately, the pilot is the final authority who determines if his aircraft can safely fly during various bird watch conditions.

c. Flying in formation during BWC Severe or Moderate is not recommended due to the fact that the wing aircraft is/are not looking out, rather concentrating on the lead aircraft. Avoiding bird hazards is unlikely.

d. The following are recommendations to pilots:

(1) BWC Severe. Perform only full stop landings. Avoid formation takeoffs or landings. Consider changing runways, delaying takeoffs and landings, or diverting.

(2) BWC Moderate. Touch and goes and low approaches, should be limited to the number required for training.

(3) BWC Low. This is the normal condition. Pilots should maintain their typical situational awareness and use routine precautions.

3. Field Services Division

a. Bird Detection and Dispersal Team (BDDT or "Scare Team"). If required by NAS Tower, the dispersal team shall disperse the birds by means of vehicle hazing or use of pyrotechnics as per APPENDIX C. This task shall be done immediately. Extreme care will be taken so that birds will not fly into oncoming aircraft. All attempts will be made to drive birds away from the flight path.

b. In the event of a bird or animal strike, if requested by ATC, make all attempts to recover the bird for identification. In cases in which the animal cannot be identified, use APPENDIX F for procedures to retrieve them. Proper recovery and identification is crucial for tracking, education, and prevention of future bird strikes

c. Consider bird or other wildlife remains, whether in whole or in part, that are found within 250 feet of a runway centerline or within 1,000 feet of a runway end, unless another reason for the animal's death is identified, as a bird strike. Collect the remains and report the strike to the AFM.

4. Depredation

a. A depredation permit is intended to provide short-term relief for bird damage until long-term nonlethal measures can be implemented to eliminate or significantly reduce the problem.

b. The USDA Wildlife Biologist (WB), with a valid depredation permit, is authorized to "take" birds protected under the Migratory Bird Treaty Act (MBTA). Take includes killing birds, trapping birds, egg addling (oiling), and destruction of active nests. Capture or killing of birds will not be the primary methods used to address depredation and is ONLY authorized in conjunction with ongoing nonlethal measures.

c. This authorization includes taking of any migratory birds except for eagles and threatened or endangered species.

d. The USDA WB is authorized in emergency situations only to take, trap, or relocate any migratory birds, nests and eggs (Except Bald or golden eagles or threatened species) when the migratory birds, nests, or eggs are posing a direct threat to safety.

APPENDIDIX B

FLIGHT OPERATIONAL CHANGE RECOMMENDATIONS

The Air Traffic Control Officer/Supervisor should consider the following flight operational changes to avoid areas and times of known hazardous bird concentrations, operations and missions permitting:

- a. Raise pattern altitude.
- b. Change pattern direction to avoid bird concentrations.
- c. Be aware of the higher odds of BASH strikes for takeoffs/landings at dawn/dusk and +/- 1 hour before and after.
- d. Limit or prohibit formation takeoffs and landings
- e. Depart pattern in trail; rejoin 3000 AGL.
- f. Reschedule local training or transition elsewhere.
- g. Split formation during recovery.
- h. Discontinue formation instrument approaches.
- i. Make full-stop landings.

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APPENDIX C

DISPERSING BIRDS

Guidelines and recommendations for dispersing birds on the airfield

1. Airfield Services Division will perform a Bird Watch Condition (BWC) check as part of their daily airfield-opening checklist. Additionally a BWC check will be performed whenever requested by the control tower, following a runway in use change, and as soon as possible following inclement weather.
2. Bird dispersal will not be performed without control tower's approval; therefore, the dispersal team shall request control tower's approval prior to initiating any means of dispersing birds. Dispersal shall NOT be attempted if there is any chance that dispersed birds may fly into landing, departing or taxing aircraft. Consideration should be given to increasing the BWC to SEVERE when dispersing birds.
3. The following methods are available for dispersing birds:
 - a. Vehicular dispersing may be successfully accomplished using duty vehicles to drive taxiways and runways. Use of horn, lights, and sirens, in addition to the vehicle itself, will discourage birds from their resting spots. Great care will be exercised in not hitting any bird. Birds will more than likely move just feet away so re-harassment may be necessary.
 - b. Pyrotechnics are 15-MM scare cartridges that produce a secondary explosion to scare the birds from the area. The scare cartridges are launched from a pyrotechnic pistol. Pyrotechnics are effective for dispersing most bird species.
4. The BHWG will consider the following dispersal methods if warranted:
 - a. Bioacoustics are taped distress or alarm calls of birds. The equipment required to adequately project these calls includes a cassette tape deck mounted in a vehicle and a speaker mounted on its roof. Special care must be taken to play the tape in short intervals to prevent habituation by the birds.

