
**Integrated Natural Resources
Management Plan for
Homestead Air Reserve Base,
Homestead, Florida**

Volume I

July 2009



Prepared for:

United States Department of the Air Force
Headquarters, Air Force Reserve
Environmental Division
Robbins Air Force Base, Georgia 31098-1635

Executive Summary

The primary purpose of this integrated natural resources management plan (INRMP) is to integrate the management and conservation of natural resources with the military mission and land use needs of Homestead Air Reserve Base (HARB; the “Base”), Homestead, Florida. The United States Air Force Reserve Command (AFRC) has prepared this INRMP for HARB. This INRMP has been developed to meet the statutory regulations of the Sikes Act Improvement Act (SAIA) of 1997, Air Force Instruction (AFI) 32-7064 (17 December 2004), “Integrated Natural Resource Management,” and Air Force Policy Directive 32-70, “Environmental Quality.” In cooperation with its federal and state partners, the United States Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FFWCC), along with public input, HARB will endeavor to conserve, protect, and manage fish and wildlife resources on the Base.

This INRMP identifies goals, objectives, and strategies for the management of HARB’s natural resources for the next five-year period. Management practices and projects have been identified to support the strategies and accomplish the objectives of this INRMP. The recommended management practices and projects take into consideration and are consistent with the military mission requirement for the use of land within the boundaries of HARB. HARB’s land area is used for the military mission, a majority of which includes uses for explosive safety clear zone (ESCZ) arcs, runway primary and transitional surface zones, administrative and industrial support facilities, and airfield drainage; therefore, management practices and projects in the INRMP largely focus on ways to enhance the natural environment consistent with mission requirements, including airfield drainage, maintaining safety clearance zones, wetland management practices and initiatives, and grounds maintenance practices. This INRMP provides environmental stewardship initiatives for the remaining natural communities, as well as efforts to control both invasive and exotic animal and plant species. HARB will explore measures to reduce the prevalence of invasive exotic plant and animal species on HARB only to the extent that those measures would not result in conditions that would contribute to a bird-aircraft strike potential.

The goals, objectives, strategies, recommended management practices, and projects of this INRMP have been determined by the HARB Chief-Environmental Flight (CEV; (Environmental Management) and Headquarters United States Air Force Reserve Command (HQ ARFC) to:

- Result in no net loss of HARB's capability to support its military mission;
- Be in compliance with the SAIA of 1997, AFI 32-7064 (17 December 2004), and Air Force Policy Directive 32-70;
- Be consistent with other plans, programs, and initiatives at HARB; and
- Integrate natural resources management activities with HARB's mission.

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Glossary of Terms, Abbreviations, and Acronyms

- °F** – degrees Fahrenheit.
- ACC** – Air Combat Command.
- AFB** – Air Force Base.
- AFBCA** – (Homestead) Air Force Base Conversion Agency; now the Air Force Real Property Agency (AFRPA).
- AFCEE** – Air Force Center for Environmental Excellence.
- AFI** – Air Force Instruction.
- AFPAM** – Air Force pamphlet.
- AFPD** – Air Force Policy Directive.
- AFRPA** – Air Force Real Property Agency; formerly, Air Force Base Conversion Agency (AFBCA).
- AFRC** – (United States) Air Force Reserve Command.
- AGE** – aerospace ground equipment.
- agriculture outleasing** – The use of United States Department of Defense (DoD) lands under a lease to an agency, organization, or person for growing crops or grazing animals.
- AICUZ** – Air Installations Compatible Use Zones.
- airfield** – The area comprised of runways, taxiways, aprons and other adjacent land areas of an airport which are dedicated to aircraft operations.
- AOC** – area of concern.
- APHIS** – Agriculture, Animal and Plant Health Inspection Service.
- apron** – A defined area, on an airfield, intended to accommodate aircraft for the purposes of loading or unloading passengers or cargo, refueling, parking or maintenance.
- Argonne** – Argonne National Laboratory.
- APZ** – accident potential zone.
- ATSDR** – Agency for Toxic Substances and Disease Registry.
- Base Civil Engineer (BCE)** – responsible for all maintenance, environmental, and construction activities at HARB.
- BASH** – bird/wildlife aircraft strike hazard.
- BCE** – *see* Base Civil Engineer.
- best management practices (BMPs)** – schedules of activities, prohibitions of certain practices, implementation of maintenance procedures, or other measures or practices that limit, prevent, or avoid negative impacts to land, water, vegetation, wildlife or other resources of the environment. BMPs include, but are not limited to, structural and nonstructural controls, changes in management practices, and operation and maintenance procedures.
- BMP** – *see* best management practices.
- BNP** – Biscayne National Park.
- BRAC** – Base Realignment and Closure.
- CAA** – Clean Air Act (1970); the comprehensive federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.
- canopy (crown or overstory)** – The upper leafy branches of trees and shrubs that intercept light and shade the forest floor.
- CATEX** – categorical exclusion.
- CDMP** – (Miami-Dade) Comprehensive Development Management Plan.

Glossary of Terms, Abbreviations, and Acronyms, continued

- CERCLA** – Comprehensive Environmental Response, Compensation, and Liability Act (1980).
- CERP** – Comprehensive Everglades Restoration Plan.
- CEQ** – Council on Environmental Quality.
- CEV** – Environmental Flight Chief.
- CFR** – Code of Federal Regulations.
- cfs** – cubic feet per second.
- CIP** – capital improvement program.
- clear zone** – A surface on the ground or water beginning at the runway end and symmetrical about the runway centerline extended.
- CO** – carbon monoxide.
- conservation** – The wise use and management of natural resources.
- critical habitat** – Any air, land, or water area and constituents thereof that the USFWS has designated as essential to the survival and recovery of an endangered or threatened species or a distinct segment of its population.
- CWA** – Clean Water Act.
- CZMA** – Coastal Zone Management Act (1972).
- DD** – Decision Document (as pertains to Installation Restoration Program [IRP] Site Status).
- DERM** – (Miami-Dade County) Department of Environmental Resource Management.
- disposal area** – The term used for the land that is no longer the property of DoD but was formerly part of the former Homestead Air Force Bases.
- DO** – dissolved oxygen.
- DoD** – (United States) Department of Defense.
- DoDI** – (United States) Department of Defense Instruction.**DRMO** – Defense Reutilization and Marketing Office.
- EA** – environmental assessment.
- ecosystem** – An interacting, interdependent community of living organisms together with their physical environment.
- ecosystem management** – An approach to natural resources management that focuses on the interrelationships of ecological processes linking soils, plants, animals, minerals, climate, water, and topography.
- EIAP** – environmental impact analysis process.
- EIS** – environmental impact statement.
- EMB** – Environmental Management Board.
- endangered species** – Any plant or animal listed as endangered by the federal or state government.
- EPC** – Environmental Protection Committee.
- ERP** – Environmental Resource Permit.
- ESA** – Endangered Species Act (1973).
- ESCZ** – explosive safety clear zone.
- exotic species** – Any plant or animal not native or indigenous to a region, state, or county.
- F.A.C.** – Florida Administrative Code.
- FAA** – Federal Aviation Administration.
- FANG** – Florida Air National Guard.
- FCMP** – Florida Coastal Management Program.
- FDEP** – Florida Department of Environmental Protection.
- FEMA** – Federal Emergency Management Agency.
- FFA** – Federal Facility Agreement.
- FFWCC** – Florida Fish and Wildlife Conservation Commission.
- FIG** – Fighter Interceptor Group.
- FNAI** – Florida Natural Areas Inventory.
- FONPA** – Finding of No Practicable Alternative.
- FONSI** – Finding of No Significant Impact.
- FW** – Fighter Wing.
- GIS** – geographic information system.
- gpm** – gallons per minute.
- habitat** – An area that provides the environmental elements of air, water, food, cover, and space necessary for a given species to survive and reproduce.
- HAFB** – *see* Homestead Air Force Base.
- HARB** – *see* Homestead Air Reserve Base.
- HARS** – *see* Homestead Air Reserve Station.
- Homestead Air Force Base (former; HAFB)** – The area of DoD land used by the USAF for Homestead Air Force Base prior to the 1993 Base Realignment and Closure list which determined that approximately 1,632 of

Glossary of Terms, Abbreviations, and Acronyms, continued

Homestead AFB were excess to its need and surplus to the needs of the federal government.

Homestead Air Reserve Base (HARB) – An area of DoD land used by HQ AFRC to operate the 482nd Fighter Wing. The primary difference between the current boundary configuration of HARB and that of HARS is that HARB includes the airfield lands that were formerly to be transferred to Miami-Dade. The current configuration of HARB is largely a result of the 2001 Second Supplemental Record of Decision.

Homestead Air Reserve Station (HARS) – An area of DoD land that was largely configured as a result of the First Record of Decision, which permitted the transfer of airfield lands to Miami-Dade County for the proposed construction of a commercial airport. The primary difference between the current boundary configuration of HARB and that of HARS is that HARB includes the airfield lands that were formerly to be transferred to Miami-Dade.

HQ AFRC – Headquarters Air Force Reserve Command.

HRP – Homestead Recycling Program.

HWMP – hazardous waste management plan.

imaginary surfaces – Surfaces in space established around airfields in relation to runway(s), helipad(s), or helicopter runway(s) that are designed to define the obstacle-free airspace around the airfield. The imaginary surface for DoD airfields are the primary surface, the approach-departure clearance surface, the transitional surfaces, the inner horizontal surface, the conical surface (fixed-wing only), and the outer horizontal surface (fixed-wing only).

INRMP – *see* integrated natural resources management plan.

infield – Airfield/infield is the area between the runway and taxiway.

integrated natural resources management plan (INRMP) – A plan based on ecosystem management that describes and delineates the interrelationships of

the individual natural resources elements in concert with the mission and land use activities affecting the basic land management plans. Defines the natural resources elements and the activities required to implement stated goals and objectives for those resources.

integrated pest management (IPM) – A planned program incorporating continuous monitoring, education, record-keeping, and communication to prevent pests and disease vectors from causing unacceptable damage to operations, people, property, material, or the environment. IPM includes methods such as habitat modification, biological control, genetic control, cultural methods, mechanical control, physical control, regulatory control, and the judicious use of least-hazardous pesticides.

IPM – *see* integrated pest management.

IRA – Interim Remedial Action (as pertains to Installation Restoration Program [IRP] site status).

IPT – Integrated Process Team.

invasive species – An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

IPMP – integrated pest management plan.

IRP – Installation Restoration Program.

ISWMP – integrated solid waste management plan.

land management – The development of programs and techniques for managing lands.

lbs/yr – pounds per year

levee – A continuous dike or ridge designed to prevent flooding.

LTM – Long-Term Monitoring (as pertains to Installation Restoration Program [IRP] Site Status).

LUC – Land Use Controls (as pertains to Installation Restoration Program [IRP] Site Status).

MBTA – Migratory Bird Treat Act (1918).

mgd – million gallons per day.

MILCON – military construction.

Glossary of Terms, Abbreviations, and Acronyms, continued

- MOP** – Monitoring Only Plan (as pertains to Installation Restoration Program [IRP] Site Status).
- MSGP** – multi-sector generic permit.
- msl** – mean sea level.
- MWR** – Morale, Welfare, and Recreation.
- N-E** – north-east; descriptive pertaining to a segment of the Boundary Canal.
- NA** – natural attenuation.
- NAAQS** – *see* National Ambient Air Quality Standards.
- NAM** – (Miami-Dade) Natural Areas Management.
- National Ambient Air Quality Standards (NAAQS)** – nationwide ambient air standards authorized by the Clean Air Act (1970).
- National Oceanic and Atmospheric Administration Fisheries Division (NOAA Fisheries)** – formerly the National Marine Fisheries Service (NMFS).
- native species** – A native species in Florida is defined as a species already occurring at the time of European contact in 1500.
- neotropical migratory bird** – Birds that breed in the spring and summer in North America, but spend their winters south of the US in Mexico, the Caribbean Islands, and other Central and South America tropical countries.
- NEPA** – National Environmental Policy Act.
- NFA** – no further action.
- NFI** – no further investigation.
- NGVD** – National Geodetic Vertical Datum.
- NO₂** – nitrogen dioxide.
- NO_x** – oxides of nitrogen.
- NOAA Fisheries** – National Oceanic and Atmospheric Administration Fisheries Division, formerly National Marine Fisheries Service (NMFS).
- NPL** – National Priorities List.
- NPS** – National Park Service.
- NRCS** – Natural Resources Conservation Service.
- O & M** – operations and maintenance.
- obstacle** – An existing object, natural growth, or terrain, at a fixed geographical locations, or which may be expected at a fixed location within a prescribed area, with reference to which vertical clearance is or must be provided during flight operations.
- OU** – operable unit.
- outdoor recreation** – Recreation that relates directly to and occurs in natural, outdoor environments.
- PAO** – *see* Public Affairs Officer.
- PBS&J** – Post, Buckley, Schuh, and Jernigan
- PM₁₀** – particulate matter (soot) of 10 microns or less in diameter.
- PM_{2.5}** – particulate matter with aerodynamic diameters less than 2.5 microns.
- POLs** – petroleum, oils, and lubricants.
- POVs** – privately owned vehicles.
- primary surface zone** – The lateral limit of the primary surface zone coincides with the lateral clearance zone, (i.e., 1,000 feet either side of the runway measured perpendicular from the runway centerline). The primary surface extends 200 feet beyond each end of the runway. The elevation of any point of the primary surface is the same as the elevation of the nearest point on the runway centerline.
- Public Affairs Officer (PAO)** – responsible for the coordination of public access within HARB.
- QMB** – (Environmental) Quality Management Board.
- RAB** – Restoration Advisory Board.
- RCRA** – Resource Conservation and Recovery Act (1976).
- RD/RA** – remedial design/remedial action.
- reservoir** – An artificial lake where water is kept and retained for use.
- RFA** – RCRA (Resource Conservation and Recovery Act) Facility Assessment.
- ROD** – record of decision.
- ROF** – record of findings.
- runway** – A defined rectangular area of an airfield for the landing and takeoff run of the aircraft along its length.
- SAC** – Strategic Air Command.
- SAIA** – Sikes Act Improvement Act (1997).
- SARA** – Superfund Amendments and Reauthorization Act (1986).
- SEA** – Science and Engineering Associates, Inc.

Glossary of Terms, Abbreviations, and Acronyms, continued

SEIS – supplemental environmental impact statement.

SF-IAQCR – Southeast Florida Intrastate Air Quality Control Region.

SFRPC – South Florida Regional Planning Council.

SFWMD – South Florida Water Management District.

SHPO – State Historic Preservation Officer.

SIP – State Implementation Plan.

SO₂ – sulfur dioxide.

SOW – scope of work.

Species of Special Concern (SSC) –

Species of Special Concern is any species or subspecies of fish or wildlife or population of mammal or bird native to Florida that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance

SROD – supplemental record of decision.

SS – State Site (as pertains to Installation Restoration Program [IRP] Site Status)..

stewardship – The management of a resource base with the goal of maintaining or increasing the resource’s value indefinitely into the future.

storm water – The precipitation that falls onto surfaces such as roofs, streets, the ground, and is not absorbed or retained by that surface, but collects volume and energy and runs off.

stratigraphy – geology that deals with the origin, composition, distribution, and succession of strata.

SWMM – Surface Water Management Model.

SWMU – solid waste management unit.

SWPPP – storm water pollution prevention plan.

TAC – Tactical Air Command.

TAS – Tropical Audubon Society.

taxiway – A specially prepared or designated path, on an airfield other than apron areas, on which aircraft move under their own power to and from landing, service and parking areas.

T/E – threatened and endangered (as pertains to plant and animal species).

TFW – Tactical Fighter Wing.

threatened species – Those federally or state listed species of plant or animal that are likely to become endangered within the foreseeable future.

topography – The physical and natural features of the landscape, including characteristics such as elevation, slope, and surface area configuration.

tpy – tons per year.

transitional surface – The transitional surface begins at the outer edge of the primary surface and extends outward and upward at right angles to the runway centerline and extends at a slope of 7H:1V. The transitional surface connects the primary and the approach-departure clearance surfaces to the inner horizontal, the conical, and the outer horizontal surfaces.

TSP – total suspended particulate.

UDB – urban development boundary.

UEA – urban expansion area.

USACE – United States Army Corps of Engineers.

USAF – United States Air Force.

USAFCEA – United States Air Force Civil Engineer Support Agency.

U.S.C. – United States Code.

USCS – United States Customs Service.

USDA – United States Department of Agriculture.

USEPA – United States Environmental Protection Agency.

USFWS – United States Fish and Wildlife Service.

VOC – volatile organic compound.

W-S – west-south; descriptive pertaining to a segment of the Boundary Canal.

WASD – (Miami-Dade) Water and Sewer Department.

wellfields – A tract of land which contains a number of existing or proposed wells for supplying water.

Glossary of Terms, Abbreviations, and Acronyms, continued

wetlands – Areas inundated or saturated by surface or ground water at a frequency and a duration to support, and that under normal circumstances do support, a

prevalence of vegetation typically adapted for life in saturated soils.
WRAP – wetlands rapid assessment procedure.

1.1 Purpose and Authority

The primary purpose of this integrated natural resources management plan (INRMP) is to integrate the management and conservation of natural resources with the military mission and land use needs of Homestead Air Reserve Base (HARB; also referred to herein as the Base), Homestead, Florida. This INRMP will serve as a guide for all natural resources and land use management actions on HARB over the next five years. The plan will serve as a tool for integrating natural resources and land management actions on HARB with other government and non-government agency actions and plans, and as the basis for funding natural resource management projects (see Appendix A).

The legal authority for natural resources management programs on United States Air Force Reserve Command (AFRC) lands is the Sikes Act of 1960. The Sikes Act promotes the effective planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation on military reservations. In November 1997, the Sikes Act was amended by the Sikes Act Improvement Act (SAIA). The SAIA requires the secretaries of military departments to prepare and implement INRMPs for each military installation in the United States that has significant natural resources.

The AFRC has prepared this INRMP for HARB to comply with the SAIA. This INRMP also complies with the following United States Department of Defense (DoD) and United States Air Force (USAF) instructions and directives:

- DoD Instruction 4715.3 “*Environmental Conservation Program*;”
- Air Force Instruction (AFI) 32-7064 “*Integrated Natural Resources Management*;” (17 SEP 2004);
- Title 32 Code of Federal Regulations (CFR) 989, “*Environmental Impact Analysis Process (EIAP)*;” and
- Air Force Policy Directive (AFPD) 32-70 “*Environmental Quality*.”

1.2 Plan Development

Ecosystem management is the guiding philosophy for the development of this INRMP and it was prepared in consideration of USAF principles for ecosystem management outlined in AFI 32-7064 (17 SEP 2004). An interdisciplinary team approach was used in the plan's preparation. Coupled with stakeholder involvement, an interdisciplinary approach ensures that management opportunities for the human-made and natural environments are addressed and integrated into a set of goals and objectives that, when implemented collectively, achieve the overall aim of ecosystems management. The interagency team for this INRMP included the United States Fish and Wildlife Service [USFWS] and the Florida Fish and Wildlife Conservation Commission [FFWCC]). See related correspondence in Appendix B.

Information used in the preparation of this INRMP was gathered from various military and non-military sources, field surveys and investigations, and previously prepared plans and programs for HARB. Military sources include the Air Force Center for Environmental Excellence (AFCEE), the AFRC, the Air Force Real Property Agency (AFRPA; formerly the Air Force Base Conversion Agency [AFBCA]), and HARB personnel. Non-military resources contacted during the development process include various local government departments, federal and state government agencies, and regional authorities, as well as non-government conservation organizations (see Section 6). These agencies and others assisted with the data collection efforts and analyses throughout the development of this document.

The INRMP's goals, objectives, recommended management actions, and projects have been reviewed for, and determined to be consistent with, the military mission of HARB. The INRMP was developed in consideration of the *General Plan Homestead Air Reserve Base* (December, 2006) and supports the objectives of the Bird/Wildlife Aircraft Strike Hazard (BASH) Reduction Plan (revised 2006), Integrated Pest Management Plan (IPMP), and the 2007 Air Installations Compatible Use Zones (AICUZ) study prepared for HARB.

1.3 Use and Organization of the Plan

This INRMP will serve as the guide for all natural resources and land management planning and operations, including updates to management processes, plans, and programs for HARB over the next five years per AFI 32-7064 (17 SEP 2004). The plan provides a comprehensive overview of HARB's natural resources, as well as goals and objectives for resources management that are consistent with the military mission. HARB will use the INRMP to reinforce measures for compliance with applicable laws, executive orders, regulations, directives, and instructions, as well as

to identify and provide direction for stewardship initiatives that are not necessarily required by law or regulations but that are considered best management practices (BMPs).

As indicated previously, this INRMP was prepared in accordance with AFI 32-7064 “*Integrated Natural Resources Management Plan.*” Each section of the INRMP corresponds with a chapter(s) of AFI 32-7064, as described below.

Table 1-1	
Comparison of HARB INRMP Sections to Air Force Instruction (AFI) 32-7064	
INRMP Section	AFI 32-7064 Chapter(s)
Section 1 provides a general overview of the purpose and intent of the INRMP and the associated processes for review, implementation, and revision of the plan, as well as natural resources issues used to prepare the plan.	
<i>1.1 Purpose and Authority</i>	1 “Background”
<i>1.2 Plan Development</i>	2 “Implementing Integrated Natural Resources Management”
<i>1.3 Use and Organization of the Plan</i>	2 “Implementing Integrated Natural Resources Management”
<i>1.4 INRMP Approval and Revision</i>	2 “Implementing Integrated Natural Resources Management”
<i>1.5 INRMP Roles and Responsibilities</i>	2 “Implementing Integrated Natural Resources Management” 13 “Public Relations Process”
<i>1.6 Base Location, History and Military Mission</i>	2 “Implementing Integrated Natural Resources Management”
<i>1.7 Summary of Management Issues</i>	2 “Implementing Integrated Natural Resources Management”
Section 2 describes the current military mission and command structure and discusses relevant plans and programs at HARB. This section also provides information on the HARB natural resources planning processes and additional natural resources management tools.	
<i>2.1 Organization and Structure</i>	2 “Implementing Integrated Natural Resources Management”
<i>2.2 Environmental Planning</i>	2 “Implementing Integrated Natural Resources Management” 13 “Public Relations Process”
<i>2.3 Plans and Programs</i>	2 “Implementing Integrated Natural Resources Management”
<i>2.4 Natural Resources Management Projects</i>	2 “Implementing Integrated Natural Resources Management” 12 “Natural Resources Budgeting”
<i>2.5 Management Philosophy</i>	2 “Implementing Integrated Natural Resources Management”
<i>2.6 Management Tools</i>	2 “Implementing Integrated Natural Resources Management” 3 “Wetlands” 4 “Floodplain Management”
Section 3 describes the existing physical and biological characteristics of the local and regional environment. Physical characteristics include, but are not limited to, air quality; climate, topography, geology, soils, hydrology, and land use. Biological characteristics include flora, fauna, natural communities, threatened and endangered species, and species of special concern (SSC).	
<i>3.1 Climate and Air Quality</i>	Not Required
<i>3.2 Geology, Stratigraphy, Soils, and Topography</i>	Not Required
<i>3.3 Installation Restoration Program Sites</i>	Not Required
<i>3.4 Water Resources</i>	Not Required
<i>3.5 Wetlands</i>	3 “Wetlands”
<i>3.6 Flood-Prone Areas</i>	4 “Floodplains”
<i>3.7 Coastal Environment</i>	5 “Coastal and Marine Resources”
<i>3.8 Agricultural Outleasing</i>	9 “Agriculture Outleasing”

Table 1-1	
Comparison of HARB INRMP Sections to Air Force Instruction (AFI) 32-7064	
INRMP Section	AFI 32-7064 Chapter(s)
3.9 <i>Cultural Resources</i>	Not Required
3.10 <i>Land Management</i>	10 “Outdoor Recreation Management” 11 “Land Management”
3.11 <i>Vegetation</i>	6 “Fish and Wildlife Management” 7 “Threatened and Endangered Species Management”
3.12 <i>Wildlife</i>	6 “Fish and Wildlife Management” 7 “Threatened and Endangered Species Management”
Section 4 establishes the goals and objectives for implementing this INRMP. It also identifies specific strategies for accomplishing goals and objectives, and a number of projects and other management initiatives are called out for supporting these measures. The section also establishes a monitoring program for the implementation of the goals and objectives. Goals and objectives were developed with consideration given to laws, regulations, executive orders, DoD and USAF instructions and directives, natural resources issues and challenges at HARB, and stewardship opportunities are identified.	
4.1 <i>The Purpose and Relationships of the INRMP Goals, Objectives, and Strategies</i>	2 “Implementing Integrated Natural Resources Management”
4.2 <i>Monitoring</i>	2 “Implementing Integrated Natural Resources Management”
Section 5 , in accordance with INRMP goals and objectives, examines the natural resource management focus for the various geographic areas of HARB based upon the functional uses of the land, and the natural resources conditions, features, and opportunities unique to each area.	
5.1 through 5-14 <i>Land Management</i>	3 “Wetlands” 6 “Fish and Wildlife Management” 7 “Threatened and Endangered Species Management” 11 “Land Management”
Section 6 provides sources of supporting guidance and other information for INRMP development and for implementation of a natural resources management program at HARB.	
6.1 through 6.8 <i>Additional Sources of Information Pertaining to Natural Resource Management</i>	Not Required
Section 7 is a comprehensive list of laws, regulations, legal and other information sources used in the preparation of this document.	
7.1 and 7.2 <i>Bibliography</i>	Not Required

1.4 INRMP Approval and Revision

AFI 32-7064 (17 SEP 2004) provides for specific procedures and a time-line for the approval and revisions of an INRMP. The INRMP must be signature-endorsed by the Wing Commander, and agency representatives of the USFWS and the FFWCC also must sign the INRMP to reflect mutual agreement on those portions of the INRMP within the scope of their authority. In cooperation with the USFWS and FFWCC, the INRMP will be updated every five years. The INRMP will be reviewed annually by the Environmental Flight (CEV; see also Section 2.2), with the cooperation of the USFWS and the FFWCC. At its discretion, the CEV may seek assistance from the AFCEE, Headquarters (HQ) AFRC, USFWS, FFWCC, and/or other agencies or individuals during the annual review.

In the event that an action requires a significant change in the management approach for HARB's natural resources, (e.g., military mission realignment, property boundary changes, etc.) an INRMP update may be required prior to the scheduled five-year interval. The CEV would consult with HQ AFRC and AFCEE to determine the need for, and scope of, any interim INRMP updates; the Wing Commander and the USFWS must approve any major interim updates.

1.5 INRMP Roles and Responsibilities

HARB is responsible for implementing all activities for the management of its natural resources and the HARB Wing Commander is the responsible landowner. As the responsible party for HARB's natural resources, the Wing Commander has delegated implementation authority for natural resources management activities to the Environmental Flight Chief. Other Base personnel, such as Security; Base Civil Engineer (BCE), Services (Morale, Welfare, and Recreation [MWR]); and the Air Operations Officer have functions that involve the management and/or use of natural resources and must coordinate their activities with the Environmental Flight Chief, as appropriate.

1.6 Base Location, History, and Mission

Location

HARB consists of approximately 1,943 acres and is located within Miami-Dade County, approximately 25 miles southwest of the city of Miami, roughly 2 miles west of BNP, and 8 miles east of Everglades National Park (see Figure 1-1). Nearby incorporated areas include the communities of Homestead and Florida City located west and southwest of HARB, respectively. Land use in the immediate vicinity of HARB is a mixture of commercial, residential, and agricultural parcels.

History

The present-day HARB is situated on property that Pan American Air Ferries, Inc. originally operated as a commercial airfield. The property was deeded to the federal government after the United States entered World War II. Homestead Army Air Field was activated in September 1942 when the Caribbean Wing Headquarters of the United States Army obtained control of the property. Homestead Army Air Field served as a staging facility for the Army Transport Command, which was responsible for maintaining and dispatching aircraft to overseas locations. Homestead Army Air Field remained in operation until September 1945, when a severe hurricane caused extensive damage to most of the airfield's facilities. Because of the high costs of rebuilding, coupled with the anticipated post-wartime reductions in military operations, the facility was placed on inactive status, at which time the Dade County Port Authority took possession of the property and released it to Dade County

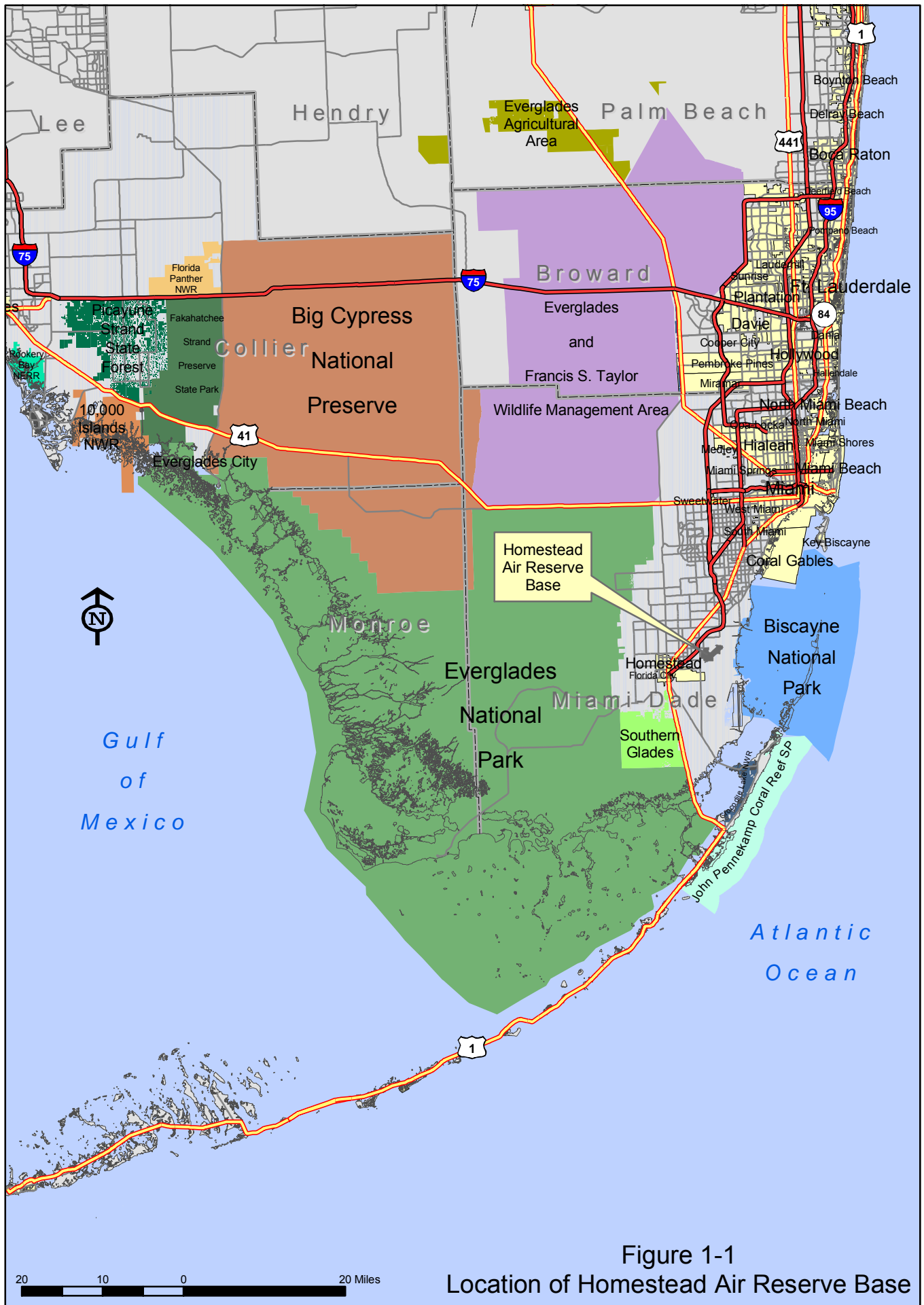


Figure 1-1
Location of Homestead Air Reserve Base

Source: Florida Natural Areas Inventory, 2002; Environmental Systems Research Institute, 2002.

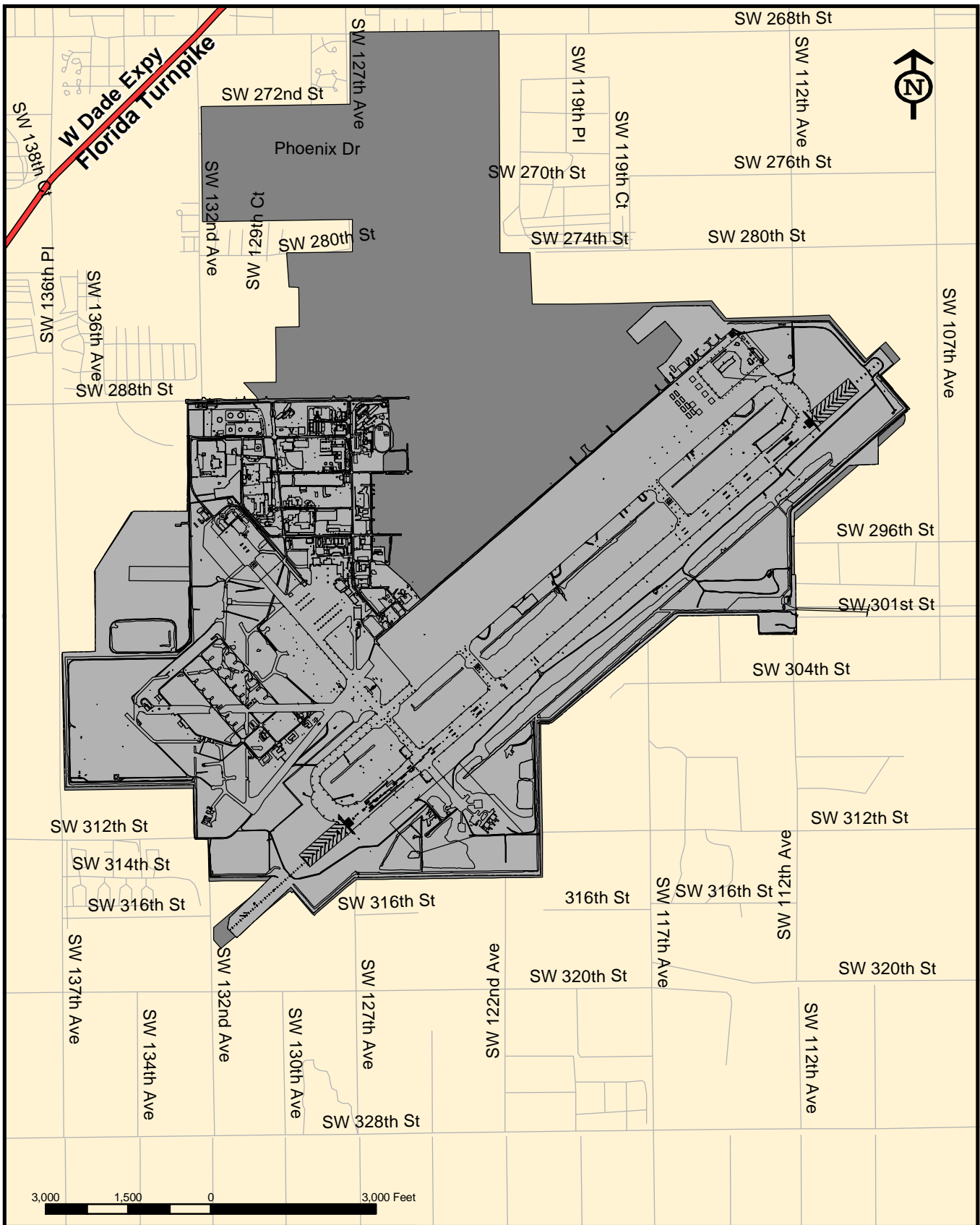
(now known as Miami-Dade County) for management. The port authority retained possession for the next eight years. During this period, crop dusters used the runways, and the buildings housed a few small industrial and commercial operations (Air Force Reserve Command [AFRC], 1996).

In 1953, the federal government again acquired the facility and rebuilt it as a Strategic Air Command (SAC) base. The first operational squadron arrived in 1955, and Homestead Army Air Field was redesignated Homestead Air Force Base (AFB). In 1960, the facility was modified to accommodate B-52 aircraft. In 1962, the 31st Tactical Fighter Wing (TFW) moved from George AFB, California, to Homestead AFB in response to growing concerns regarding Cuba's actions. In October 1962, the Cuban Missile Crisis occurred resulting in the recognized need for an operational tactical air force presence in southern Florida. On July 1, 1968, the command of the facility was changed from SAC to Tactical Air Command (TAC), and the 31st TFW became the host unit, flying F-4 aircraft. In 1984, the 31st TFW converted to F-16 aircraft. In 1992, TAC transitioned into the Air Combat Command (ACC; AFRC 1996).

In 1992, Hurricane Andrew struck South Florida and caused extensive damage to Homestead AFB, which totaled approximately 2,938 acres at that time (see Figure 1-2). As a result, in 1993, Homestead AFB was placed on the Base Realignment and Closure (BRAC) list and slated for realignment with a reduced mission. The USAF determined that approximately 1,632 acres of Homestead AFB were excess to its needs and surplus to the needs of the federal government, so later that year the AFBCA began operating from the Base to manage the disposal of the land declared excess and surplus. The AFBCA mission included the remediation of sites at the Base that were contaminated by petroleum products and derivatives (AFBCA, 2002). The AFBCA (later known as the AFRPA) mission also included assistance to the local community for determining property reuse and conveyance.

In January 1994, the USAF issued a final environmental impact statement (EIS) on the disposal of Homestead AFB, and in April 1994, Homestead AFB officially was closed (AFBCA, 2002). The USAF decided to make over 1,800 acres of surplus property available to Miami-Dade County, Florida, for use as a public airport. The AFRC planned to use the remainder of the property and designated it the Homestead Air Reserve Station (HARS; United States Air Force and Federal Aviation Administration [USAF and FAA], 2001).

In December 1997, the USAF and the Federal Aviation Administration (FAA) determined that the potential development of a commercial airport at the former Homestead AFB warranted further review and study, and began preparation of a supplemental EIS (SEIS). A draft SEIS was published for public review and comment in December 1999, and in December 2000, the final SEIS for the disposal of portions of the former Homestead AFB was prepared (USAF and FAA, 2001).



Legend

- Homestead Air Reserve Base Boundary
- Former Homestead Air Force Base Boundary

Figure 1-2
Comparison Between the Former
Homestead AFB and Homestead ARB

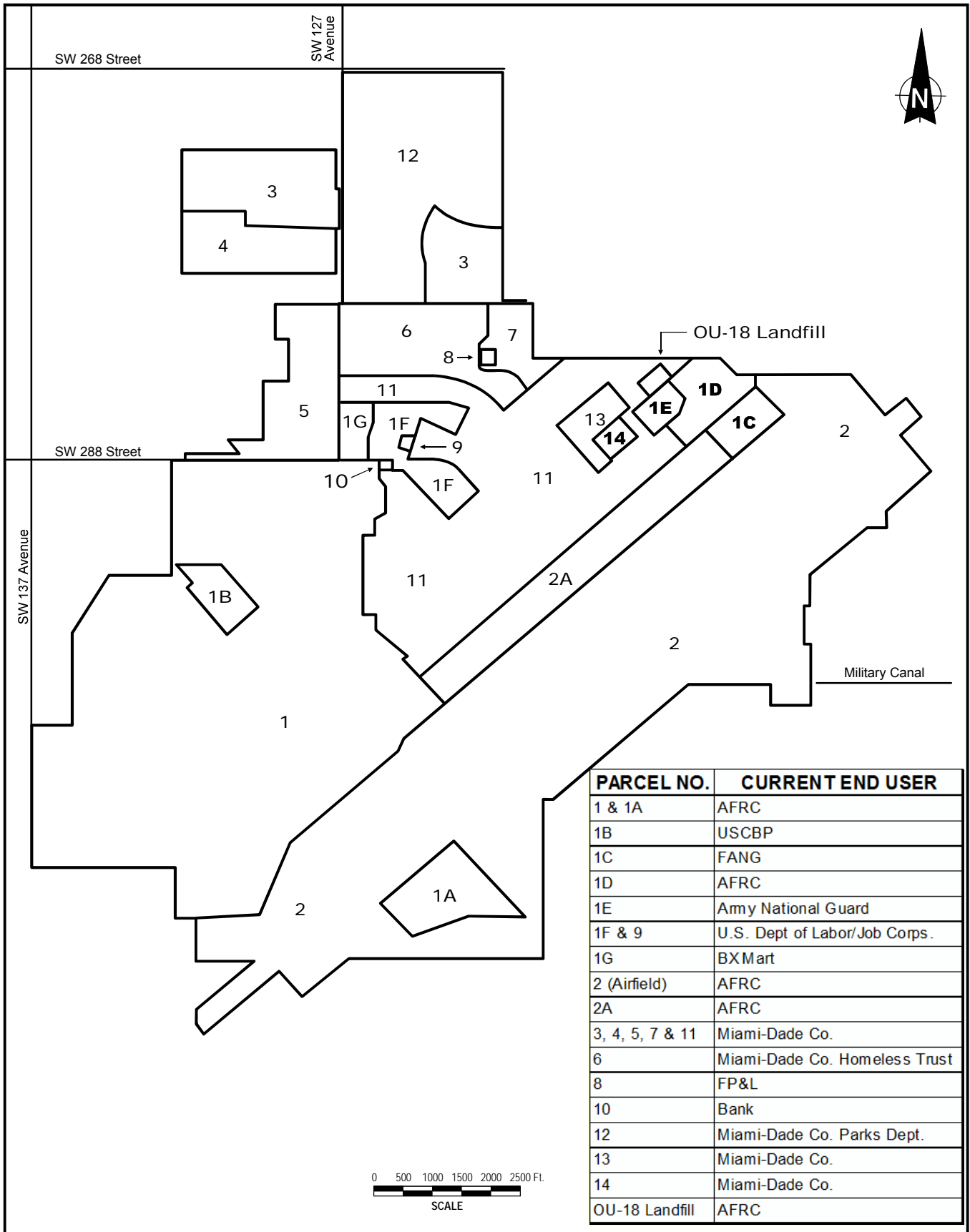
On January 15, 2001, a second supplemental record of decision (SROD) was issued to supplement both the record of decision (ROD) dated October 26, 1994, and the SROD dated February 20, 1998. According to the second SROD, the USAF would transfer the remaining surplus property (717 acres) to Miami-Dade County for mixed-used development. The USAF would retain about 915 acres, including the airfield (USAF and FAA, 2001).

As a result of the second SROD, the USAF approved (in 2002) Miami-Dade County's mixed-use redevelopment, non-aviation land redevelopment plan, and the county's application for Economic Development Conveyance on 614 acres (AFBCA, 2002). An additional 26 acres was given to the United States Department of Education for transfer via a Public Benefit Conveyance to Miami-Dade County Public Schools (AFBCA, 2002). The 482nd Fighter Wing (FW) assumed ownership of approximately 1091 additional acres of land, including the airfield, runway, airfield apron, control tower, and Boundary Canal System in 2003. Management of the Outfall Canal (also known as Military Canal) was also transferred to the 482nd FW after the AFRPA completed CERCLA remedial actions (AFBCA, 2002).

In total, approximately 1,943 acres of former HAFB property have been retained for use by the 482nd FW and its tenant commands, including the airfield (see Figure 1-2). Surplus former HAFB property totals approximately 1,000 acres which have been conveyed or leased to a variety of outside entities (AFBCA, 2002). The configuration of retained and surplus property use as of July 2002 is shown on Figure 1-3.

Mission

The 482nd FW's mission is to train and equip reservists to respond to wartime and peacetime taskings as directed by higher headquarters. The FW specifically trains for mobility, deployment, and employment.



SOURCE: HAFBCA 2002A.