Play the tape for 20-30 seconds and then pause briefly. Repeat the procedure several times if necessary. The birds should respond by taking flight or becoming alert/wary. These calls are effective for gulls, blackbirds, starlings, cowbirds, grackles, ravens, crows, and some shorebirds. Pyrotechnics should be used in conjunction with bioacoustics to enhance complete dispersal.

b. Gas cannons may also be used. These devices should be operated at dawn and dusk as birds come in to feed or roost. Cannons must be relocated frequently to avoid habituation problems. These devices are very effective on gulls, blackbirds and waterfowl.

c. Depredation. Birds must be killed occasionally as a reinforcement of other methods. Domestic pigeons, European starlings, and house sparrows can be killed without a permit.

5. Other Devices. Ingenuity is encouraged in the bird scare program. Other devices may be used.

a. Radio-controlled model aircraft, hawk kites, model birds in distressed positions, falconry, etc., may all be considered based on availability and problem bird species.

b. Falconry has been quite successful with blackbirds, pigeons and gulls, but it is unlikely to be successful with much larger raptors. There is some risk that the falcons may join in rabbit hunting, rather than frightening raptors. The presence of falcons may add to the existing BASH risk, rather than reduce it.

6. Ineffective methods. Ultra sound, rubber snakes, stuffed owls, rotating/flashing lights, loud music, and other such devices have not proven effective and should not be used.

APPENDIX D

SUMMARY OF LOCAL BIRDS HAZARDS

1. General. This appendix provides information concerning birds that may pose bird strike hazards and recommendations for countering each hazard. Due to its unique location, Key West is on the migration route for many birds and home to many others. Birds in transit to the winter homes are foraging and eating as much as possible in order to build energy reserves. The airfield's open space in the form of runways, taxiways, hangars, and fields provide terrain unlike most areas of Key West. Due to this, birds are naturally attracted to it. Fresh water is one of the biggest attractants to all wildlife.



Seagulls, like most birds, are attracted to fresh water

2. BIRDS

a. Grebes, Pelicans, Cormorants and other fish eating birds may be found in and around borrow pits and lagoons on and around the base. Pelicans and Cormorants typically move from roosting areas to feed at dawn and return at dusk. Avoid flying at sunrise and sunset when large flocks, often in formation, can be flying to and from feeding areas. High hazard rate below 200 feet. The North American white and brown pelican populations grew at average annual rates of 2.9% and 8.5%, respectively, 1980-2000.

Brown Pelican



Cormorants



Long-legged waders (Heron, Egrets, and Ibises) are found typically in large numbers feeding and roosting in the wetland areas on and around the airfield. There is minimal flight activity associated with these birds since most of their time is spent on the ground wading through shallow water in search of food. When they do fly it is generally low to the ground, 100' and below. The greatest activity is at dusk and dawn. Control is best accomplished by eliminating food sources. Steepening the sides of ditches and ponds and removing emergent vegetation with drastically reduce accessibility to food sources.

Ibis



Great Egret



b. Cattle Egrets are present in flocks on the airfield usually foraging in open grassy areas. The highest concentrations of Egrets are seen between April and September. They tend to follow mowing machinery which expose insects. Mowing should be done during non-flying hours when Cattle Egrets are present. If possible, mow the off-duty runway, during flight ops. Periodic pesticide applications may be required to keep insects in check and thus reducing the food source for the Egrets. Reduction of roosting areas will help keep Egret populations down.

Cattle Egret



c. Turkey Vultures and Black Vultures are present at altitudes of 1000 feet and higher, soaring on thermals during the months of October through May. They are active from mid-morning to late afternoon. Proper drainage of muddy areas discourages roosting on the airfield. Removal of dead animals, rodent control and removal of dead trees and other perching sites can help in making NASKW unattractive to these birds.

Turkey Vulture can weigh up to 10 pounds with a wingspan of 6 feet.



Black Vultures (below left) Turkey Vulture (below right)



Vultures are attracted to open trash containers

d. Other Raptors (Hawks, Falcons, Eagles, and Ospreys) are present at NASKW as well. Raptors are located throughout the airfield. These species are a higher hazard than other birds due to the wide range of altitudes these birds hunt and live. In the fall (October - December), large numbers of Broad Wing Hawks, American Kestrels, and other migratory raptors move through this area on their way south. Removal of food sources through vegetation management is the best tool to keep this area unattractive to these birds. Removal of perch sites will also help.