Figure 1-3 FORMER HOMESTEAD AFB PARCEL MAP

1.7 Summary of Management Issues

Ecosystems in South Florida have been degraded over the last century. Much of the area's wetlands have been filled in and an extensive series of canals and channels has been created to support agriculture, urban development, and population growth. South Florida restoration efforts involve the cleanup and restoration of water flows, natural habitat, and flora and fauna. This restoration effort involves a variety of projects, including restoring coastal ecosystems, protecting threatened habitat and species, and promoting less-polluting agriculture practices, among others.

Natural resource management practices on HARB must be conducted in accordance with military mission requirements and must not increase BASH or other safety concerns. The primary environmental management issues on HARB include:

- Protecting and maintaining wetland functions;
- Restoring pine rockland without using fire;
- Controlling/eradicating invasive/exotic species;
- Managing water quality;
- Maintaining and enhancing natural habitat values; and
- Encouraging, where possible, natural resource-based outdoor recreation opportunities.

These environmental issues are similar to persistent problems occurring throughout South Florida and continuing efforts to restore important ecosystem functions. Implementing the recommended goals and objectives in this INRMP would be compatible with, not only the HARB military mission, but also with the region's broader ecosystem needs. Identification of these issues occurred through both public and agency contact, and form the basis of the natural resources management focus in this INRMP.

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2

Natural Resources Management

2.1 Organization and Structure

The 482nd FW maintains and operates HARB, and is a fully combat-ready unit capable of providing F-16C multi-purpose fighter aircraft, along with mission-ready pilots and support personnel, for short-notice worldwide deployment. The 482nd FW includes the following groups (Homestead Air Reserve Base [HARB], 2002a):

482nd Operations Group

- 482nd Operations Support Flight
- 93rd Fighter Squadron
- 70th Aerial Port Squadron

482nd Support Group

- 482nd Mission Support Squadron
- 482nd Communications Squadron
- 482nd Services Flight
- 482nd Civil Engineer Squadron
- 482nd Security Forces Squadron

482nd Logistics Group

- 482nd Maintenance Squadron
- 482nd Logistics Support Squadron
- 482nd Medical Squadron

The 93rd Fighter Squadron (“Makos”) flies and maintains the F-16C Fighting Falcon aircraft. This squadron’s F-16s can be identified by the letters “FM” (“Florida Miami”) and by the mako sharks displayed on the planes’ tails. The 482nd FW also supports and trains civil engineering, communication, medical, logistics, aircraft maintenance, mission support, aerial port, and security police squadrons, which can be used interchangeably with active-duty units to meet USAF responsibilities around the world.

The 482nd FW has a high operations tempo, engaging in year-round training to ensure that the 482nd FW remains combat-ready and worldwide deployable. With its unique geographic location, the 482nd FW regularly hosts combat units from around the world. Visiting units come to southern Florida to take advantage of the superb flying weather and the training airspace equipped with state-of-the-art air combat maneuvering instrumentation.

As the host unit at HARB, the 482nd FW supports the operations of several tenant units, including the “scramble” capability of a detachment of North American Air Defense Command F-15 fighter interceptors in addition to the U.S. Customs and Border Protection Services -Miami Aviation Branch drug enforcement air interdiction mission. During the Atlantic hurricane season, the 482nd FW routinely supports forward deployment of the Air Force Reserve’s “Hurricane Hunters” weather reconnaissance mission. HARB tenant and partner commands and their missions are:

- **Florida Air National Guard (FANG).** Detachment 1 of the 125th Fighter Interceptor Group (FIG) is responsible for supporting the Southeast Air Division Sector with armed interceptor aircraft on continuous alert status. Central to the unit’s mission are escort, identification, and shadowing activities. When directed, the unit is responsible for the destruction of aircraft posing a clear and immediate danger to the United States and its property.
- **United States Army Special Operations Command South (SOCSOUTH).** This unit is a subordinate unit of the United States Southern Command (SOUTHCOM). It is a joint Theater Special Operation Command that plans and conducts special operations in support of the combatant commander’s strategies, plans, and operations.
- **United States Customs and Border Protection Service (USCBP).** The mission of the USCBP’s Miami Aviation Branch is intercepting, tracking, and apprehending suspect air and marine drug smugglers in the direct interdiction of smuggling operations and national security issues within the eastern United States.
- **Defense Reutilization and Marketing Offices (DRMOs)** DRMOs receive and temporarily store excess federal government supplies at Building 164, the Base Recycling Center. The Defense Reutilization and Marketing Service, which manages the DRMOs, is responsible for the sale, redistribution, donation, or disposal of excess and obsolete federal government supplies.

2.2 Environmental Planning

The Base uses a number of factors, including existing land-use, mission requirements, and plans and programs (see Section 2.4), when making land use and environmental management decisions. USAF environmental instructions and guidance used during the decision-making process include the 32 CFR 989, *Environmental Impact Analysis Process*; AFD 32-70, “Environmental Quality;” and AFI 90-801, “Environment, Safety, and Occupational Health Councils (ESOHC).”

These are used to guide the decision-making process through a systematic approach to achieve and maintain environmental quality.

Environmental Planning and Impact Analysis Process

The Environmental Flight Office is responsible for implementing the EIAP at HARB in accordance with the National Environmental Policy Act (NEPA) and 32 CFR 989. The EIAP ensures that environmental concerns are considered as early as possible and serves to integrate these issues into the decision-making process. The EIAP procedures have statutory public involvement requirements that are determined by the nature of the action and are based on the amount of potential impact. In addition to public review, state environmental resource agencies would be provided an opportunity to comment on and review proposed work, as deemed appropriate by AFRC.

Any project that has the potential to affect natural resources must be supported by a work request during the project planning phase. Environmental Flight staff would then review work requests for each individual project to determine the appropriate level of EIAP analysis and documentation required (i.e., categorical exclusion [CATEX], environmental assessment [EA], or EIS).

Environmental Flight staff review project plans and EIAP documentation to ensure compliance with the federal Endangered Species Act (ESA) and other natural resources regulations. The size of the project and the amount of the disturbance determine the required level of documentation. Project planning emphasizes maximum reuse and siting of facilities within previously disturbed areas to minimize impacts to natural resources. Projects found to have no significant impacts are normally covered under a categorical EA and may routinely proceed as exempt or a CATEX without further processing. Projects that are found to potentially have a significant impact require more detailed environmental study. Consultation with the USFWS and other federal agencies and substantially more analysis and documentation, as well as public involvement, is required for these projects prior to approval (Figure 2-1; also see Section 2.6 for additional information). On-Base projects are reviewed by ESOHC member organizations to ensure that all environmental impacts are identified and considered early in the project planning process and that appropriate mitigation actions are considered. At HARB, the ESOHC is a tiered entity that ensures appropriate level of consideration of environmental issues at every level of management. Individual Integrated Process Teams (IPT) from affected organizations on the Base meet and review proposed projects to ensure that all potentially affected disciplines have input into the decision-making process. After review by the Environmental Management Director and the staff, constituting the Environmental Quality Management Board (QMB), recommendations and comments are sent through the Environmental Management Board (EMB), chaired by the Base Vice Commander, and finally to the

Corporate Board ESOHC, chaired by the Base Commander. Adherence to this process enables mission requirements and time-critical deadlines to be met while maintaining compliance with the appropriate environmental regulations and minimizing impacts to environmental resources on the Base.

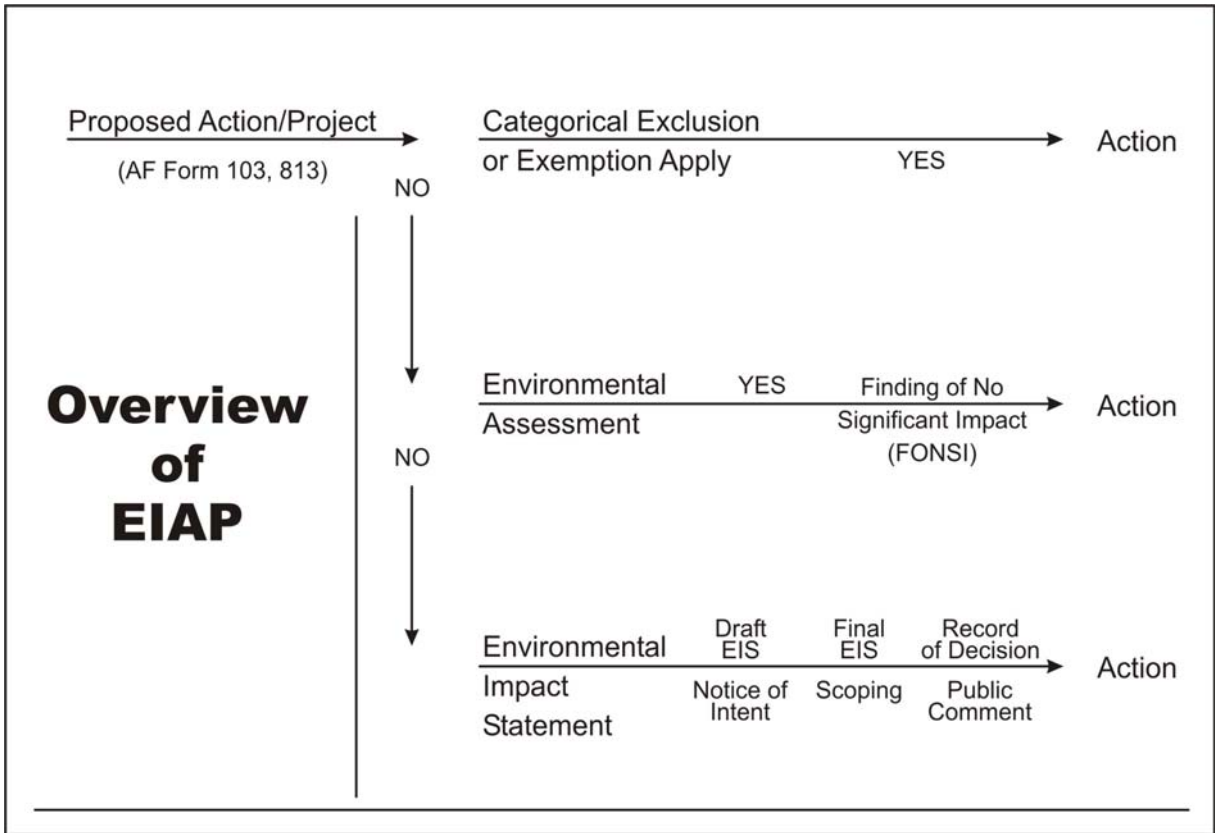


Figure 2-1 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

Geographic Information Systems

Today, Geographic Information Systems (GIS) are widely used for planning, decision-making, and ecosystem monitoring. GIS offers an effective tool for processing large amounts of ecosystem-level monitoring data, especially when data are related at varying temporal and geographic scales. GIS systems use computer technology, mapping methods, and geography to blend spatial data from various sources.

HARB has detailed GIS capabilities. HARB can process on-base any GIS requirements associated with management or project implementation. All survey data on wetlands and other natural resources conducted as part of this INRMP update have been entered into a GIS database for use by

HARB during future planning and decision-making efforts to ensure the consistency between the military mission and natural resources protection.

2.3 Plans and Programs

HARB operates under a variety of plans and programs to maintain the operational integrity of its military mission. Plans and programs have been prepared in accordance with AFIs and USAF directives and are compliant with federal and state requirements. The plans and programs address aspects of both the human-made environment (e.g., facilities associated with operations) and the natural environment, and have a direct impact on natural resources and land management decisions within HARB. This INRMP is designed to recognize, integrate, and support the future development of existing plans and programs. These plans are hereby incorporated by reference into this INRMP. This section provides a brief summary of HARB's existing major plans and programs.

2.3.1 Plans

General Plan Homestead Air Reserve Base

The most recent version of the *General Plan Homestead Air Reserve Base (HARB)* was prepared in 2006 based on comprehensive planning guidance provided in AFI 32-7062, "Air Force Comprehensive Planning." The plan was prepared well after the control and ownership of the airfield was transferred in 2003 from the Air Force Real Property Agency to the AFRC at HARB. The intent of the most recent HARB general plan is to guide the Base's long-range development process by providing the base commander, base civil engineer, and other decision-makers with a concise assessment of on-base conditions and recommendations for improvements to and future development of the Base. The plan goals are to:

- Support the wise use of Base resources;
- Advance environmental stewardship;
- Protect the AFRC community's high quality of life; and
- Achieve optimum land use and facility development.

Integrated Natural Resources Management Plan

Natural resources management at HARB is performed in compliance with AFI 32-7064, "*Integrated Natural Resources Management*." The INRMP focuses on the management of natural resources on HARB. The plan describes the existing environment, identifies topics of concern, and addresses each topic of concern through goals and objectives.

Flight Operations Plan

The flight operations plan (Homestead Air Reserve Base [HARB], 2009) is a single-source document concerning air traffic control and related operations. This plan includes air traffic pattern procedures that are coordinated with and help define the imaginary surface zones (e.g., clear zones, accident potential zones [APZs] I and II). These imaginary surface zones were used in the 2007 AICUZ study and are necessary for operational safety.

Integrated Pest Management Plan

HARB has prepared an integrated pest management plan (IPMP) in accordance with AFI 32-1053, "Pest Management Program," which implements DoD 4150.7, "Pest Management Program." The HARB IPMP (most recent update, JAN 2008) describes the Base's pest management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety, and environmental requirements of the program. HARB uses commercial pest control contractors to control insects, rodents, and unwanted vegetation. Miami-Dade Public Works Department is contracted to control mosquitoes. Pests addressed in the plan include weeds and aquatic vegetation, mosquitoes, wasps, crawling insects, nesting birds, and other vertebrate pests such as mice and rats. Actions addressing birds on or near the runway are discussed in the Base's BASH program (see Volume II, Appendix C).

Storm Water Pollution Prevention Plan

AFI 32-7041 "Water Quality Compliance" addresses compliance with a number of water quality issues, including storm water pollution prevention. Under this and other USAF regulations, each major command is responsible for developing contingency plans and procedures for minimizing pollutant contributions to the environment through storm water contact and flow. This includes developing, maintaining, and implementing a written storm water pollution prevention plan (SWPPP).

The last update to HARB's SWPPP was in April 2009. The SWPPP covers all industrial operations of the 482nd FW and all tenants associated with HARB. The objective of the plan is to minimize the impact of storm water discharges from industrial sites to surface waters through the implementation of SWPPP BMPs for source control, treatment control, and erosion and sedimentation control. HARB is covered under a multi-sector generic permit (MSGP) issued by the Florida Department of Environmental Protection (FDEP) for storm water discharges associated with industrial activities (Rule 62-621.300[5], Florida Administrative Code [F.A.C.]

Integrated Solid Waste Management Plan

AFI 32-7042 “Solid and Hazardous Waste Compliance” describes the requirements for all aspects of integrated solid waste management, including the content of the integrated solid waste management plan (ISWMP); recycling; disposal; handling, storage, and collection; oversight; record keeping and reporting; and budgeting. The ISWMP (updated June 2008) contains guidance for managing municipal solid waste, compostable materials, construction and demolition debris, and industrial solid waste at HARB. The ISWMP does not address the management of hazardous waste or other regulated waste.

Hazardous Waste Management Plan

AFI 32-7042 “Solid and Hazardous Waste Compliance” and Air Force pamphlet (AFPAM) 32-7043 “Hazardous Waste Management Guide” mandate that each USAF installation develop and implement a comprehensive hazardous waste management plan (HWMP). The HWMP requires annual review and update if existing conditions or requirements change.

The HARB HWMP (updated JAN 2009) outlines procedures for the proper accumulation, collection, transportation, and disposal of hazardous wastes. The HARB generates less than 1,000 kilograms of hazardous waste per month, and is considered a small-quantity generator of hazardous waste. Most of the hazardous waste generated is related to degreasing activities, while other wastes include waste paint, solvent-contaminated rags, and dye penetrants.

Bird/Wildlife Aircraft Strike Hazard Plan

Chapter 7 of AFI 91-202, “The U.S. Air Force Mishap Prevention Program” and AFPM 91-212, “BASH Management Techniques” establish procedures and guidelines for the development of the HQ 482nd FW BASH Reduction Program Plan (482nd FW BASH Plan, updated 7 SEP 2006; see Volume II, Appendix C). The purpose of the 482nd FW BASH Plan is to minimize aircraft exposure to potentially hazardous bird strikes or strikes with other wildlife. The plan is designed to:

- Establish procedures to identify high-hazard situations and to aid supervisors and pilots in altering/discontinuing flying operations when required;
- Establish aircraft and airfield operating procedures to avoid high-hazard conditions;
- Provide for disseminating information to all assigned and transient pilots on bird hazards and procedures for bird avoidance;
- Establish guidelines to decrease airfield attractiveness to birds;
- Provide guidelines for dispersing birds when they occur on the airfield; and
- Establish a Bird Hazard Working Group and designate responsibilities to its members.

The plan is based on hazards from both residential and migratory bird populations. Two distinctive land features contribute to the majority of BASH-related issues at HARB. First, the Base is located between two national parks (Everglades National Park and BNP; see Figure 1-1). These parks serve as breeding and migratory grounds for numerous bird species. Furthermore, the approach/departure end of the main runway is located approximately 5 miles south of the South Dade Landfill (known locally as “Mt. Trashmore”) owned and operated by Miami-Dade County.

2.3.2 Programs

Capital Improvement Program

The HARB Capital Improvement Program (CIP) describes projects needed to satisfy current facility deficiencies and to support future missions. The plan includes data on both existing and future programmed or proposed facilities and preliminary site recommendation for these facilities.

Air Installations Compatible Use Zones Program

AFI 32-7063, “Air Installation Compatible Use Zones (AICUZ) Program,” implements AFPD 32-70, “Environmental Quality,” by identifying the requirements to develop, implement, and maintain HARB’s AICUZ program. AFI 32-7063 also implements DoD Instruction 4165.57, “Air Installations Compatible Use Zones,” which was developed by the DoD to promote compatible land uses in non-government areas surrounding military airfields.

The 2007 AICUZ study for HARB is intended to protect the public’s health, safety, and welfare, and to prevent civilian encroachment from degrading the operational capacity of the military air installation. The 2007 AICUZ study provided noise contours, APZs, flight clearance zones and requirements, and recommended land uses that are compatible with noise levels, accident potential, and flight clearance requirements associated with military airfield operations. The AICUZ study is part of the continuing AFRC participation in the local planning process. As local communities prepare land-use plans and zoning ordinances, the AFRC has the responsibility to provide input on its activities relating to the local community. The results of the AICUZ study were intended to assist the local community in its land-use planning process.

Explosive Safety Clear Zones Program

Chapter 10 of AFI 91-202 requires the HARB to delineate explosive safety clear zones (ES CZ) around munitions areas based on quantity-distance criteria, which is discussed in Air Force Manual 91-201, *Explosive Safety Standards*. In compliance with this AFI, HARB has established a program with the primary objective of curtailing incompatible land uses and activities within the ESCZ arcs. By controlling land use activities within these arcs, HARB can limit the number of non-

essential personnel within the ESCZ, thereby, minimizing the inherent health and safety risks associated with these areas. ESCZs are centered on the Munitions Storage area west of the runway, on the hot cargo area refueling area, and the FANG area (HARB, 2006).

Homestead Recycling Program

AFI 32-7045, "Municipal Solid Waste Management," requires the HARB to integrate cost-effective waste reduction and recycling programs into their municipal solid waste management program. The Homestead Recycling Program (HRP) at HARB was established in 1993, focusing primarily on paper, cardboard, and aluminum products. In 2001, to more effectively meet the programmatic goals of at least 40 percent (%) diversion from landfills by 2004 established by Executive Order 13101 and the ISWMP, the HRP began to focus more on solid waste diversion. The most recent quarterly report indicated that 74.0% of solid waste was diverted from landfills.

Recyclable products are retrieved from all major buildings at HARB, collected, sorted, and packaged by a work crew from the Federal Correctional Institutional and Federal Prison Camp Inmate Work Release Program. The HRP also assists tenant agencies on the Base with recycling efforts. HRP efforts are coordinated with local off-Base recycling companies to increase the Base's recycled materials to include the most common paper, cardboard, and aluminum products, as well as glass, lead acid batteries, paints, used oils and petroleum products, scrap metals, toner and ink-jet cartridges, fluorescent tubes, and scrap wood, including pallets and crates. Other recyclable materials include tin cans, certain types of plastic containers, compact and floppy discs, and videotapes. The HRP even handles recycling office products, such as binders, and notifies various departments of their availability.

Installation Restoration Program

The Installation Restoration Program (IRP) was established by the DoD to ensure that military installations identify and evaluate suspected problems associated with past waste disposal. The IRP determines a process to evaluate past disposal sites, control the migration of contaminants, assess potential hazards to human health and the environment, and if needed conduct environmental restoration activities. The IRP is conducted in accordance with Section 211 of the Superfund Amendments and Reauthorization Act (SARA) and the Defense Environmental Restoration Program. The AFRC at HARB coordinates their IRP activities through representatives of the U.S. Environmental Protection Agency (USEPA), FDEP, and DERM.

The IRP at HARB was initiated in 1983 with a Phase I Record Search to identify potential areas of concern (AOCs) at the Base. HARB was placed on the National Priorities List (NPL) on August 30, 1990, which brought it under the Federal Facilities provisions of Section 120 of the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). On 1 March 1991, Homestead AFB, the USEPA, and the FDEP signed a Federal Facility Agreement (FFA) establishing a framework and schedule for developing, implementing, and monitoring appropriate remedial actions at potential source-of-contamination sites in accordance with the National Contingency Plan. The FFA also provided guidance relative to the record of decision (ROD) and remedial design/remedial action (RD/RA) process. By the end of September 2006, all CERCLA clean-up remedies and remedial actions were in place.

Program Awards

Over the past several years, HARB has won several USAF environmental program awards including the “Best Civil Engineering Base in the Reserves Award” and the Thomas D. White Award for environmental excellence in several areas. Receipt of these awards is based upon HARB’s excellence in environmental management. To achieve this level of management, HARB has worked with various entities to develop and implement numerous plans, programs, and studies.

2.4 Natural Resources Management Projects

INRMP Projects

Projects that were proposed in the two previous INRMPs, but were not completed during that planning period, have been reviewed and incorporated into this 2009-2014 INRMP update. The status of each project from the 1996 INRMP (see shaded area below) is depicted in revised and updated Table 2-1 and compared to the 2004 INRMP. During the development of this INRMP, goals and objectives, issues, and projects from the 1996 INRMP, as well as a review of regional ecosystem concerns, were evaluated to form the goals, objectives, and projects proposed for this 2009 INRMP. Depending on the methodology proposed, projects associated with clearing of vegetation and forested resources may require authorization through issuance of an Environmental Resource Permit (ERP) from the South Florida Water Management District (SFWMD).

Table 2-1						
INRMP Project Implementation Table						
Project	Completed 1996-2001	Completed 2004-2009	Proposed 2004-2009 ^a	Est. Cost FY 2004-2009 (09\$)	Est. Completion Date	Completed
Grounds Maintenance (Landscape Management Plan)	--	--	Project #2	\$35,600	2010	Update In progress
Threatened and Endangered Species Component Plan	--	✓ ^b	--	N/A	2011	--
Wetlands Assessment and JD ^c	--	✓ ^b	--	N/A	--	--
Canal Survey	✓	--	--	N/A	--	--
Fish and Wildlife Management Plan	✓	--	--	N/A	--	--
Recreation Management Plan	--	--	Project #s 6 and 7	\$50,100	None	Cancelled; Areas not suitable
Southeast Triangle Drainage Evaluation	--	--	Project #1	\$28,500	None	Cancelled; Area not suitable
Wetlands Removal Study	--	X	Project #3	\$23,700	2005/2010	50%; update in progress
Exotic Species Management Plan	--	X	Project #4	\$47,500	2005/2010	50%; update in progress
Pine Rockland Restoration Plan	--	--	Project #5	\$11,500	2011	--
Boundary Canal Exotic Fish Removal Study	--	--	Project #8	\$41,500	None	Cancelled; not feasible.
Caiman Removal Study	--	--	Project #9	\$42,100	2011-2012	--
Ecosystem Management Training	--	--	Project #10	\$23,700	2009/2010	partial

Notes: Shaded projects were proposed in the 1996 INRMP.

^a See Volume II, Appendix A.

^b Projects completed as part of this INRMP.

^c The changes to the Wetland Assessment and Jurisdictional Determination should be reviewed by SFWMD for concurrence that the delineation accurately reflects the wetland boundary, as defined by Rule 62-340, Florida Administrative Code.

Key:

FY = Fiscal year.

Est. = Estimated.

JD = Jurisdictional Determination.

Recent and Ongoing Projects

The Base has initiated a number of projects, including military construction (MILCON) projects related to natural resources management. Although these projects are primarily related to the continuance of the military mission, these projects will also enhance natural resources on HARB.

Completion of these projects assists HARB in obtaining the designated goals and objectives of this INRMP (see Goal 1, Section 4). Any vegetation alteration involving soil disturbances may require an ERP. The following projects have either been completed or are currently moving forward since the 2004 INRMP was completed.

On-Base projects include:

- **Clear Trees from Primary Surface RW 05/23 (MILCON Project KYJM029010).** The proposed work was to clear trees that violated the primary surface of the runway to comply with Unified Facilities Criteria 3-260-01, “Airfield and Helicopter Planning and Design.” The criteria require that no obstructions penetrate the height of the runway centerline within 1,000 feet of the centerline. It also requires that at the end of the primary surface that no objects penetrate the 7:1 glide slope ratio. A large portion of the trees on the south side of the runway have been removed. Work is proceeding on the north end of the runway.
- **Repair Flood Control System Building 875 (KYJM09020).** The proposed work is to remove existing flood control systems and install new pumps, intakes, flood gates, protection cages, motors, controls and all new electrical. It is expected to start in late FY09 or early FY10. The floodgates are in poor condition and the two auxiliary floodgates located on the north side of Building 875 are inoperable. Under certain conditions during periods of high rainfall and hurricane season, the current system is unable to regulate the flow of water in the holding pond. As a result, the flight line and other areas of the Base are subject to flooding (AFRC, 2002b).
- **Clear Vegetation in Boundary Canal (MILCON Project KYJM019023).** The project is for the mechanical removal of excess vegetation within and along the banks of the Base’s Boundary Canal south of the runway. It is expected to start in late FY09 or early FY10. Vegetation in the canal has become thick enough to impede the free flow of water to the storm water reservoir. Miscellaneous debris also has accumulated. These conditions make the Base vulnerable to flooding during periods of high rainfall and hurricane season (AFRC, 2002b).
- **Encapsulation of Entire OU-11 Canal and Installation of Sediment Control Structure at Base of Reservoir.** The CERCLA project consisted of two main components:
 - Construction of a sediment control structure within the reservoir in front of the pump station to allow suspended solids to settle prior to entering the pump intake structure. This prevents the pumps from collecting and transporting sediment into Military Canal.
 - Encapsulation of Military Canal and portions of the Boundary Canal storm water reservoir with impermeable concrete-filled fabric to prevent contaminated sediments from migrating to BNP (AFBCA, 2002). This was completed in 2002-2003 through coordination with the USEPA and FDEP.

Off-Base projects include:

- **Comprehensive Everglades Restoration Plan (CERP) Biscayne Bay Coastal Wetlands Project.** This project is listed as “not yet authorized” and in its “Pre-

Construction, Engineering and Design” phase on the Comprehensive Everglades Restoration Plan’s website. Restoring Biscayne Bay involves recreating natural overland sheet flow of water that has been changed with the construction of drainage canals. The project is intended to restore the overland sheet flow in a 13,600-acre area through the construction of spreader canals and other features. Project work will primarily occur from the Deering Estate at C-100C, south to the Florida Power and Light Turkey Point power plant, generally along L-31E. The more natural water flow should improve the ecology of Biscayne Bay including its freshwater and tidal wetlands, near shore bay habitat, marine nursery habitat, oysters and the oyster reef community

While the project is still largely in the planning phases, it will eventually affect water flow in the Military Canal as described below. The April 2009 monthly Project Status Report notes that plans for the first project increment include adding a pump, spreader canal, culverts, and other improvements to an unspecified canal. Another project involves adding a pump, culverts, a canal, and restoration of the Lennar Flow-way. In the L-31E Flow-way/North Canal Flow-way the additions will include pumps, a spreader canal, and several culvert structures to manage flow between C-102, L-31E, Military Canal, and C-103 and the nearby restoration areas. No construction activities are recommended in the first increment for the Barnes Sound area. Work planned for the next reporting period involves drafting a Scope of Work and beginning negotiations for peer reviews of documents.

2.5 Management Philosophy

Management Philosophy

HARB lacks the natural resources to support a management concept based on endemic conditions for resource type, such as wetlands, habitats, or water quality; however, ecosystem principals continue to form the basis for the management concepts in this INRMP.

Historically, the natural conditions on HARB were relatively uniform, consisting of wet marsh and isolated tree islands (see Section 3.11). Over time, the natural hydrologic conditions, land surface conditions, and vegetation communities have been significantly altered and degraded through land use changes, creation of upland urban areas, water delivery modifications, wetland losses, fire suppression, and exotic species proliferation, which are also prevalent concerns throughout the South Florida region. As a result of these man-made conditions, the Base has lost much of its historical natural diversity and cannot be meaningfully separated into natural vegetative communities or other resource categories.

Similarly, the lands surrounding HARB have been highly altered to accommodate intensive residential and commercial development and agricultural uses and bear almost no resemblance to the natural conditions of pre-development. However, the HARB INRMP recognizes that, on a regional scale, the Base is located within the South Florida ecosystem and that, to a degree; it continues to support some important natural functions and features that are associated with this larger ecosystem.

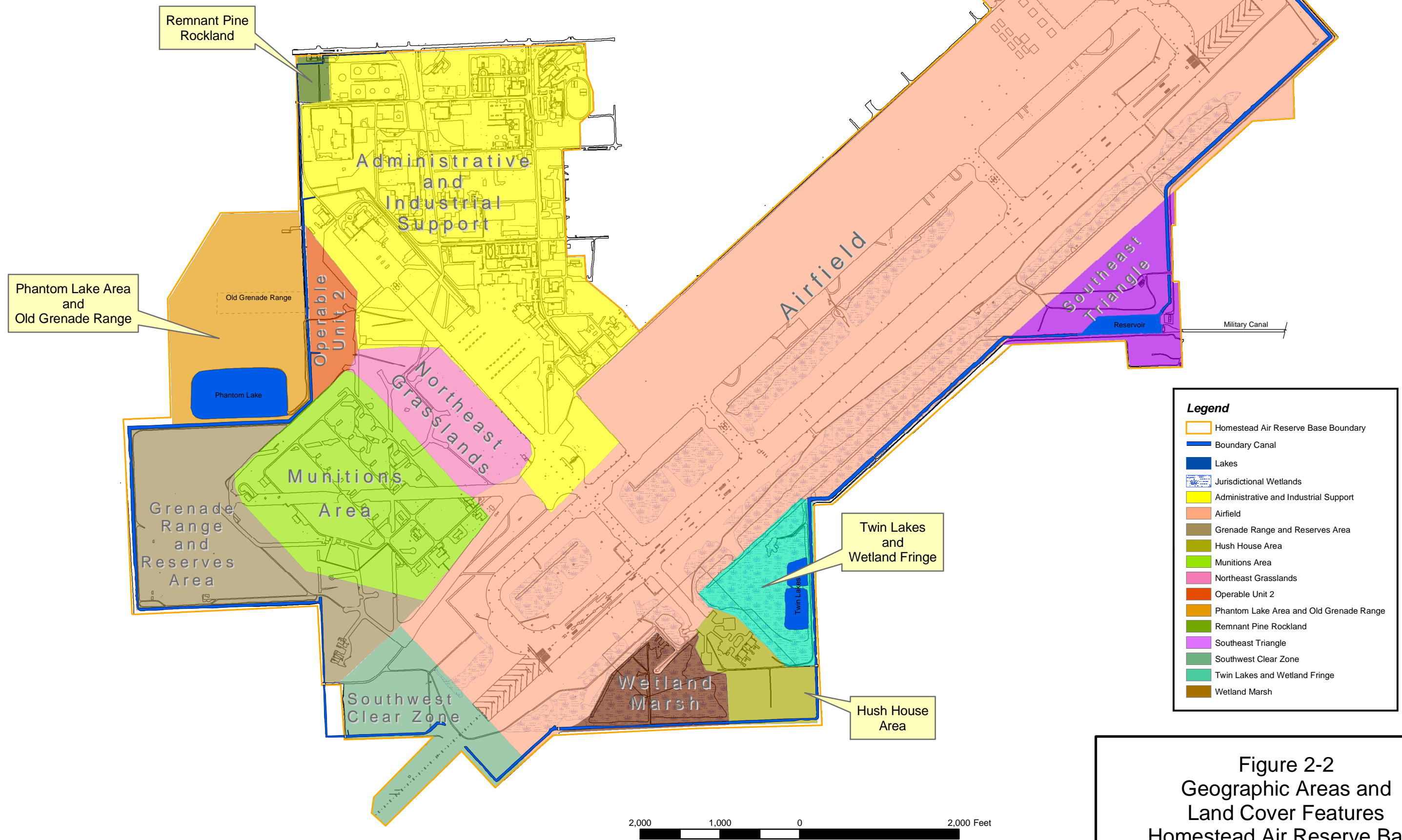
Land Management Units

The altered hydrology, the developed condition of the HARB property, and the importance of complying with practices for preserving the mission's integrity limit the development of an environmental approach that separates the Base according to its natural resource functions. They do, however, allow for certain management initiatives for enhancing and/or maintaining a semi-natural condition, and in some areas more so than in others. The goals and objectives strive to identify, protect, and enhance natural systems on the Base while fully incorporating social, economic, and other human concerns into the planning process.

To accomplish this approach, fourteen separate land management units have been identified based on similar land uses and activities within each that support the military mission and/or the opportunities afforded on these lands for natural resources management (see Figure 2-2). This is particularly critical since the entire Base is fully utilized for mission activities, and the natural features must co-exist within these intensively managed efforts (see Figure 2-3). The fourteen land management units, as identified in the 2004 INRMP, are listed below (acreages are approximated) and are depicted on Figure 2-2:

- Boundary Canal: 40,400 linear feet;
- Administrative and Industrial Support: 334.3 acres;
- Airfield area: 945.3 acres;
- Grenade Range and Reserves area: 116.6 acres;
- Hush House area: 30.6 acres;
- Munitions area: 122.0 acres;
- Northeast Grasslands: 50.5 acres;
- Operable Unit (OU)-2 area: 21.1 acres;
- Phantom Lake, including the Old Grenade Range: 93.8 acres;
- Remnant Pine Rockland: 5.1 acres;
- Southeast Triangle: 51.9 acres;
- Southwest Clear Zone: 57.0 acres;
- Twin Lakes and Wetland Fringe: 40.8 acres; and
- Wetland Marsh: 34.7 acres

As natural resource goals and objectives are implemented, future conditions on HARB would be expected to improve; however, it is necessary to monitor programs to ensure desired outcomes. To accomplish this, a monitoring component is included in Section 4.1 (see Table 4-1) to track progress related to implementing the goals and objectives of this INRMP. With continued maintenance and monitoring, proposed management activities in this INRMP can contribute to improving and conserving some important ecosystem functions on the Base.



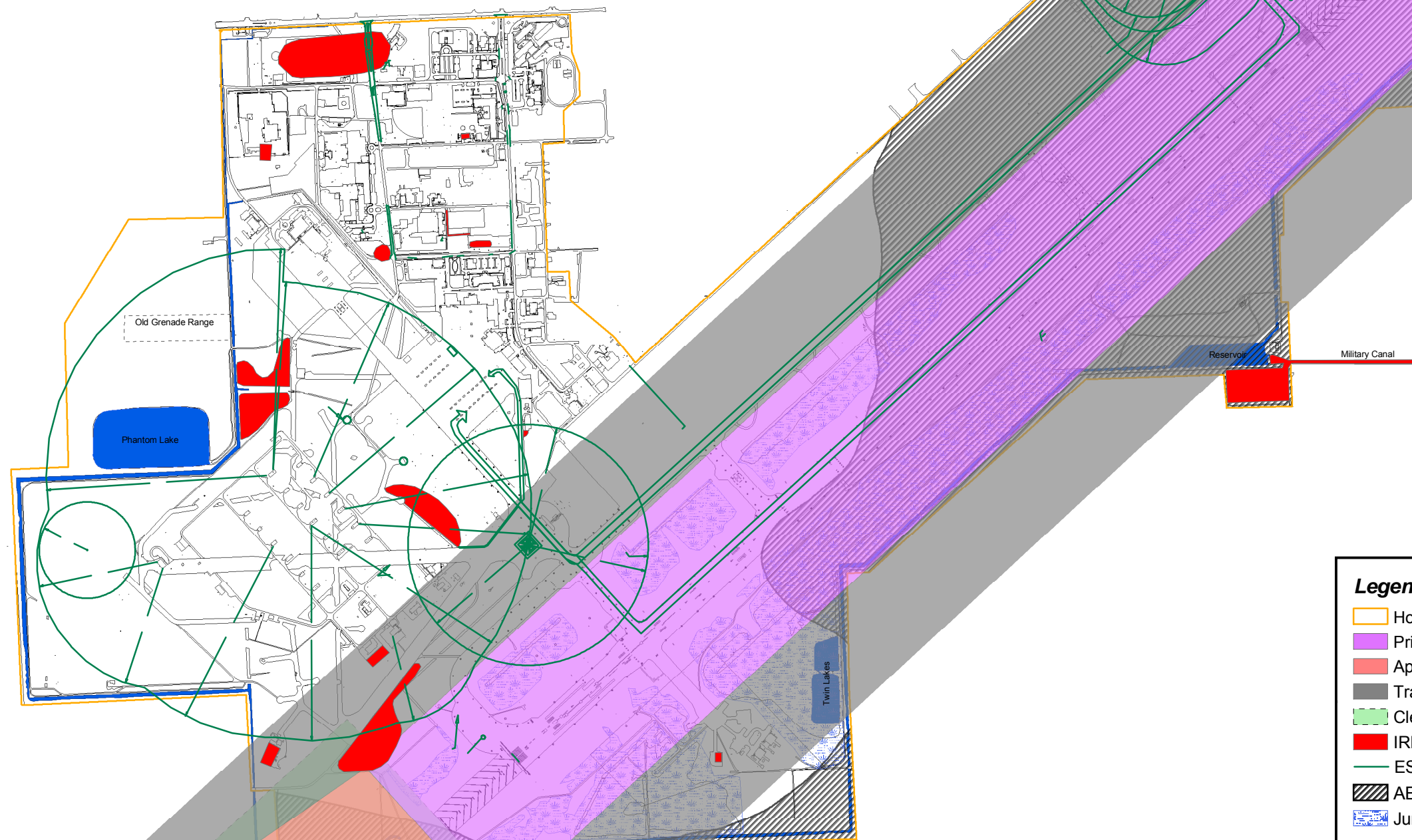
Legend

- Homestead Air Reserve Base Boundary
- Boundary Canal
- Lakes
- Jurisdictional Wetlands
- Administrative and Industrial Support
- Airfield
- Grenade Range and Reserves Area
- Hush House Area
- Munitions Area
- Northeast Grasslands
- Operable Unit 2
- Phantom Lake Area and Old Grenade Range
- Remnant Pine Rockland
- Southeast Triangle
- Southwest Clear Zone
- Twin Lakes and Wetland Fringe
- Wetland Marsh

Figure 2-2
Geographic Areas and
Land Cover Features
Homestead Air Reserve Base

Source: HARB 2001; E&E 2002c

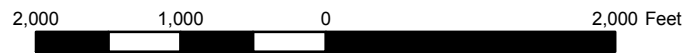
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Legend

- Homestead Air Reserve Base Boundary
- Primary Surface Zone
- Approach-Departure Clearance Surface
- Transitional Surface Zone
- Clear Zone
- IRP Sites
- ESCZ Arcs
- AE: 100-Year Flood Zone
- Jurisdictional Wetlands

Figure 2-3
Constraint Features
Homestead Air Reserve Base



Source: USAFCESA, 2001; HARB, 2001; SEA, 1996; E & E, 2002c; FEMA, 1996.

2.6 Management Tools

For any proposed INRMP project, federal, state, and local permits, and other requirements may be necessary. Because no two projects are ever the same, communication with the appropriate agencies should be started as early as possible to gain a preliminary understanding of what permits, consultation, or other regulatory requirements may be necessary. A list of agencies consulted is provided in Section 6. The permitting and consultation processes listed in this section are the primary laws to consider during the initial project planning stages.

Coastal Zone Management

Under provisions of the federal Coastal Zone Management Act (CZMA) of 1972, any federal activity that has the potential to impact a state's coastal resources is reviewed for consistency with the state's approved Coastal Zone Management Program. Section 304 of the Act excludes all federal lands from the coastal zone; however, Section 305 requires federal agencies that conduct activities that directly affect a state's coastal zone to make sure these activities are consistent, to the maximum extent practicable, with the state's program. The Florida Coastal Management Program (FCMP) is comprised of 23 Florida statutes. Projects that may affect any land or water use, or natural resource of the coastal zone are subject to the FCMP and the consistency review process. A manual entitled, "Florida Coastal Program Guide: A Guide to the Federally Approved Florida Coastal Management Program" can be downloaded at www.dep.state.fl.us.

Wetlands Regulation

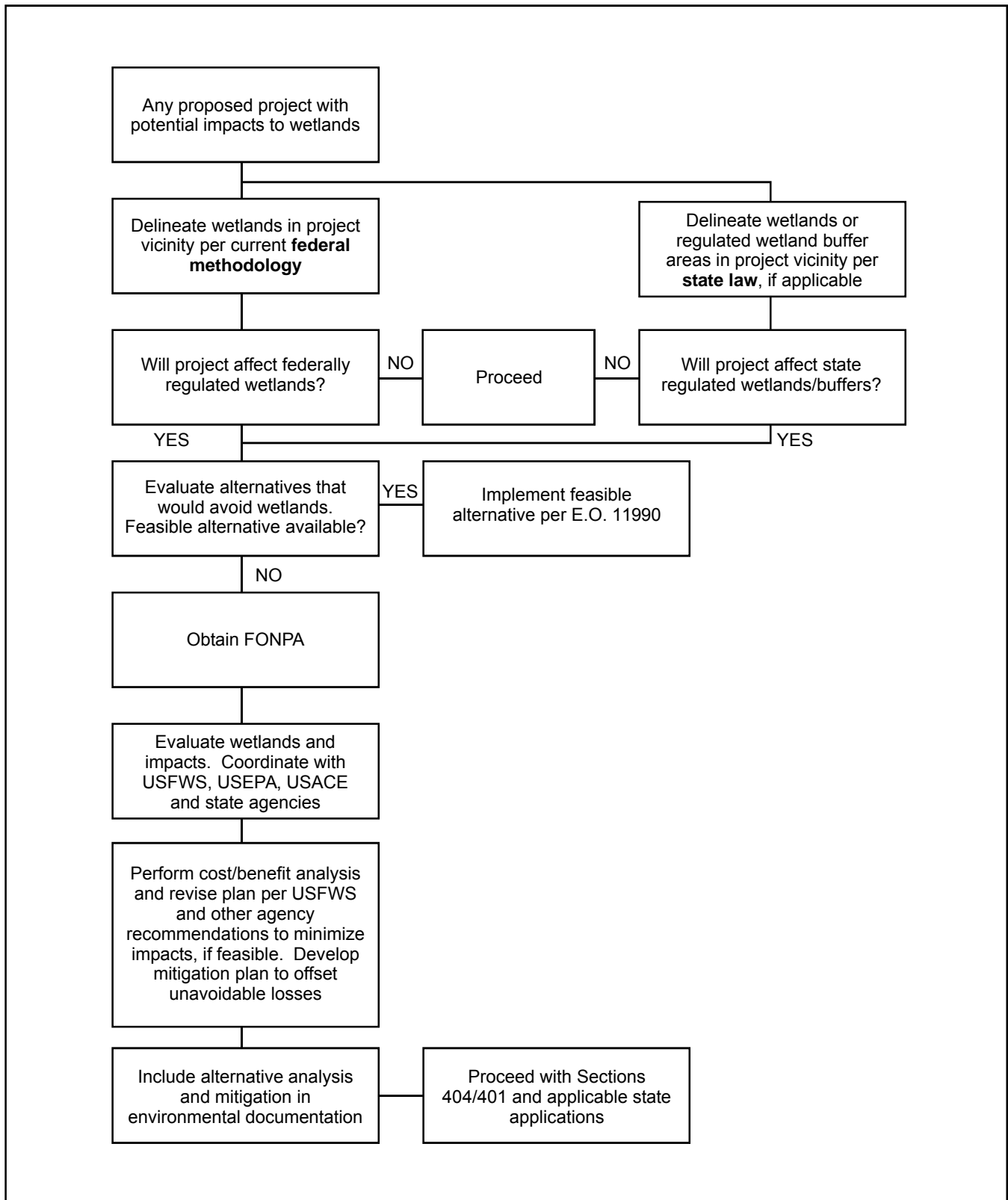
Congress passed the federal Clean Water Act (CWA) to provide a regulatory framework that would allow development affecting wetlands, while preserving wildlife habitat and water quality. Section 404 of the CWA created a permitting program for regulating projects that have the potential to impact wetlands. The United States Army Corps of Engineers (USACE) has authority under Section 404 to issue permits for the discharge of dredged or fill material into jurisdictional wetlands or other waters of the United States. The USEPA, under Section 401 of the CWA, also requires water quality certification for these projects. Prior to implementation of any action that affects a wetland or occurs within a floodplain; a Finding of No Practicable Alternative (FONPA) must be prepared and signed as directed by AFI 32-7064. Figure 2-4 outlines the wetland permitting process, while Figure 2-5 illustrates the eight-step planning process for floodplain/wetland management. Additional contact information is provided in Section 6.