American Kestrel



Red Tailed Hawk



American Bald Eagle



Osprey



e. Sandpipers, Plovers and other shorebirds are present in large numbers in the area. They normally do not pose a threat under normal circumstances, however, after a significant downpour, standing fresh water pools on the airfield attract flock of these low-flying birds. Caution should be given as runways and taxiways often pool up.

Sandpiper



f. Gulls are not normally located in Key West, however due to the former landfill that was in use on Stock Island, a number of Gulls have permanently remained in Key West and the local vicinity. The landfill is currently not in use and is covered. This should keep the influx of Sea Gulls from increasing and perhaps eventually decrease their numbers.

g. Least Terns nest in gravel areas around runways and taxiways between April and August. Establishment of vegetation and drainage of fresh water sources, both temporary and permanent, will decrease the attractiveness of the airfield to nesting terns. Establishment of gravel areas away from the airfield may attract terns to these areas for nesting.

Tern



h. Pigeons and Doves are seedeaters attracted to food producing weeds, grasses, and shrubs. Open areas are attractive as nesting and feeding sites. White-Crowned Pigeons feed on poisonweed berries in the hammock areas during the summer months. Proper vegetation control and mowing frequently will prevent plants the opportunity to produce seeds, thus reducing the numbers of these seed eating birds.



Mourning Dove by Larry McQueen

i. Black Birds, Grackles, Cowbirds, and Starlings are present in large numbers during the fall migration period. Alerts to pilots during these periods are critical to pilot awareness of possible hazards. Proper mowing of the airfield will help reduce the attractiveness to these birds. Starlings are "feathered bullets", having a body density 27% higher than herring gulls.



**European Starling
(winter plumage)
by Larry McQueen**

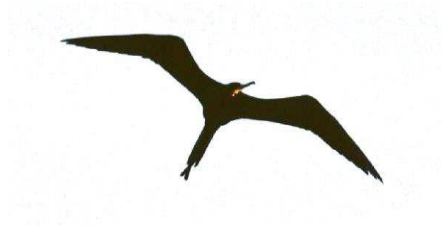


**Brown-headed Cowbirds
by Larry McQueen**



Common Grackle by Larry McQueen

j. Magnificent Frigatebirds are now only found nesting in the United States on the Dry Tortugas, west of Key West. They are routinely seen soaring over open water searching for food. These birds are a significant risk to aircraft, particularly to SAR helicopters, operating over water.



Magnificent Frigatebird -M- (FL) Copyright 1998 - Monte M. Taylor

Magnificent Frigatebird

3. Endangered Species Act. This act protects certain birds from habitat destruction, harassment, and of course poisoning and killing. Protected nesting or migratory birds are present at Boca Chica throughout much of the year. If any control is deemed necessary for a protected species, the Natural Resources Manager must confer with the appropriate state and federal agencies prior to taking any control measures.



APPENDIX E

ANIMAL/BIRD STRIKE REPORT

In the event of a reported animal/bird strike, including suspected strike, obtain the following information. Do not attempt to obtain information if doing so may adversely affect safety of flight. Information may be taken by radio or phone once the aircraft is safely on deck or airborne. It is important that all animal/bird strikes be expeditiously reported.

- a. Date _____ Time of Strike (specify local or Zulu time):
- b. Aircraft Type: _____ Call-sign: _____ Squadron:
- c. Geographic location of strike, be as exact as possible:
- d. Phase of flight: ___ takeoff ___ landing ___ level
 ___ climbing ___ descending ___ taxiing ___ stationary
- e. Lights being used: ___ none ___ landing ___ strobe ___ both
 ___ N/A
- f. Type of strike: ___ bird other :
- If known, what type of bird (gull, blackbird, vulture, etc):
- g. Number individual birds seen at strike: _ few ___ many
exact #
- h. Who removed the remains: _____ None found _____ Natural Res.
 ___ Crash/Fire _____ Other:

i. If known, what was the extent of damage to the aircraft

j. Weather: _____ Surface Wind (direction & speed):

k. Altitude at strike: _____

l. Airspeed at strike: _____

m. Visibility: _____

Your name and phone ext.

Pilot of aircraft and Phone ext.

.

APPENDIX F

PROCEDURES FOR UNKNOWN BIRD/ANIMAL AIRCRAFT STRIKE

Step 1. Collect all information pertaining to the strike such as the aircraft type and tail number, impact point, etc. (use bird strike reporting procedures as guidance). TAKE A PICTURE (PREFERABLY DIGITAL) OF THE STRIKE IF IT IS NOTEWORTHY AND PLEASE SEND TO NASKW Airfield Manager @ 293-2250. See picture below.