Endangered Species Act

The ESA requires that federal agencies act to conserve endangered and threatened species. In furtherance of these goals, the ESA prohibits the “taking” of any endangered fish or wildlife species and the removal or destruction of any endangered plant species. If a federal action would affect an endangered or threatened species or result in the destruction or modification of its critical habitat, the agency must consult with the USFWS. Figure 2-6 outlines the ESA consultation process. Additional contact information is provided in Section 6.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes national policies and goals for the protection of the environment. NEPA requires federal agencies to consider the environmental impacts of their proposed actions and incorporate reasonable alternatives to those actions. Agencies must also establish specific criteria for actions that: 1) usually require an EIS; 2) normally require an EA, but do not necessarily require an EIS; and 3) require neither an EA, nor an EIS (i.e., is categorically excluded). Because of its multipurpose scope as the basic policy-setting federal law relating to protection of the environment, the NEPA process is an excellent means to accomplish the required coordination among the various environmental laws. NEPA requirements were promulgated in DoD’s EIAP rule. The rule and process to follow at HARB are described in Section 2.2. Additional contact information is provided in Section 6.



SOURCE: AFRC, 1996.

Figure 2-4 WETLAND PERMITTING PROCESS

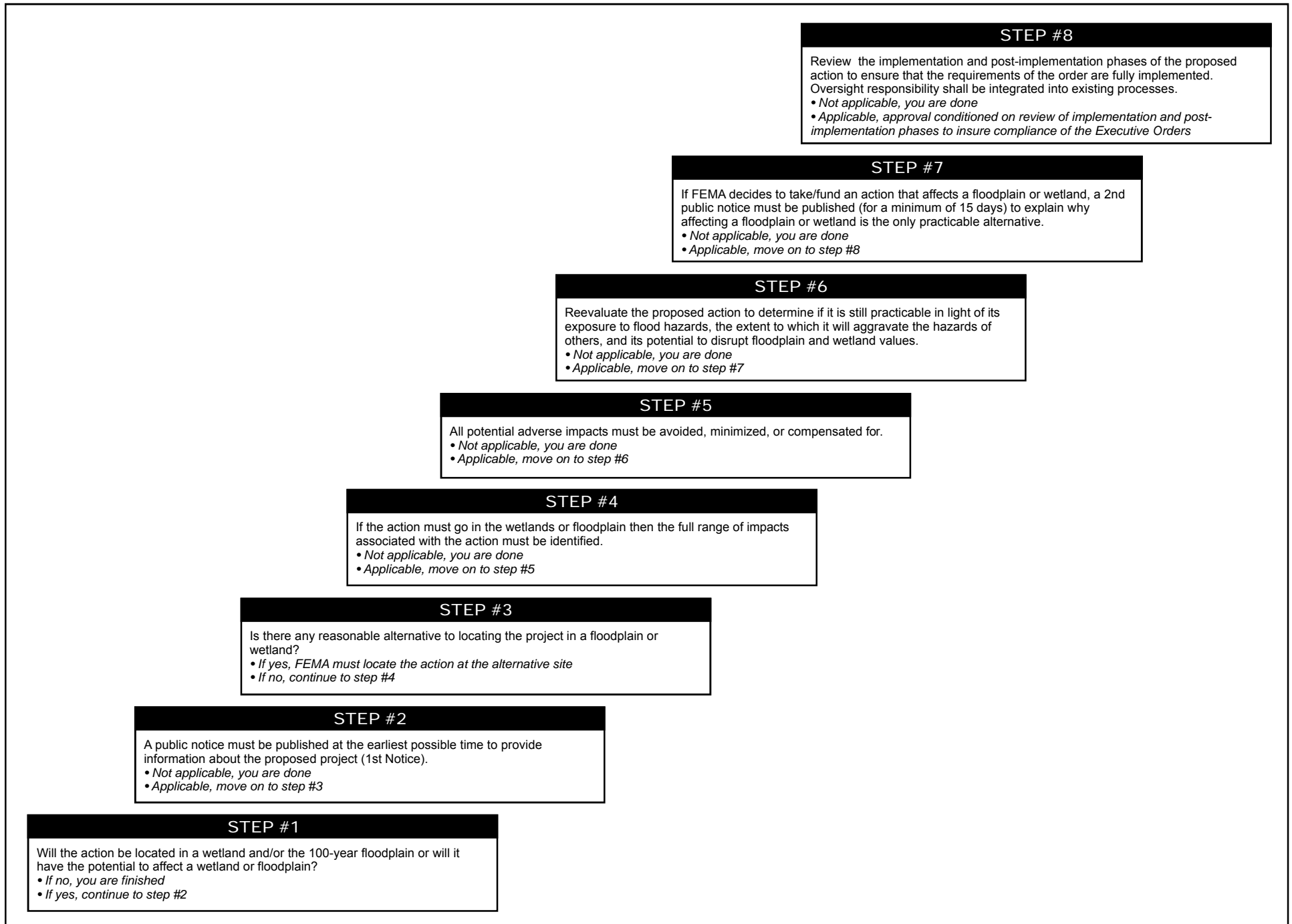
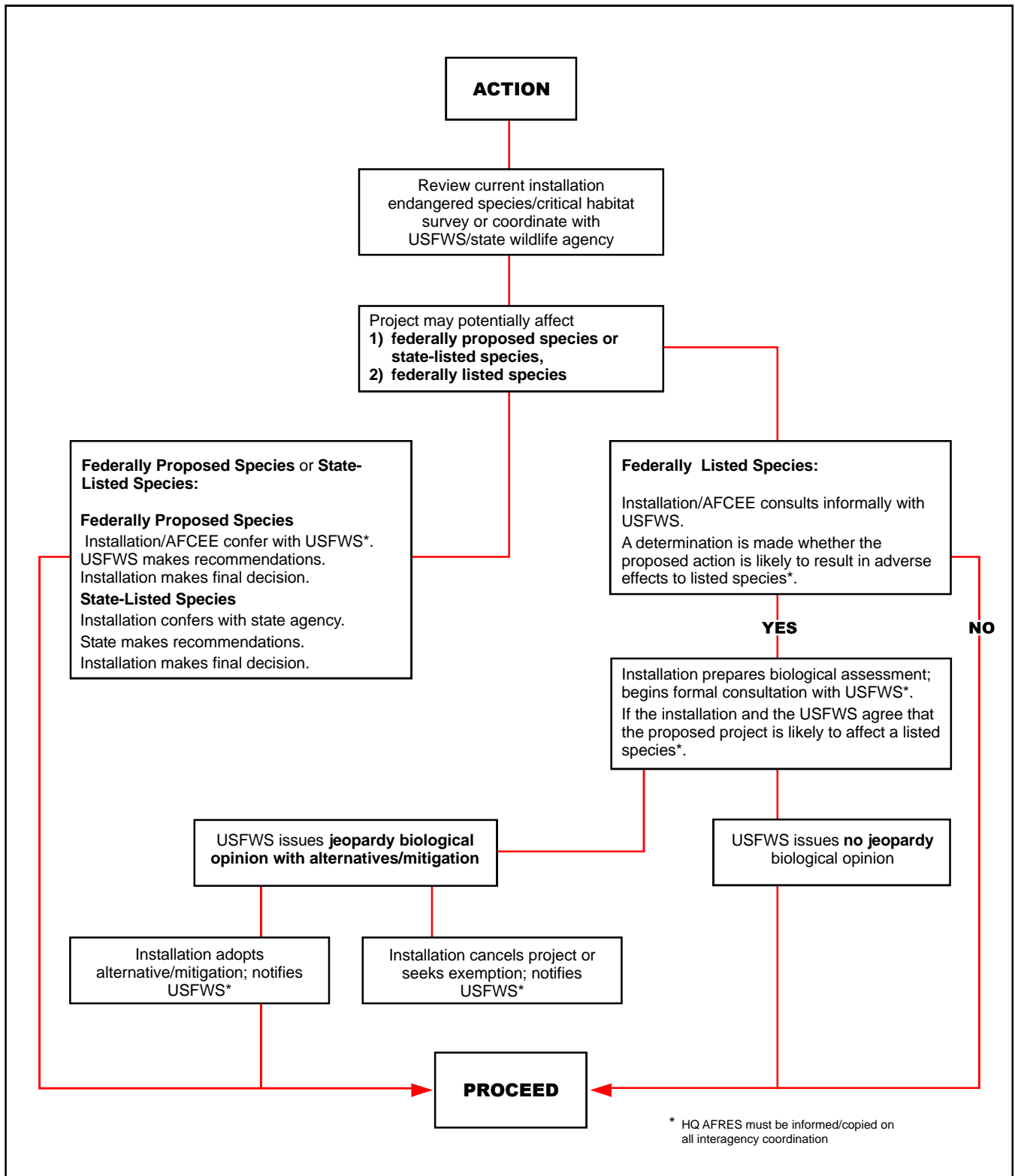


Figure 2-5 EIGHT-STEP PLANNING PROCESS FOR FLOODPLAIN/WETLAND MANAGEMENT



SOURCE: AFRC, 1996.

Figure 2-6 PROTECTED SPECIES COORDINATION PROCESS

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3

Existing Environment

This section describes the existing physical and biological environments on HARB and within the geographic region of HARB. The information presented in this section will establish a baseline for monitoring the success of implementing the goals and objectives presented in Section 4.

3.1 Climate and Air Quality

3.1.1 Climate

HARB is located within a subtropical maritime climate characterized by long, warm, rainy summers and mild, dry winters. Temperatures in the region are warm, but are moderated by the maritime influences of the Atlantic Ocean and Gulf of Mexico. The average high temperature for HARB is 81.3 degrees Fahrenheit (°F) while the average low temperature is 68.2°F (see Table 3-1).

Table 3-1													
Average Temperatures and Rainfall Amounts Homestead Air Reserve Base, Homestead, Florida													
	January	February	March	April	May	June	July	August	September	October	November	December	Year
<i>Average Maximum Temperature</i>													
Degrees Fahrenheit	73.9	75.0	77.2	80.8	82.8	85.6	87.4	88.2	86.9	83.7	78.8	74.8	81.3
<i>Average Minimum Temperature</i>													
Degrees Fahrenheit	58.6	59.4	62.8	67.8	71.2	74.5	76.1	76.1	75.6	71.6	65.1	59.5	68.2
<i>Average Rainfall Amount</i>													
Inches	2.2	3.1	2.8	3.8	10.2	7.5	4.0	6.7	14.2	7.6	0.6	0.6	63.3

Source: Buttle and Tuttle, 2002.

In general, only two seasons characterize the local weather: a summer wet season from May through October, and a winter dry season from November through April. Table 3-1 indicates that rainfall averages about 8 inches per month during the rainy season and about 2 inches per month during the dry season, with a total average rainfall of 63.3 inches per year.

Typically, the area receives sea breezes of 6 to 8 knots from the east and southeast, but wind direction varies depending on the season. Between December and February, the prevailing winds are from the northwest; between March and August, the winds are primarily from the southeast; and between September and November, the prevailing winds are easterly (USAF and Federal Aviation Administration [FAA], 2000).

Tornadoes are very rare within this region, but can occur. Severe lightening storms also may occur during the summer. Hurricanes impact the region approximately every three years during hurricane season (between June and October; AFRC, 1996). In September 1945, a severe hurricane caused extensive damage to the airfield placing the Base on inactive status until 1953. In August 1992, Hurricane Andrew struck the Homestead/Miami area causing the most property damage in United States history. The hurricane caused severe damage to 97% of the former Homestead AFB (Agency for Toxic Substances and Disease Registry [ATSDR], 1998).

3.1.2 Air Quality

The Clean Air Act (CAA), which was last amended in 1990, requires the USEPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The USEPA Office of Air Quality Planning and Standards has set NAAQS for six principal pollutants, which are called “criteria” pollutants (USEPA, 2002a). Criteria pollutants include ozone (smog), lead, carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), particulate matter (soot) of 10 microns or less in diameter (PM₁₀), and particulate matter (soot) of 2.5 microns diameter (PM_{2.5}). It should be noted that ozone does not occur directly from any source, but results from a series of reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in sunlight.

All areas within the state of Florida are designated with respect to the concentrations of each of these six criteria pollutants. The designations include “attainment,” in compliance with the standards; “nonattainment,” not in compliance with the standards; or “unclassifiable,” insufficient data to classify (Florida Department of Environmental Protection [FDEP], 1999).

HARB is located within the Southeast Florida Intrastate Air Quality Control Region (SF-IAQCR). This region consists of Broward, Miami-Dade, Indian River, Martin, Monroe, Okeechobee, Palm Beach, and St. Lucie counties. Ambient air quality within the SF-IAQCR and subsections of it

are monitored for NO_x, CO, SO₂, ozone, particulate matter with aerodynamic diameters less than 2.5 microns (PM_{2.5}), particulate matter with aerodynamic diameters less than 10 microns (PM₁₀), and total suspended particulate (TSP; or particulate matter [PM]) to determine compliance with NAAQS.

Homestead ARB is located adjacent to the city of Homestead within Miami-Dade County, Florida. The County is classified as in attainment with the following air quality standards: CO, SO_x, and PM₁₀. As of June 15th, 2005 Miami-Dade County is no longer subject to the 1 hour standard for ozone. This is on the EPA website at <http://www.epa.gov/oar/oaqps/greenbk/oindex.html>. Under the new eight-hour ozone standard Miami-Dade County is designated as in attainment based on sampling data from 2001 through 2003.

HARB Stationary Sources

In 2007, stationary air emission source categories at HARB included external combustion sources, internal combustion sources, fuel transfer/dispensing, storage tanks, surface coating operations, degreaser/solvent cleaners, fuel cell maintenance, off-aircraft engine testing, miscellaneous chemical usage, and dust collectors. Major source thresholds have been established to determine the applicability of Title V air permit requirements for these stationary sources of air pollutants. Because annual emissions from these sources are less than the corresponding major source thresholds, HARB is not required to operate under a Title V permit. Currently, HARB operates under Air Emissions Annual Operating Permit No. 0250553-002-AO, issued by Miami-Dade County.

Table 3-2 details the actual air emissions from CY 2007. The use of internal combustion engines, including stationary and portable emergency generators, and the engine test stand contributed to the largest amounts of NO_x, CO, SO₂, PM, PM_{2.5} and PM₁₀. HARB currently utilizes 25 emergency generators, five fire suppression pumps, and three outflow canal pumps.

Mobile Sources

Mobile Sources are not tracked on HARB.

**Table 3-2.
Actual Air Emissions from Stationary Sources in 2007 (in tons per year)^a**

Source Category	PM₁₀	PM_{2.5}	CO	NO_x	SO_x	VOCs	Total HAPs
Degreasers	-	-	-	-	-	-	-
Dust Collectors (includes Firing Range)	< 0.01	< 0.01	<0.01	-	-	-	-
Emergency Generators	0.14	0.138 0	.489	2.24	0.0334	0.187	< 0.01
Engine Test Stand	0.0722 0	.0722	1.63	1.44	0.0298	0.906	.0109
External Combustion	< 0.01	< 0.01	0.0135	0.0993	0.0106	< 0.01	-
Fuel Cell Maintenance	--		-	-	-	0.0202	< 0.01
Fuel Transfer	-	-	-	-	-	0.404	0.0228
Misc. Chemical Use						-	0.2399
Storage Tanks	-	-	-	-	-	0.869	0.0287
Surface Coating	< 0.01	< 0.01	-	-	-	0.5	0.187
Total for all Sources	0.22	0.22	2.14	3.78	0.07	2.89	0.49

a) Emissions of less than 0.01 tons/year are shown as <0.01.

CO = Carbon monoxide
HAP = Hazardous air pollutant
NO_x = Nitrogen oxides
VOCs = Volatile organic compounds

PM₁₀ = Particulate matter of 10 microns or less
PM_{2.5} = Particulate matter of 2.5 microns or less
SO_x = Sulfur oxides

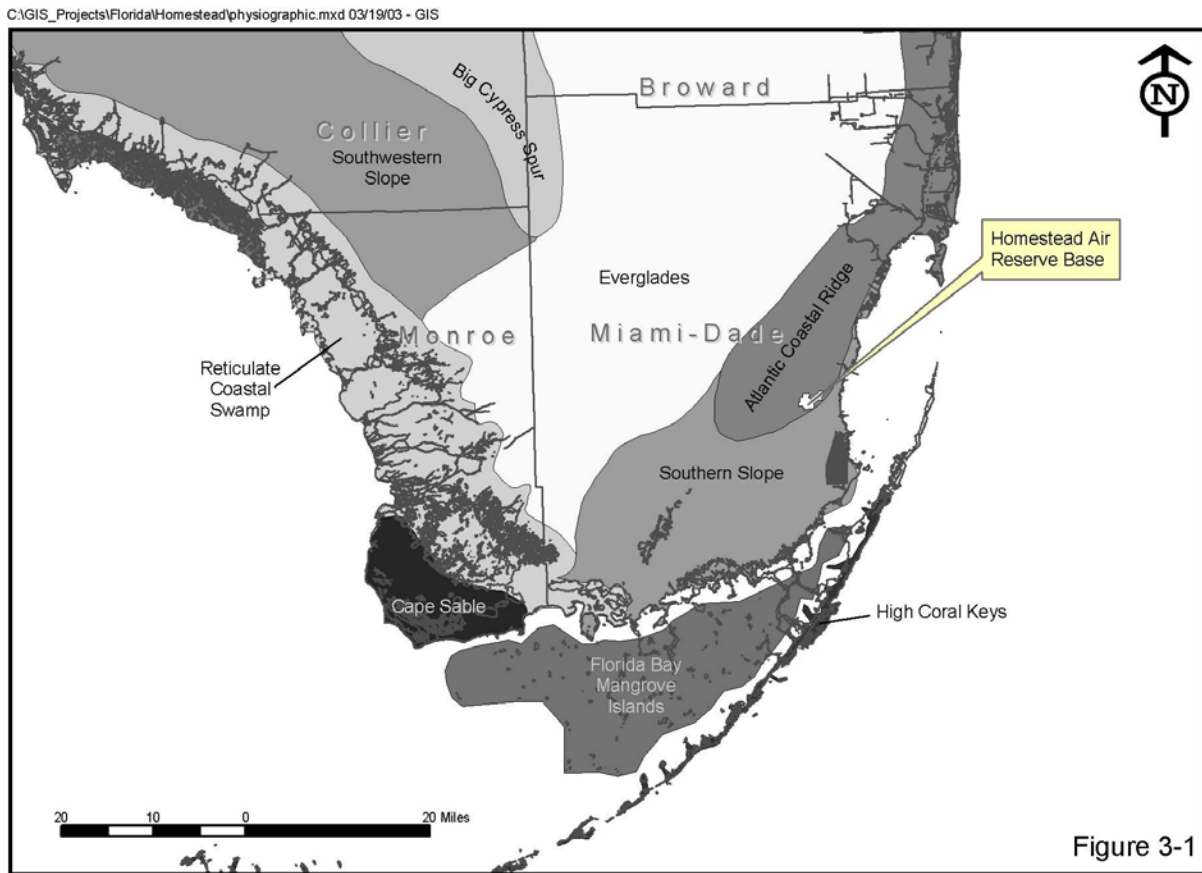
3.2 Geology, Stratigraphy, Soils, and Topography

3.2.1 Geology

The following geomorphic or physiographic features are present in the southeastern peninsula of Florida: the Everglades Trough, the Atlantic Coastal Ridge (Miami Ridge), and the Southern Slope

(Figure 3-1). HARB is located within the Atlantic Coastal Ridge physiographic province (see Figure 3-1; White, 1970).

The Atlantic Coastal Ridge extends south from the Jacksonville vicinity along Florida’s east coast. The southern extension of the Atlantic Coastal Ridge is called the Miami Ridge, which is underlain by very porous oolitic limestone that was formed under warm, shallow marine waters during higher sea levels of the Pleistocene era about 2 million years ago (United States Department of Agriculture Natural Resources Conservation Service [USDA NRCS], 1996). The Miami Ridge is relatively narrow and sandy, bounded by coastal marshes and mangrove swamps to the south and east and the Everglades to the west, and forms the highest ground elevations (up to 10 feet) in southeastern Miami-Dade County (AFRC, 1996).



Source: Florida Geological Bulletin No. 51 "The geomorphology of the Florida Peninsula", White, 1970

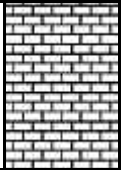




Figure 3-1: The Geologic and Physiographic Features of the Southeastern Peninsula of Florida

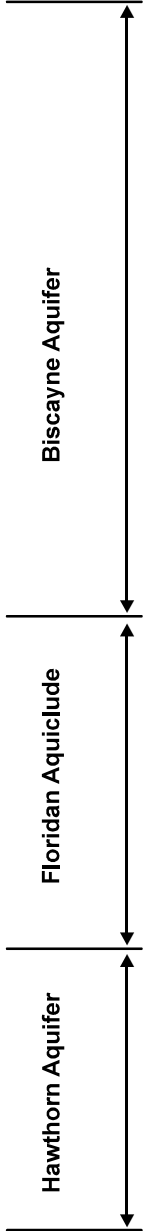
3.2.2 Stratigraphy

In the Homestead area, the Miami Oolite consists of soft, cream or tan oolitic limestone, interbedded with sandy limestone and thin layers of hard limestone. The thickness of the Miami

Oolite ranges from about 20 to 30 feet at the Base (Figure 3-2; Air Force Center for Environmental Excellence [AFCEE], 2001).

The Miami Oolite is underlain by the Fort Thompson formation. The Fort Thompson formation consists of a series of alternating shallow, marine, brackish marine, and freshwater limestone. In the Homestead area, the Fort Thompson formation consists of approximately 50 feet of white and tan to gray calcareous sandstone and sandy limestone with some quartz sand (Figure 3-2; AFCEE, 2001). Both the Miami Oolite and Fort Thompson formation are highly permeable and are the principal components of the Biscayne aquifer in the area (Fish and Stewart, 1991).

Age	Formation	Lithology	Thickness (Feet)
Pleistocene	Miami Oolite		15-20
	Fort Thompson		50
Pliocene	Tamiami		0-10
			100-140
Miocene	Hawthorn Group		



Homestead Area Generalized Stratigraphic Column
Homestead Air Reserve Base
Homestead, Florida
FIGURE 3-2

The Tamiami formation, Pliocene to late Miocene in age, underlies the Fort Thompson formation in the Homestead area. The Tamiami formation is approximately 130 feet thick in the HARB area (Figure 3-2; AFCEE, 2001). The Tamiami formation consists of limestone, clayey and calcareous marl locally hardened to limestone, silty and shelly sand, and shell marl (Causaras, 1987). The upper portion of the Tamiami formation is permeable limestone that, in places, grades into loosely to well-cemented sandstone, shelly sand, and silt.

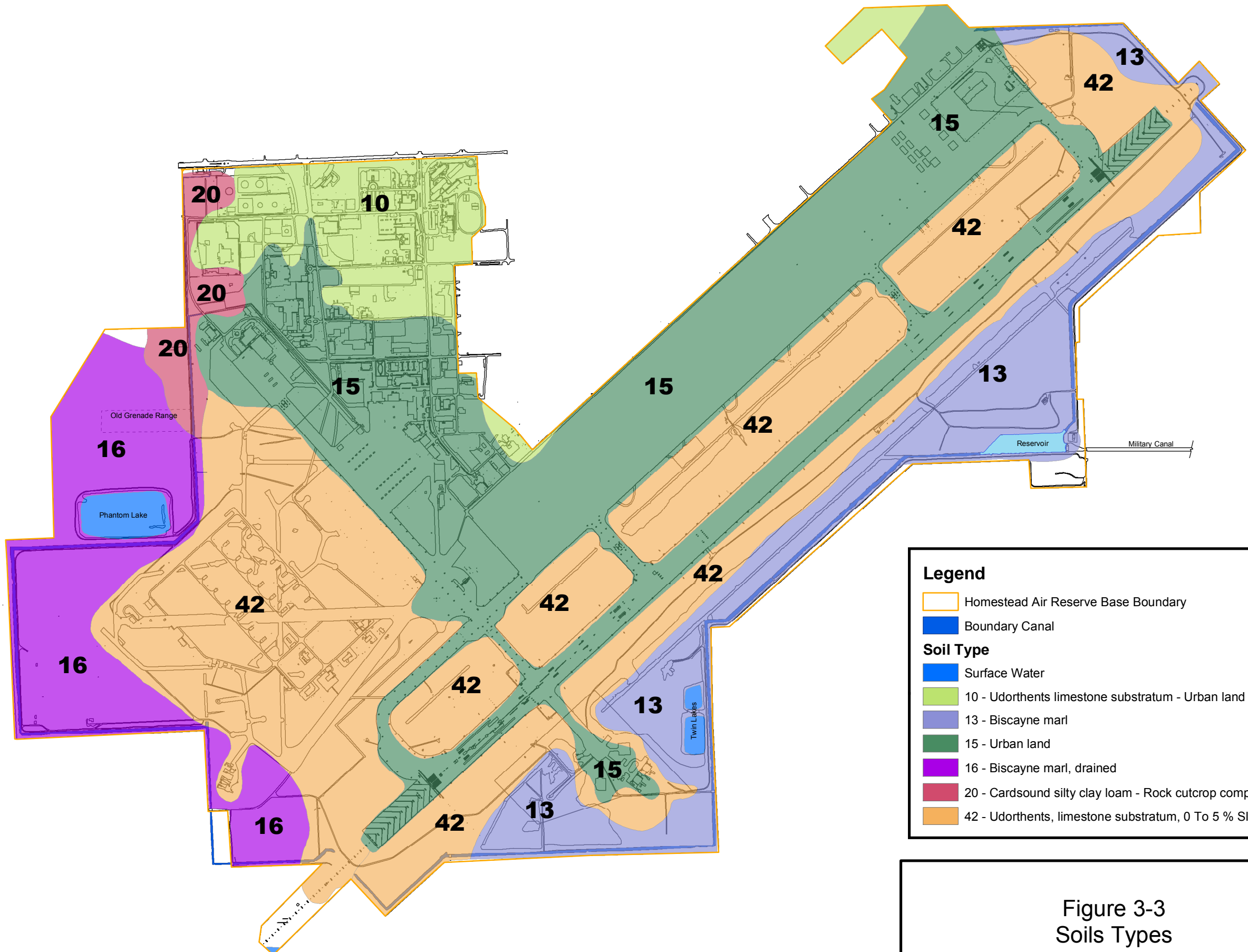
Locally, the upper Tamiami formation is permeable limestone. The lower part of the Tamiami formation is composed primarily of very coarse to fine grained shelly sand and sandstone. The sand and sandstone grades vertically and interfingers with shelly, silty calcareous sand, siltstone, and claystone (Causaras, 1987). In the Homestead area, the lower Tamiami formation is green and gray sandy and silty marl with some clay and compact limestone. The lower part of the Tamiami formation is moderately porous to virtually nonporous and, in conjunction with similar low permeability sediments of the underlying Hawthorn Group, comprises a confining unit between the Biscayne aquifer and the underlying Floridan aquifer.

3.2.3 Soils

There are six different soil map units within HARB. Table 3-4 summarizes the important characteristics and the coverages of soil types on HARB (USDA NRCS, 1996). Figure 3-3 indicates the general location of the soil units on the Base. In general, approximately 74% of HARB land consists of Urban Land/Udorthents-Urban Land Complex soil types (see Table 3-4). Udorthents are nearly level areas of extremely stony fill material that are almost always used for urban or recreational development, and are limited in their ecological potential. Limitations for this soil unit include wetness and the presence of underlying organic material. These limitations may be overcome by the use of stable fill material and the addition of in some cases extensive drainage systems (USDA NRCS, 1996).

3.2.4 Topography

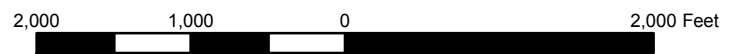
The land surface at HARB is relatively flat with elevations ranging from approximately 5 to 10 feet above mean sea level (msl; AFCEE, 2001).



Legend

- Homestead Air Reserve Base Boundary
- Boundary Canal
- Soil Type**
- Surface Water
- 10 - Udorthents limestone substratum - Urban land complex
- 13 - Biscayne marl
- 15 - Urban land
- 16 - Biscayne marl, drained
- 20 - Cardsound silty clay loam - Rock cutcrop complex
- 42 - Udorthents, limestone substratum, 0 To 5 % Slopes

Figure 3-3
Soils Types
Homestead Air Reserve Base



Source: USDA NRCS, 1996.

Table 3-4					
Soil Map Units, Descriptions, and Coverage Homestead Air Reserve Base, Homestead, Florida					
Soil Map Unit		Description	Depth to Apparent High Water Table (feet)	Building Site Suitability	Percentage of Land Surface
10	Udorthents, limestone substratum - Urban land complex	Moderate/not hydric includes nearly level areas consisting of lawns, vacant lots, parks, and playgrounds.	NA NA		7
13 B	Biscayne marl	Very shallow, nearly level and poorly drained on broad low areas.	Typically, the water table in Biscayne Marl soil is within 10 inches of the surface, but could recede down to 20 inches during drought.	Severe This soil is severely limited for development due to the high water table and depth to the bedrock.	12
15 Ur	Urban land	NA/not hydric includes streets, buildings, or other structures where the soil is covered and cannot be identified.	NA NA		31
16	Biscayne marl, drained	Very shallow, nearly level and poorly drained on broad low areas.	Typically, the water table in Biscayne Marl soil is within 10 inches of the surface, but could recede down to 20 inches during drought.	Severe This soil is severely limited for development due to the high water table and depth to the bedrock.	10
20	Cardsound silty clay loam - rock outcrop complex	Calcareous, loamy mixture, very shallow, well drained, and moderately slowly permeable underlain with limestone bedrock.	5-6	Severe Due to depth to the bedrock and small stones, these soil types are severely limited for development; however, local construction methods can generally overcome these limitations	2
42	Udorthents, limestone substratum, 0 to 5% slopes	Rapid/not hydric	NA	NA	36
NA	Water	NA	NA	NA	2
	Total	NA NA		NA	100

Source: USDA NRCS, 1996

Key:

NA = Data not available or not applicable.

3.3 Installation Restoration Program Sites

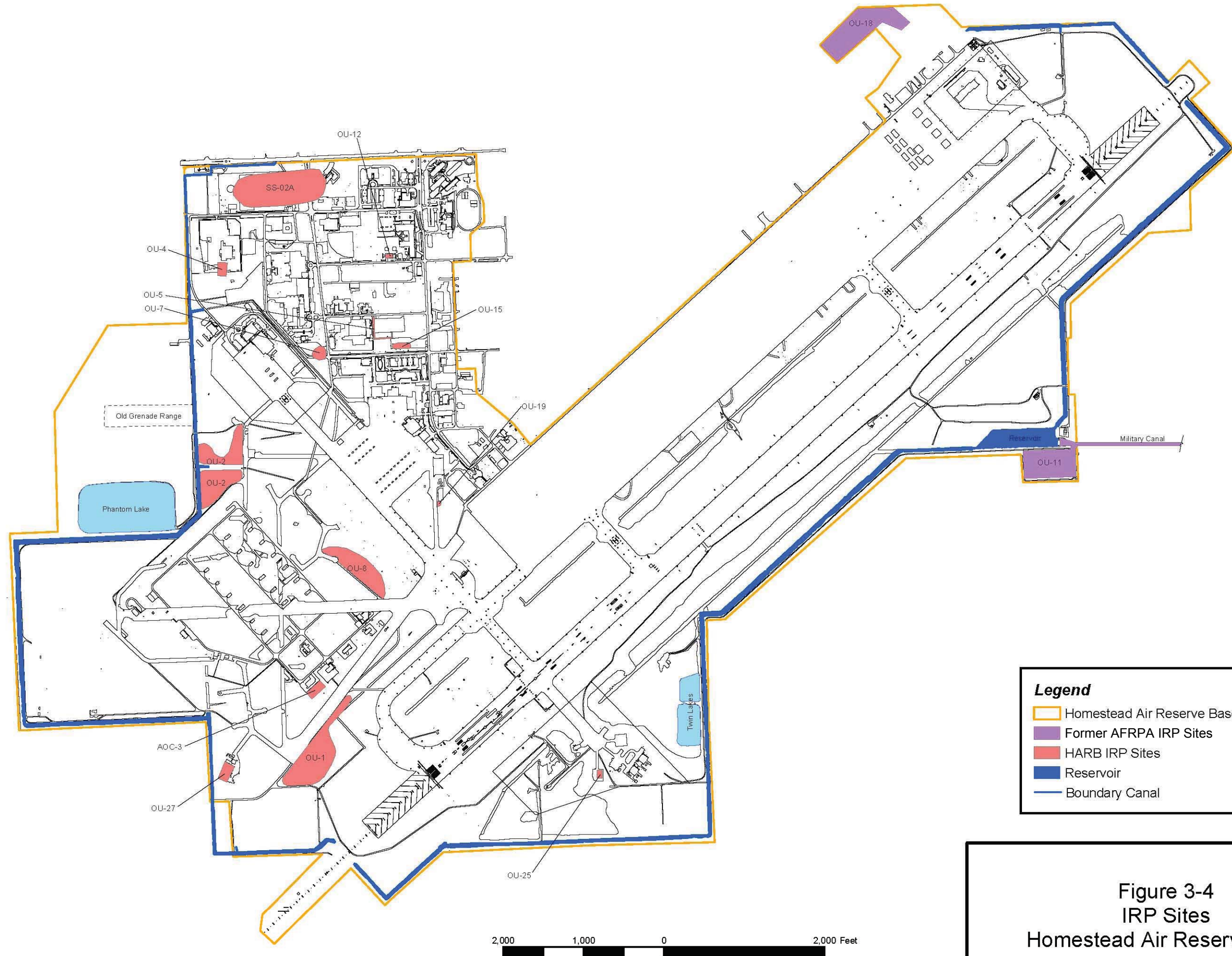
The IRP at Homestead AFB (see Section 2.4.2) was initiated in 1983 with a Phase I Record Search to identify potential AOCs at the Base (AFCEE, 2001). In April 1993, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted to evaluate possible releases resulting from Hurricane Andrew. This assessment resulted in the identification of 68 solid waste management units (SWMUs; AFCEE, 2001). As of the end of 2008, there are 23 IRP sites (see Figure 3-4; 21 CERCLA sites and two petroleum sites). Table 3-5 provides the site identification, site description, regulatory document status, and current site status.

Table 3-5			
Air Force Reserve Command (AFRC) IRP Site Status Homestead Air Reserve Base, Homestead, Florida			
Site	Site Description	Document	Current Site Status
OU-1	Fire Protection Training Area No.2	ROD (1995)	NFI/LUC (soil)
OU-2	Residual Pesticide Rinse Area	ROD (1996)	NFI/LUC (soil)
OU-3	PCB Spill Area	ROD (1994)	NFA
OU-4	Motorpool Oil Spill (Bldg. 312)	ROD (1995)	NFI/LUC (soil)
OU-5	Electroplating Waste Disposal Area	ROD (1997)	NFI/LUC (soil)
OU-7	Entomology Storage Area	ROD (1998)	GW LTM (annual)
OU-8	Fire Protection Training Area No.3	DD (1997)	NFI/LUC (soil)
OU-9 Bo	undary Canal	ROD (2003)	NFRAP
OU-10	Former Landfill	Closure Ltr. (1997)	NFRAP
OU-11(A)	Reservoir/Military Canal	ROD (2003)	Sediments LTM (annual)
OU-11(T)	Old Sewage Treatment Plant	ROD (2006)	GW LTM (annual)
OU-12	Entomology Shop (Bldg. 373)	ROD (2006)	NFI/LUC (soil)
OU-13	Hardfill Storage Area No. 3	DD (1997)	NFRAP
OU-15	Haz-Waste Storage (Bldg. 153)	ROD (2006)	GW LTM (annual)
OU-16	Hawk Missile Site/Waste Storage	Closure Ltr. (1997)	NFRAP
OU-17	C-130 Fuel Release (Bldg. 793)	Closure Ltr. (1997)	NFRAP
OU-18	Construction Debris Landfill	ROD (1998)	GW LTM (annual)
OU-19	AGE Shop (Bldg. 208)	Closure Ltr. (2001)	NFA
OU-25	Hush House Area	ROD (2006)	NFI/LUC (soil)
OU-27	Jet Engine Test Cell Facility	ROD (2006)	NFI/LUC (soil)
AOC-3	Munitions Storage Area	ROF (2000)	NFI/LUC (soil)
Petroleum Sites			
SS-02A	Bulk Storage Facility	N/A	GW LTM (annual)
SS-15C	Fuel Pipeline	N/A	GW LTM (annual)

Notes:

AOC= Area of Concern
 DD = Decision Document
 GW = Groundwater
 LTM =Long-Term Monitoring
 LUC = Land Use Controls
 N/A = Not applicable

NFRAP = No Further Required Action Planned
 NFI = No Further Investigation.
 OU = Operational Unit
 ROD = Record of Decision.
 ROF = Record of Findings
 SS = Spill Site



Legend

- Homestead Air Reserve Base Boundary
- Former AFRPA IRP Sites
- HARB IRP Sites
- Reservoir
- Boundary Canal

Figure 3-4
IRP Sites
Homestead Air Reserve Base

Source: AFRC, 1996.

3.4 Water Resources

3.4.1 Surface Water Hydrology

Natural drainage on HARB is generally poor due to the relatively flat surface and the location of the water table, which is either at or near the land surface of HARB. Storm water runoff is collected in an internal drainage system of canals, swales, ditches, and pipes, most of which eventually discharge into the Boundary Canal.

Boundary Canal System

The Boundary Canal system consists of the Boundary Canal, the Flightline Canal, several associated drainage canals/ditches, and the storm water reservoir. The Boundary Canal surrounds HARB property (AFCEE, 2001; Figure 3-5). A levee that runs along the outer bank of the Boundary Canal prevents runoff originating outside the Base from entering the property except for a small portion at the northernmost end of the Base at a point along SW 288th Street (AFCEE, 2001; see Figure 1-2). The Boundary Canal is divided into two major segments (see Figure 3-5):

- The **west-south (W-S)** Boundary Canal segment begins in the northwestern corner of HARB at Biscayne Drive (SW 288th Street). The segment flows along the west and south perimeters of the Base and leads to the storm water reservoir at its western edge. The total length of the W-S segment is approximately 25,000 feet (4.9 miles; AFCEE, 2001).
- The **north-east (N-E)** Boundary Canal segment begins at the north end of the former Homestead AFB south of the former golf course at SW 280th Street (Walden Drive; HARS, no date). It flows east past Mystic Lake and along the north and east perimeters of the former Base. The N-E segment leads to the storm water reservoir at the northeast corner of the former Base. The total length of the N-E segment is reported to be approximately 15,400 feet (2.9 miles; AFCEE, 2001).

Storm Water Reservoir

The storm water reservoir is located on the eastern side of the Base and receives flow from the W-S and N-E segments of the Boundary Canal system (Figure 3-5). The reservoir is approximately 300 feet wide and 900 feet long (AFCEE, 2001). Typical depths are estimated to range between 10 to 20 feet. Assuming an average depth of 12 feet, the reservoir volume is estimated to be 46.3-acre feet (AFCEE, 2001).

A control structure is located at the eastern edge of the reservoir, which discharges water into the culvert between the reservoir and Military Canal (AFCEE, 2001). This control structure is normally open and provides passive flow between the canal and the reservoir, but is closed during pumping operations (AFCEE, 2001). During periods of heavy rainfall, three 100,000-gallon manual

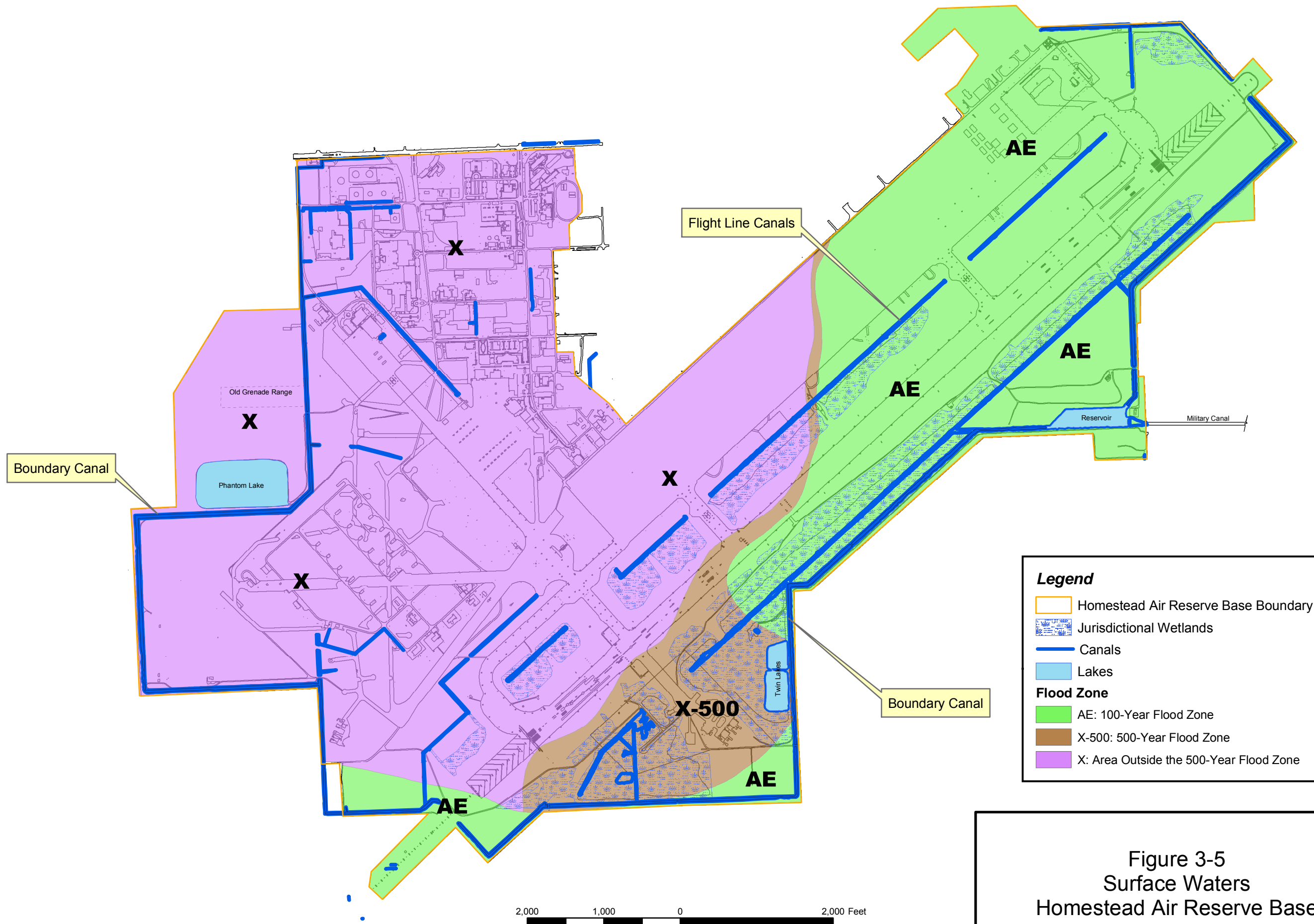
pumps with a total combined maximum rate of 300,000 gallons per minute (gpm; 668 cubic feet per second [cfs]; AFCEE, 2001) pump water to the Military Canal. These pumps were designed to begin pumping at an elevation of 3.0 feet National Geodetic Vertical Datum (NGVD) and shut down at an elevation of 2.5 feet NGVD (AFCEE, 2001). This enables water elevations in the Flightline Canal to occur at acceptable operational levels and the pumps continue to operate until the water level in the canal is lowered to 2.5 feet NGVD.