Step 2. Use a spray bottle to wet down the area ONLY when the sample is extremely small and moisture is needed to aid in collection. Usually remains can be gathered by simply picking material out by hand (tweezers can often be used for minute samples, look at photo to the right). See picture below.

Step 3. Wipe the area with a paper towel, cloth, etc. Collect all feather, fuzz, beak, bone, talons, etc. that are found in the engine, on the aircraft, or on the airfield. Never cut feathers from the bird's body because the fluffy barbs at the very base of the feather are often important in making identifications. Whole birds can be sent if mailed properly (freeze/wrap in newspaper or pack on dry ice).

Step 4. Place unknown sample (as much as you can find) in a zip lock bag. DO NOT USE TAPE because barbules (the smallest part of the feather structure) get tangled and destroyed. If the sample is very small, put it in a folded piece of paper and then place in a zip-lock bag.

Step 5. Swab the affected area with a Whatman® FTA Nucleic Acid Micro Collection Card.

Step 6. Fill out the NAS Key West Strike report. Inform the Airfield Manager. The AFM will contact the USDA Wildlife Biologist for identification. If the USDA WB cannot ID the specimen, the feathers and a copy of the report will be sent to: Smithsonian Institute; Natural History Building; Division of Birds (ATTN: Dr. Carla Dove); NHBE 610 MRC 116; 10th and Constitution Ave NW; Washington, D.C. 20560)



1. Recommended items for Unknown-Bird Recovery Kit:
 - (a) Zip-lock bags - large
 - (b) Spray bottle with fresh water
 - (c) Clean white cotton cloth
 - (d) FTA Nucleic Acid Collection Card
 - (e) Latex gloves
 - (f) Tweezers

APPENDIX G

**PUBLIC WORKS/ENVIRONMENTAL DEPARTMENTS GUIDELINES AND
RECOMMENDATIONS**

Most bird and animal activity can be reduced by aggressive land management practices to reduce BASH potential at the airfield. The following practices should be considered and used as much as feasible or practical:

1. Vegetation Control

a. Manages airfield mowing. Grass height should be maintained at between seven to fourteen (7-14) inches to discourage birds that prefer shorter grass without attracting large numbers of rodents and birds that prefer taller grasses. Mowing should be done just before grasses go to seed as this food source may also attract birds and rodents. Rodents, such as the marsh rabbit, may attract raptors to feed in that area. Mowing immediately adjacent to an active runway should not be done during heavy use since this mowing may attract birds drawn to easily accessible insects. Also, avoid mowing grass shorter next to the runway than in other areas, as much as possible.

b. Control broad-leaf weeds, the seeds of which are a food source for birds and rodents. Use mowing or specific herbicides to control if necessary. Herbicides should be used as last resort to keep detrimental impact to surrounding bodies of water to a minimum.

c. Plant bare, non-vegetated areas using low maintenance, non-bird/animal attracting ground cover.

d. Coordinate removal of dead/dying vegetation, perches or other high spots, edge effects and tree other plants with berries.

2. Water Control

a. Fresh water is one of the biggest attractants to all wildlife. After heavy rainfalls birds are attracted to temporary pools formed on runways and taxiways: extreme caution should be

exercised during these times. Expeditious drainage of these pools should be a top concern for the NASKW BASH program.

b. Eliminate standing water as environmental permitting allows. This may require obtaining dredge/fill permits or mangrove alteration permits.

c. Maintain drainage ditches. Ditches should be kept clear with sides maintained as steeply as possible. Shallowest slope ratio should be 5:1 in silty areas and 1:1 in rocky areas to discourage wading birds and emergent vegetation. Improve drainage as necessary to inhibit temporary ponds or puddles of fresh water. If needed and able, cover ditches with netting/plastic covering.

3. Waste Control

a. Collect and dispose of solid wastes (trash) from dumpsters, trash cans, and otherwise out in the open to prevent the overflow from attracting birds and rodents.

b. Oversee the management of solid waste disposal and accumulation points in the vicinity of the airfield to prevent attracting birds and rodents.

4. Bird Control

a. Attempt to bird proof buildings and hangars.

b. Check for and eliminate unnecessary perching areas within current environmental regulations.

c. If perches cannot be eliminated, then render them undesirable by using sharp projections.

d. Control food source rodents and insects as possible within environmental constraints.

e. Limit bird access to hangars by closing hangar doors as often as possible.

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