Military Canal

Military Canal is located immediately east of the pump house and storm water reservoir (see Figure 3-5). Military Canal is one in a series of canals that serve as a part of a complex water management system to control flooding, reduce salt water intrusion, maintain water flow into Biscayne Bay, and provide recharge for municipal wellfields. The canal is approximately 11,400 feet long with an average width of 40 feet (AFCEE, 2001). A salt water control structure (S20G) is located along Military Canal approximately 1.4 miles east of the reservoir (AFCEE, 2001). According to the South Florida Water Management District (SFWMD), this structure controls the flow of Military Canal to minimize salt water intrusion from Biscayne Bay. The majority of the flow from Military Canal into Biscayne Bay is from HARB; however, agricultural lands, commercial nurseries, and other unused areas between HARB and Biscayne Bay also contribute to runoff into the bay (USAF and FAA, 2000). The estimated average annual discharge from Military Canal to Biscayne Bay, using the Surface Water Management Model (SWMM) results, is 4,560 acre-feet (USAF and FAA, 2000). This represents about 1.1% of the total freshwater input to southern Biscayne Bay (USAF and FAA, 2000).

Previous water quality monitoring studies performed on the reservoir/canal system indicate that runoff discharging from HARB is of excellent water quality and generally meets Florida Class III surface water quality standards (AFCEE, 2001). Of the 3,960 water quality tests performed on the Military Canal from 1989 to 1998, exceedances of Class III standards have been limited to 111 instances of dissolved oxygen (DO), 233 of specific conductance, and three of total coliform (AFCEE, 2001). These exceedances are normal and are not indicative of a water quality problem (AFCEE, 2001). Low DO is typical of a canal system that is fed by low DO ground water; high conductance is expected because the canal is very close to Biscayne Bay and located east of the salt water intrusion line; and three coliform exceedances are normal in runoff discharges (AFCEE, 2001).

Past on-base disposal practices in the area where the old sewage treatment existed, resulted in the contamination of sediments in Military Canal and the storm water reservoir. The contaminated sediments were addressed as part of former Homestead Air Force Base's IRP CERCLA program



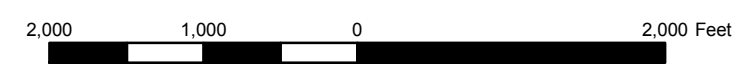
Legend

- Homestead Air Reserve Base Boundary
- Jurisdictional Wetlands
- Canals
- Lakes

Flood Zone

- AE: 100-Year Flood Zone
- X-500: 500-Year Flood Zone
- X: Area Outside the 500-Year Flood Zone

Figure 3-5
Surface Waters
Homestead Air Reserve Base



Source: FEMA, 1996; HARB, 2001; E&E, 2002 c

Regulatory issues concerning the contaminated sediments were resolved through a ROD dictated remediation project (i.e., encapsulation of the canal and portions of the reservoir) that prevent these contaminants from migrating to Biscayne National Park.

3.4.2 Storm Water Discharge

HARB is covered under a storm water MSGP issued by the FDEP for storm water discharges associated with industrial activities (Rule 62-621.300[5], F.A.C.). Instead of controlling discharges through numerical limits, storm water is controlled by adherence to the HARB SWPPP (AFRC, 2001a; see Section 2.4.1), which was prepared in accordance with AFI 32-7041, “Water Quality Compliance.”

Storm water collected from industrial areas is eventually discharged into the non-industrial storm water systems throughout HARB. The MSGP does not require HARB to conduct storm water monitoring, but HARB has conducted voluntary monitoring of its storm water discharges (AFRC, 2009b).

Primary storm water pollution concerns within HARB include potential spills from petroleum, oils, and lubricants (POLs). The greatest potential storm water contaminant is JP-8 fuel because of the large quantities used at the Base. For example, between 2004 and 2008, out of six total recorded spills, four spills were of JP-8, ranging from 25 to 260 gallons (AFRC, 2009a). Areas with the highest potential for storm water contamination because of their frequent use on HARB are the Base service station and parking areas (Ventura, 2002). Potential contamination also may result from the former Homestead AFB since the Boundary Canal remains interconnected with the former Base canal system.

In the event of a reportable spill (i.e., more than 25 gallons on pervious surfaces or more than 100 gallons on all other surfaces), HARB must submit a report to USEPA Region IV within fourteen days of the release (AFRC, 2009a). The SWPPP also must be modified to include a description of the release, circumstances leading to the release, the date of the release, and measures that will prevent the reoccurrence of such a release (AFRC, 2009a).

3.4.3 Ground Water and Potable Water

Three hydrologic units are present in the Homestead area. These include in descending order, the Biscayne aquifer, the Intermediate Confining Unit, and the Floridan aquifer system. The Biscayne aquifer extends from land surface to depths of about 80 to 100 feet below HARB vicinity (Fish and Stewart, 1991). The Biscayne aquifer is designated by USEPA as a “sole-source” potable water supply for Broward, Miami-Dade, Monroe, and Palm Beach counties. This designation under the Safe

Drinking Water Act affords stringent protection for the aquifer. Projects that receive federal funds within the designated area are subject to review by USEPA to ensure that they do not endanger the water source (USEPA, 2002b).

Because of its proximity to the land surface and connection to surface water hydrology, the Biscayne aquifer is susceptible to contamination. The aquifer is under unconfined, or water table conditions and is affected by rainfall events, channel flows, local surface water bodies, and consumptive use pumping. There is a direct relationship between the Biscayne aquifer and the canals that transect it. During extended periods of low rainfall, water levels in the canal system decrease allowing the inland movement of salt water contributing to coastal seepage. However, this has been largely alleviated by the construction of large-scale canal control structures near the coastal ends of the major canals that prevent the movement of salt water up the canals when water levels in the canals are low (Miller, 1990).

The Intermediate Confining Unit is comprised of interbedded siltstone, claystone, and sand of the Miocene Age Hawthorne Group (Fish and Stewart, 1991). In southern Miami-Dade County, the Hawthorn Group sediments are approximately 800 feet thick (Scott, 1988). The Intermediate Confining Unit hydraulically isolates the Biscayne aquifer system from the underlying Floridan aquifer system. The Intermediate Confining Unit is underlain by the Floridan aquifer system.

The Floridan aquifer is divided into the Upper Floridan aquifer and the Lower Floridan aquifer. Underlying HARB, the Lower Floridan aquifer is under variable Artesian head, approximately 950 to 1000 feet below sea level and 2,800 feet thick (USAF and FAA, 2000). Overall, the Lower Floridan aquifer is much less permeable than the upper portion and contains salt water. Because of mineralization and high salinity values, the Floridan aquifer in the general vicinity of HARB exceeds primary drinking water standards and is unsuitable as a potable water supply.

Due to salt water intrusion to portions of the Biscayne aquifer beneath the base, potable drinking water on the Base historically was supplied by off-Base wells dating back to 1992 (ATSDR, 1998). The potable water supply system for the former Homestead AFB historically included water supply wells, a water treatment plant, water storage tanks, and a distribution network. Several well fields were located on the Homestead AFB. The on-property and off-Base well fields are no longer in use and the wells have been officially abandoned. Starting in December of 2005, potable water has been supplied by Miami-Dade County Water and Sewer Department. The aforementioned water treatment plant and water storage tanks were demolished and removed beforehand.

3.4.4 Waste Water

The domestic waste water treatment plant was closed and decommissioned in 1984. Miami-Dade WASD provides waste water treatment and disposal for the Base under contract to the AFRPA (USAF and FAA, 2000). There are no industrial waste water or storm water disposal wells at HARB. Some of the waste water treatment units at industrial areas are closed-loop-recycle systems that constantly treat and reuse the same wash water.

HARB has six industrial waste water operating permits prepared in accordance with Chapter 24, Miami-Dade County Code (Environmental Protection Ordinance). Permits cover all waste-generating activities on HARB (including the FANG). Primary waste-generating activities include all hazardous waste storage, vehicle maintenance, aircraft washing and maintenance, and POL storage activities. HARB facilities covered under these permits include: the Military Aircraft Jet Engine Testing Facility, POL Tank Farm, Buildings 185, 192, 193, 194, 200, 706, and 4709; Composite Maintenance Building; Base Supply Building; Hazardous Materials Building; Air Station Truck Maintenance; Motor Vehicle Maintenance; Vehicle Washrack; and Civil Engineering Building. Tenant facilities covered under these permits include The FANG AGE building, aircraft hangars, and spray booth.

3.4.5 Lakes

The FDEP classification for all water bodies within HARB is “Class III Surface Waters” designated for recreation and maintenance of a healthy, well-balanced fish and wildlife population (Chapter 62-302.400, F.A.C.). Three lakes are within the 1,900-acre area, comprising approximately 30.2 acres or less than 2% of HARB.

All the lakes on HARB are human-made, created from limestone borrow pits many decades ago. When first created, these types of pits are often deeply excavated, resulting in limited habitat value, but through time, the process of erosion and sedimentation eventually transforms them into more natural features. HARB’s lakes are now typically shallow with steep banks that contain many old tree snags and other vegetation debris, which create good edge habitat for many species. Many snags also remain standing and are used extensively by osprey, kingfisher, cormorant, and other bird species for resting and feeding.

The 14.5-acre Phantom Lake is located along the western boundary of the Base, just north of the Munitions Storage area (see Figure 3-5). A maintained unpaved road encircles the lake and provides access (HARB, 2002c). The Twin Lakes also referred to as the North and South Flight Line Lakes (7.7 and 8.0 acres, respectively) lie southeast of the runway (see Figure 3-5). Only the North Lake has any surface water connection to the Boundary Canal system.

3.5 Wetlands

Wetlands generally are considered to be transitional zones between the terrestrial and aquatic environment and are characterized by physical, chemical, and biological features indicative of certain hydrological conditions. Currently, the USACE regulates wetlands under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 to the CWA. Jurisdictional 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 other areas.*” (United States Army Corps of Engineers [USACE], 1987).

During 2001, federal and state jurisdictional wetland surveys were conducted on HARB (HARB, 2002d). Of the 1,943 acres within HARB, approximately 233.5 acres or 12% of the total land area have been identified as jurisdictional wetlands (see Figure 3-5 and Volume II, Appendix D). All surveys were conducted in accordance with the USACE wetlands delineation manual (1987) and FDEP methods identified in Chapter 62-340, F.A.C. Additional details on the 2001 survey methods and results are provided in the *Wetlands Identification Report and Management Component Plan* from the 2004 INRMP (see Volume II, Appendix D).

In general, types of wetlands occurring on the Base include wet marsh, wet prairie, or forested wetlands. The wetland areas are primarily located within the runway infield and southeast of the runway extending in a southwest to northeast direction. Approximately 49 acres or 21% of wetlands are located within the infield of the taxiway and runway and serve as drainage basins (HARB, 2002d). Specific locations of wetlands on HARB are illustrated in Volume II, Appendix D, on Figure 3-1. Appendix D also contains the HARB wetlands rapid assessment procedure (WRAP) report from the 2004 INRMP that was conducted to assess the ecological quality of each identified wetland community based on its own attributes and characteristics. The WRAP was developed by the SFWMD and modified for use by the USACE for determining impacts to jurisdictional wetlands.

The presence of infield wetlands and wetlands southeast of the runway creates operational concerns on HARB because, in part, they occur within the 1,000-foot primary surface zone. The primary surface zone is measured from the runway centerline to a distance of 1,000 feet on either side of the runway surface (see Figure 2-3; Onoprienko, 2002; United States Air Force Civil Engineer Support Agency [USAFCEA], 2001). Primary surface zone requirements mandate the need for a graded, solid serviceable surface to establish a safe correction zone for aircraft arriving and departing from HARB (Onoprienko, 2002; USAFCEA, 2001). The wetlands and the rutting of the wetlands

from mowing do not constitute a solid, uninterrupted surface. In addition, these wetlands contribute to BASH concerns since numerous birds use the wetlands for foraging activities.

3.6 Flood-Prone Areas

Maps issued by the Federal Emergency Management Agency (FEMA) in 1996 indicate that the eastern end of the Base, generally running on a north-south axis through the runway, would be flooded from a 100-year flood event (see Figure 3-5; USAF and FAA, 2000). Flooding on HARB most likely would result from significant periods of heavy rainfall and would less likely be attributed to coastal flooding and storm surges.

It is estimated that Category 1 and 2 hurricanes would not cause inundation of the Base, but a Category 3, 4, or 5 hurricane could cause tidal surges ranging from 11 to 16 feet NGVD. Maximum surge height for sustained winds of 145 miles per hour has been estimated at around 8.5 feet (AFRC, 1996).

3.7 Coastal Environment

HARB does not contain any coastal habitats. Coastal communities within 2 miles of the Base include the mangrove swamps along the shoreline of Biscayne Bay, salt marshes, seagrass beds in nearshore waters, the coral reefs of the Florida Keys, and open marine waters in Biscayne Bay.

Due to the particular geography of Florida and for purposes associated with the federal CZMA of 1972, the entire state has been determined to be within the coastal zone and subject to oversight by the state's federally approved FCMP. HARB is, therefore, located within Florida's designated coastal zone. Under provisions of the CZMA, any federal activity that has the potential to impact Florida's coastal resources is reviewed for consistency with the 23 Florida statutes that comprise the legislative framework of the FCMP, which is implemented by the FDEP (FDEP, 2002b). HARB ensures compliance with the FCMP through the ESOHC and 32 CFR 989, "Environmental Impact Analysis Process."

3.8 Agricultural Outleasing

HARB does not sponsor or contain any opportunities for agricultural outleasing or opportunities for livestock grazing and/or growing of crops on the property.

3.9 Cultural Resources

The National Park Service (NPS) conducted a survey of Homestead AFB in 1986 as part of an interagency technical assistance agreement between NPS and Homestead AFB (Air Combat Command [ACC], 1992). This survey included the entire former Homestead AFB to determine the need for and scope of any additional investigations necessary to discover significant cultural resources.

The report concluded that there was virtually no probability for the discovery of significant archaeological resources on the Base; the Florida State Historic Preservation Officer (SHPO) concurred with that conclusion. However, in accordance with AFI 32-7065, “Cultural Resources Management,” HARB has a contingency cultural resources management plan to address actions required in the event subsurface archaeological resources should be found during land disturbance activities. In addition, a petition for waiver from the Integrated Cultural Resources Management Plan (ICRMP) Requirement was approved by the AFRC-HQ Civil Engineer in April 2008.

Two historic architectural inventories were conducted on the former Homestead AFB. The first concentrated on structures constructed prior to 1945; six were identified (ACC, 1992). All, but one, of these pre-1945 architectural resources were destroyed during Hurricane Andrew. The surviving structure, Building 121, is a 1942 maintenance shop that has been determined ineligible for the National Register of Historic Places (USAF and FAA, 2000).

3.10 Land Management

3.10.1 Land Use

HARB Land Uses

HARB land use activities are planned and managed to support the Base’s military mission, which is *“to train and equip reservists to respond to wartime and peacetime tasking as directed by higher headquarters.”* In the broadest sense, there are three basic mission-driven land uses on HARB: (1) the airfield, (2) the ammunition storage area and safety buffer associated with the ESCZ arcs, and (3) the urban/industrialized area (see Figures 2-2 and 2-3). The fourteen land management units (see Section 2.5, Figure 2-2) are each subcomponents of these land use categories. The land management units are subject to mission military requirements (i.e., specific needs for readiness, safety, and security), and are managed as such. These requirements present both opportunities and constraints for management of wetland functions, vegetation, and wildlife within these units.

The Administrative and Industrial Support area and Airfield (see Figure 2-2) are comprised of land use activities that are essential for accomplishing the Base's military mission. This area functions as the urban core of the Base and houses two major tenant commands. It includes aviation support facilities (hangers and maintenance workshops), fuel storage, administrative facilities, and military personnel support facilities, as well as the airfield complex (runway, taxiway, and flightline).

The majority of the land east and south of the runway (including the Wetland Marsh, Hush House, Twin Lakes and Wetland Fringe, and the Southeast Triangle areas; see Figure 2-2) is open space and wetland, with some scattered forested areas. With the exception of the Hush House and Southeast Triangle areas, wetlands are the predominate land use features. These wetland areas, in part, are used for airfield drainage. The enclosed structures of the Hush House area are used for noise reduction for aircraft engine testing. The Southeast Triangle contains the reservoir and pump house and is the single point for surface water discharge from the Base.

The western portion of the Base contains the Munitions, Grenade Range and Reserves, Northeast Grassland, Southwest Clear Zone, and Operable Unit (OU) -2 areas (see Figure 2-2). Collectively, these areas are largely unimproved and comprise the total area contained within the ESCZ arcs. Reserve bivouac training is conducted in the western boundary of the Grenade Range and Reserves area. Figure 2-3 depicts important constraint factors that HARB uses during decision-making.

Designing and Maintaining Landscape on HARB

Landscaping designing criteria for HARB are established in the Base General Plan (*General Plan Homestead Air Reserve Base*; HARB, 2006). As required within the plan, the landscaping effort is to create an overall image for the Base through the consistent use of landscape material that is visually and environmentally compatible with their surroundings.

Grounds maintenance activities at HARB are conducted in accordance with the *Statement of Work (SOW) for Grounds Maintenance of the Cantonment and Munitions Area at Homestead Air Reserve Station Florida* (see Volume II, Appendix E). See Figure 3-6 for the grounds maintenance mowing plan. The SOW requires the contractor to obtain and maintain all licenses/certifications required by the State of Florida and federal agencies for supervision and applications of herbicides/pesticides in accordance with 40 CFR 171.9 and Florida Statutes Chapter 482 "Pest Control." Types of services required by the SOW include:

- Mowing and trimming grass and removal of grass clippings for improved grounds,
- Edging
- Maintaining and pruning shrub, hedges, and perennial flowers;

- Maintaining shrub beds; and
- Maintaining drainage ditches.

Regional Land Use

Land uses adjacent to HARB are principally low- to medium-density residential, agriculture, and vacant land (see Figure 3-7). To the east and south of HARB, land-use activity is primarily agriculture with some residential units. The majority of the agricultural land located near HARB is used for commercial plant nurseries. Beyond the agricultural land located east and south of HARB are large tracts of vacant land unprotected from development. Some agricultural land abuts HARB along the northwest side, but the majority of land north of HARB is unimproved or developed property associated with the former Homestead AFB (see Section 1.6).

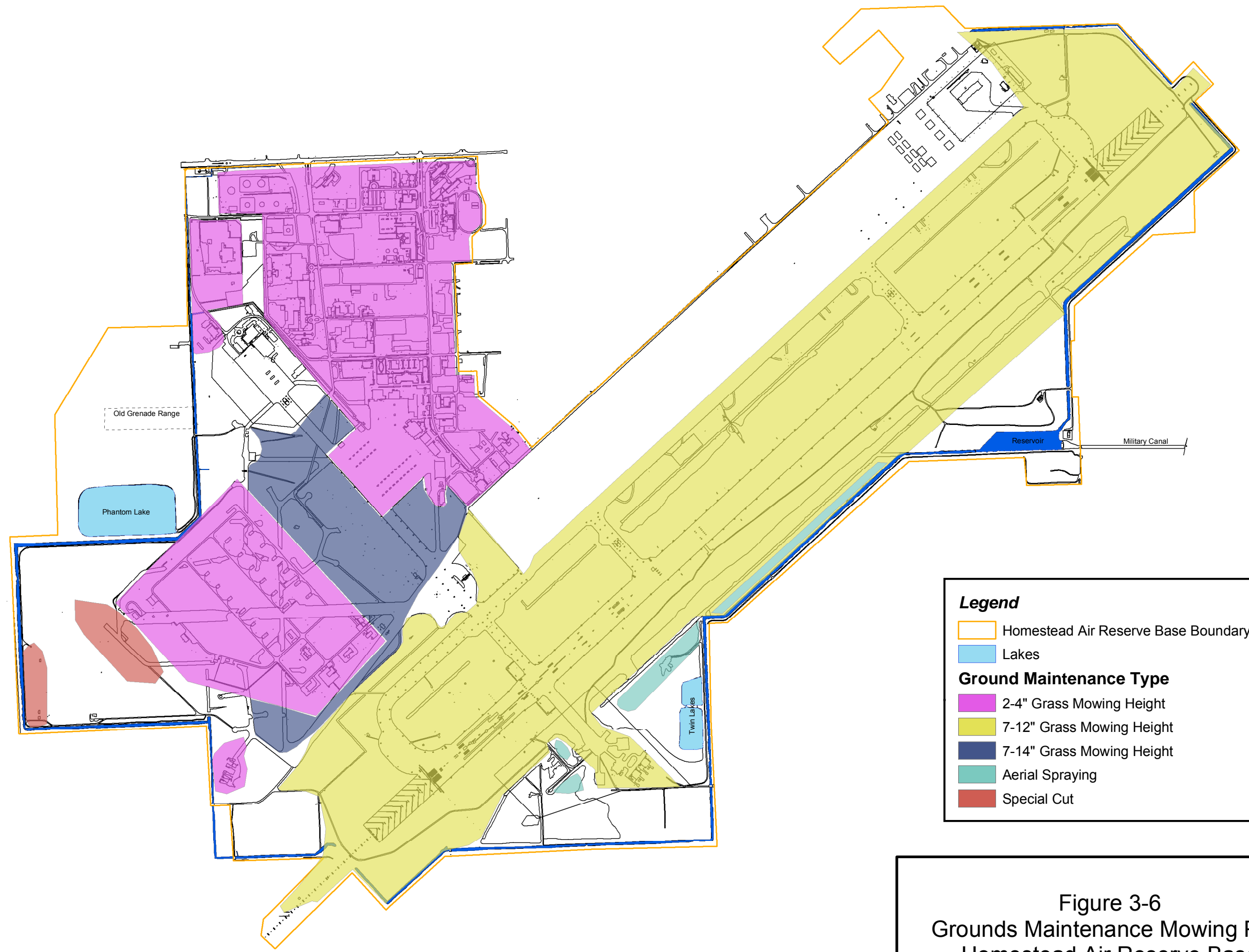
Most urban development occurs to the north and west of HARB and is within the Miami-Dade County urban development boundary (UDB). The UDB, as defined in the 2000 Miami-Dade Comprehensive Development Master Plan (CDMP), includes portions of the county where urban development is acceptable. Generally, the UDB aligns with the U.S. 1 and State Highway 821 (Florida Turnpike) corridor, and incorporates the city of Homestead, as well as Florida City, and HARB (see Figure 3-7). The urban expansion area (UEA) as defined in the CDMP delineates the area where development may be warranted within the next 20 years. The UEA encompasses property immediately north (outside the disposal area) of HARB (see Figure 3-7). Although the extent of growth in south Miami-Dade County over the next 20 years is unclear, it can be surmised that the majority of growth will occur within the UDB and the UEA boundaries.

City of Homestead

The eastern boundary of the city limits of Homestead abuts the western boundary of the base along Speedway Boulevard (see Figure 3-7). Historically, the city of Homestead has been the center of Miami-Dade County's agricultural industry and provides cultural, business, and economic opportunities for the area. The city is surrounded by unincorporated Miami-Dade County to the north, west, and east, and Florida City to the south (USAF and FAA, 2000; see Figure 3-7). The population of Homestead increased from 13,674 in 1970 to 20,668 in 1980; and to 26,694 in 1990. According to MyFlorida.com and the City of Homestead, there are 31,909 people in Homestead. However, a review of the U.S. Census data reveals that this number comes from the 2000 census. The U.S. Census estimates that the population grew to 56,601 in 2007, the most recent year in which an estimate is available. This is an increase of 56 percent.

Florida City

Florida City is located approximately 5 miles southwest of HARB (see Figure 3-7). Over the last 30 years, the population of Florida City has experienced both growth and decline. Between 1980 and 1990 the city's population decreased 3.2% (2,804 people). Between 1990 and 2000, the population increased by 31.2% to 7,843 (SFRPC, 2000). The Florida City's population is expected to increase to 13, 278 by 2015 (USAF and FAA, 2000).



Legend








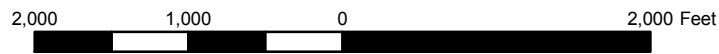
-  Homestead Air Reserve Base Boundary
-  Lakes
- Ground Maintenance Type**
-  2-4" Grass Mowing Height
-  7-12" Grass Mowing Height
-  7-14" Grass Mowing Height
-  Aerial Spraying
-  Special Cut

Figure 3-6
Grounds Maintenance Mowing Plan
Homestead Air Reserve Base



Source: HARB, 2001.

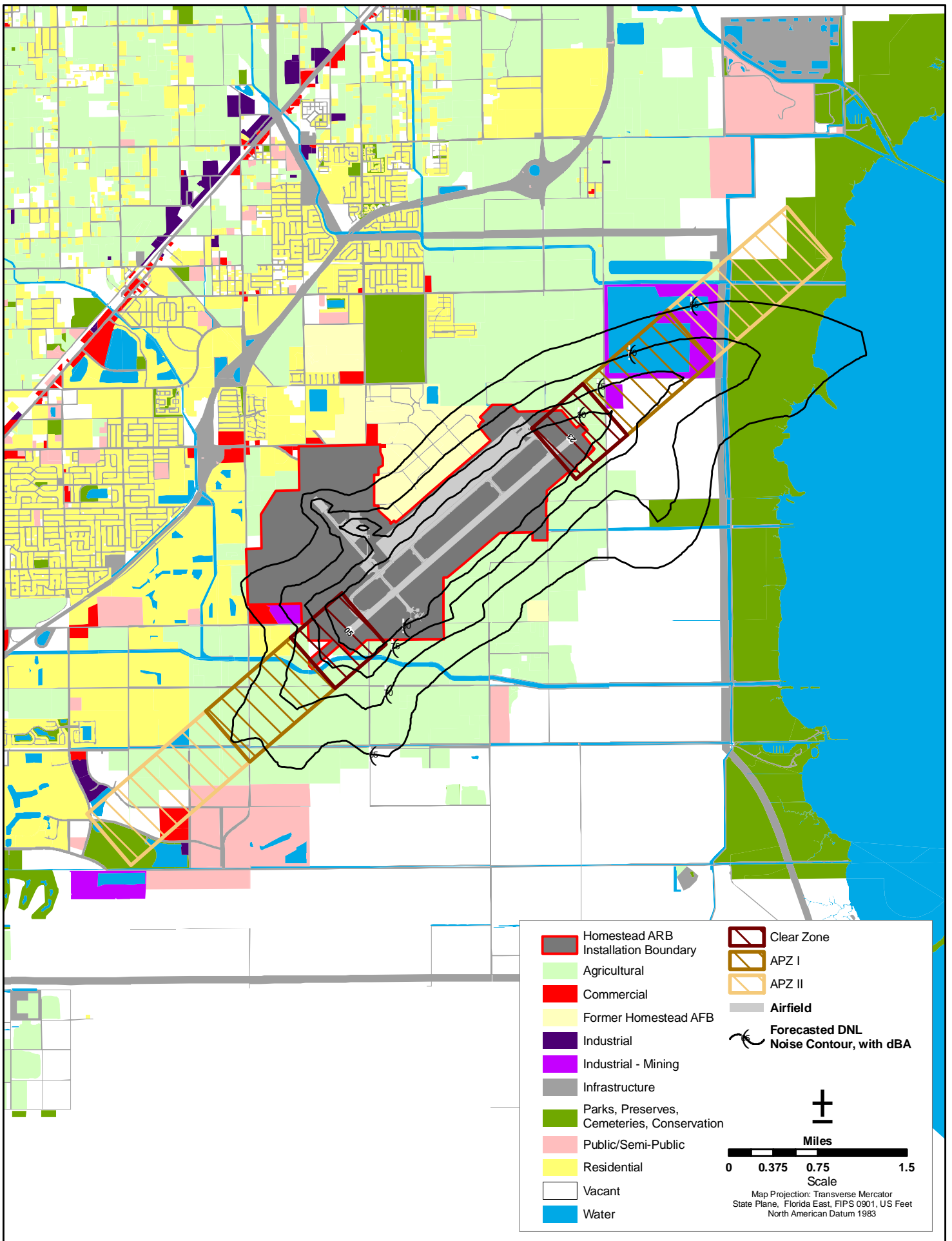


Figure 3.7 Existing Land Use in Relation to APZs and Forecasted Noise Zones

3.10.2 Outdoor Recreation

HARB Resources

Natural resources-based outdoor recreational opportunities on HARB are limited because of the large portion of acreage that is developed and/or restricted due to safety and security requirements. Limited fishing by Base personnel takes place at Phantom Lake and the Boundary Canal. Hunting is not permitted on the Base. There are no permitted recreational areas for off-road vehicle use. Access to the Base is limited to active-duty and reserve military personnel assigned to work at the Base, their dependents and accompanied guests; federal civilian employees, their dependents and accompanied guests; and military retirees.

Surrounding Natural Areas

A wealth of recreational areas are afforded locally in south Miami-Dade County, including two national parks, accessible coastline, beaches, and waters along the Atlantic coast, as well as recreation opportunities in the Florida Keys in neighboring Monroe County.

Everglades National Park is located approximately 8 miles west of HARB (see Figure 1-1). The park has been designated a World Heritage Site, a Biosphere Reserve, and a Wetland of International Significance. It also received wilderness designation in 1978. The park contains 156 total miles of trails (including canoe trails), with 5 miles of surfaced trails. Elevated boardwalk trails include the Anhinga Trail, Pa-hay-okee Overlook, Mahogany Hammock, Eco Pond, West Lake, and Shark Valley. The Hell's Bay Canoe Trail (8 miles) and the Wilderness Waterway (99 miles) are designated national trails. Three campgrounds exist within the park: Long Pine Key, Flamingo, and Chekika. There are also 48 designated backcountry campsites (accessible by boat), five visitor centers, a research facility, and two environmental education camps. Boating and fishing are popular activities in the park.

Biscayne Bay is a shallow, subtropical estuary totaling approximately 428 square miles and a drainage area of 938 square miles. Ninety-five percent of BNP is water. The park is located approximately 1.5 miles east of HARB (see Figures 1-1 and 3-7) and encompasses about two-thirds (more than 270 square miles) of Biscayne Bay. BNP was established as Biscayne National Monument in 1968, then re-designated in 1980 as Biscayne National Park to protect both historical and natural features, such as the natural environment of Biscayne Bay, the subtropical marine ecosystem, populations of fish and wildlife, and submerged cultural resources. BNP protects a rare combination of terrestrial and undersea life, and provides a significant number of recreational opportunities. Park

activities include boating, canoeing, diving, fishing, kayaking, nature viewing, sailing, swimming, snorkeling and water skiing.

3.11 Vegetation

3.11.1 Historic Vegetative Communities

HARB is within the historic range of the Everglades watershed and prior to development was probably comprised of a mixture of freshwater marsh and isolated tree islands (including pine rockland communities). Within HARB and the surrounding region, little remains of these original communities. Although remnant natural communities exist in very scattered patches, most have experienced extensive surface alterations during development and/or severe infestations by invasive exotic species.

Fresh water marsh ecological communities are generally characterized as a shallow wetland consisting of low, emergent vegetation with few or no standing trees, and standing water throughout most of the year (USDA NRCS, 1989). The type of marsh that most likely occurred on the Base was the marl prairie community, occurring on thin calcitic soil (i.e., marl) over limestone bedrock (AFRC, 1997). Typical vegetation of marl prairies includes beak rush (*Rhynchospora inundata*), spike rushes (*Eleocharis* sp), white top sedge (*R. floridensis*), and muhly grass (*Muhlenbergia capillaries*). Fresh water marsh communities are extremely vulnerable to hydrological changes and the absence of fire. The soft substrate can be easily disturbed and damaged by vehicles (Florida Natural Areas Inventory [FNAI], 1990).

Florida pine rockland is an endangered natural community that is found only in South Florida on relatively flat upland terrain that is moderate to well drained. Pine rockland habitat is characterized as an open canopy of slash pine that contains a large number of endemics within the patchy shrub understory and variable ground cover and occurs along scattered outcrops of oolitic limestone formations of the coastal ridge (AFRC, 1997). As a result of the rocky ground, pine rockland plants are adapted to conditions where there is very little soil, usually grow very slowly, and develop complex root structures or other specialized methods for absorbing nutrients (Miami-Dade County Department of Environmental Resource Management [DERM], 2002). Typical trees and shrubs include rough velvetseed (*Guettarda scabra*), Indigo berry (*Randia aculeata*), varnish leaf, (*Dodonea viscosa*), myrsine (*Myrsine floridiana*), cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*), Florida buestem (*Schizachyrium rhizomatum*), silver bluestem (*Andropogon cabanisii*), Florida five-petaled leaf flower (*Phyllanthus pentaphyllus*), Rocklands noseburn (*Tragia saxicola*), and pineland jacquemontia or clustervine (*Jacquemontia curtissii*).

Pine rocklands have been subject to intense development pressure because their higher elevations made them suitable for building sites because of the legal restrictions on filling and developing in wetlands. Less than 3% of pine rockland communities remain outside of Everglades National Park and these remaining areas are in poor condition because of improper management, geographic isolation, or natural disturbance (Cox *et al.*, 1994). In 1992, Hurricane Andrew severely damaged many of the south Florida pine rocklands resulting in further damages to these communities. High winds damaged tree limbs, canopies, and sheared off or broke the trunks of many trees. The remaining trees were stressed and then attacked by bark or boring beetles, usually the six-spined Southern pine beetle, which is ubiquitous in south Florida. Following Hurricane Andrew, the pine beetle population grew geometrically in response to the available damaged slash pine resource (Hilsenbeck, 1993).

Because this habitat type has lost much of its former range, pine rockland communities support a diverse array of rare or listed plant and animal species, many of which are dependent upon frequent fire. The need for fire every three to ten years also is important to keep pine rockland from succeeding to rockland hammock. If understory development progresses for more than eight to ten years, the fire either cannot penetrate or will become catastrophic because of excessive fuel accumulation (FNAI, 1990).

Even though much of the Base is developed or disturbed, some areas continue to support remnants of important natural communities that contain listed and rare species. Most important of these communities is the Remnant Pine Rockland area because of the number of rare and protected species that require the conditions afforded by this type of habitat. The natural communities on the Base could benefit from restoration efforts combined with proper management and continued maintenance for minimizing the invasion of exotic plant species. While the use of fire is not feasible due to the proximity of HARB's fuel tank farm and a charter school adjacent to the Base's perimeter fencing next to the Remnant Pine Rockland area, mechanical reduction of the fuel load could benefit the natural environment and enhance safety features of the Base.

The following section describes the current state of natural upland and wetland vegetative communities on HARB.

3.11.2 Natural Vegetative Communities

Areas of high quality natural communities on HARB have been identified in several previous surveys (e.g., Hilsenbeck, 1993; Argonne National Laboratory [Argonne], 1997) and were also observed and described in 2001 as part of field reconnaissance and surveys conducted in support of developing this INRMP. Plants generally associated with these areas are summarized below. Results

of the 2001 surveys conducted in these communities are further detailed in the *Fish and Wildlife/Threatened and Endangered Species Management Component Plan* in Volume II, Appendix F (HARB, 2002c). Refer to Figure 2-2 for the locations of the areas described below and to Volume II, Appendix G, Table G-1, for a Base-wide list of native and non-native plant species.

- The **Boundary Canal** system is a freshwater system even though there is a hydrologic connection (via Military Canal) to the nearby waters of Biscayne Bay. The berms along several areas of the Boundary Canal, particularly in the western segment, contain many native trees, such as, tetrazygia (*Tetrazygia bicolor*), coco plum (*Chrysobalanus icaco*), and myrsine.
- The **Administrative and Industrial Support area** is mostly urbanized but contains some disturbed habitat that continues to support a number of native species and communities, particularly just south of the Pine Rockland area. The site is mostly mowed Bermuda grass but there are also prairie-like areas that are less frequently mowed containing native and non-native shrubs and trees. Protected plant species in this area include locust berry (*Byrsonima lucida*), mahogany (*Swietenia mahagoni*), silver palm (*Coccothrinax argentata*), Christmas berry (*Crossopetalum ilicifolium*), Krug's holly (*Ilex krugiana*), pineland jacquemontia, and wedgelet fern (*Sphenomeris clavata*). A number of small canals intersperse the area.
- A substantial amount of the jurisdictional freshwater wetland communities are located in the **Airfield area**, which comprise the dominant land type. Wetland vegetation is maintained by frequent mowing or herbicide treatment in locations that are saturated or have standing water. Predominant plant species include white-top sedge, spike rush (*Eleocharis cellulose*), hurricane grass (*Fimbristylis cymosa*), torpedo grass (*Panicum repens*), pennywort (*Hydrocotyle bonariensis*), and water hyssop (*Bacopa caroliniana*).
- The **Grenade Range and Reserves area** is characterized by mostly undeveloped conditions with a mix of open grasslands, small monotypic stands of Australian pine (*Casuarina equisetifolia*), and other exotic plant species. Although the Grenade Range as a whole does not contain the dense populations of exotic plants characteristic of other sections of HARB, some areas support significant invasive plant growth. Generally, the canopy remains open and supports many native species (e.g., gumbo limbo [*Bursera simaruba*]), including state-listed species (e.g., locust berry and wedgelet fern)
- The **Hush House area** substrate primarily is exposed limestone with a few areas having a thin mantle of sand overlying the rock. Vegetation is a mixture of exotic species, such as Australian pine, Brazilian pepper (*Schinus terebinthifolius*), and Napier grass (*Pennisetum purpureum*), and native species, such as Florida trema (*Trema micranthum*), white-top sedge, and myrsine.
- The **Munitions area** and adjacent **Northeast Grasslands** contain mostly non-native, grass species (e.g., Bermuda [*Cynodon dactylon*], Bahia [*Paspalum notatum*], and St. Augustine [*Stenotaphrum secundatum*]) and the area is maintained with continual, year-round mowing to support a 2- to 4-inch vegetation height requirement; however, state-protected species have been observed in the Munitions area and Northeast Grasslands including locust berry, Bahama ladder brake fern (*Pteris bahamensis*), Porter's spurge (*Chamaesyce porteriana*), Florida lantana (*Lantana depressa*), and small-leaved melanthera (*Melanthera parvifolia*).

- **Operable Unit 2** is a fenced-in, restricted IRP area. Based on discussion with HARB personnel and observations from the periphery, the area contains only impenetrable monocultures of Brazilian pepper and Burma reed (*Neyraudia reynaudiana*).
- **Phantom Lake** and the **Old Grenade Range** are described together here. The dominant species of vegetation in the Phantom Lake area include exotics such as Burma reed and Australian pine. Although these two exotic species tend to form monocultures that eventually out-compete native species, the canopy remains open in many areas and allows for some growth of both herbaceous and woody native species, including state protected species such as satin leaf (*Chrysophyllum oliviforme*), wedgelet fern, pineland jacquemontia, and locust berry. Many of the native trees, such as locust berry and satin leaf, were probably established prior to the invasion of exotics and are tall enough to avoid becoming shaded and subsequently eliminated. Other native species (e.g., wedgelet fern, rockland jacquemontia, and small-leaf melanthera) appear to comprise the dominant groundcover along the access road and near to Phantom Lake. The lake, which is a former borrow pit, contains a shallow area in the middle exhibiting emergent vegetation surrounded by deepwater habitat along the shoreline. At the time of the 2004 INRMP work, the Old Grenade Range was not accessible for field surveys. However, during initial studies under the USAF Military Munitions Response Program (MMRP) that were performed between 2005 and 2008, most of the former range was found to be covered by dense growths of invasive species, such as Burma reed and Brazilian pepper. However, in the interior of the southern end of the study area, a number of pineland species were found in an undisturbed area.
- The **Remnant Pine Rockland** community at HARB contains many native Florida species, including species specifically associated with pine rockland community types, such as Florida slash pine (*Pinus elliottii*) saplings (a keynote species in pine rocklands). State-protected species include locust berry, Christmas berry, and tetrazygia. These observations were confirmed by a more in-depth vegetation survey performed in late 2004 by Hi-Tech Environmental Consultants. No federal-listed species were encountered. Hurricane Andrew heavily impacted the area in 1992 resulting in immediate and long-term damage to the slash pines. The area currently contains an open canopy with a heavy understory of mostly herbaceous species, such as pineland croton (*Croton linearis*), blue porter weed (*Stachytarphetta jamaicensis*), aster (*Aster* sp.), and white-top sedge. Several state-listed species (e.g., West Indian lilac (*Tetrazygia bicolor*) have also been noted. In May 2009, a federally-listed endangered species, Small's milkpea (*Galactia smallii*), and a federal candidate endangered species to be listed, Sand flax (*Linum arenicola*) were found in a remnant pine rockland tract within former HAFB property on the east side of HARB. Both of these species are small, low-to-the-ground plants, not readily recognizable when not in flower. This would suggest that both species might also be present on the subject tract within HARB.

Invasive exotic plant species are also present in this Remnant Pine Rockland area. The area contains a small stand and many saplings of Australian pine. A dense stand of Burma reed and Napier grass is located in the center of the site and along the boundary to the north, and west of the Boundary Canal. These invasive exotic species are quickly becoming established throughout the site and are out-competing native species.

- The **Southeast Triangle** consists primarily of dense monotypic stands of the invasive exotic plants Brazilian pepper and Napier grass, while Australian pines border most areas along the canal. Maintained grassy areas border the access roads. In 2001, many large

native (e.g., Florida trema) and non-native (e.g., avocado [*Persea americana*]) trees were identified (HARB, 2002c; see Volume II, Appendices F and G). These are scattered throughout and were most likely individuals established prior to the encroaching invasive exotic plant species. No threatened or endangered species were observed in this area, and with the exception of areas along the access roads, very few native herbaceous species (e.g., leather fern [*Acrostichum danaeifolium*] and wax myrtle [*Myrica cerifera*]) were identified due to the lack of open canopy necessary for their becoming established.

- **Southwest Clear Zone** contains heavy populations of Brazilian pepper and Australian pine. Listed native plants, such as the pine pink orchid (*Bletia purpurea*), Porter's spurge, satin leaf, Christmas berry, tetrazygia, and Florida lantana, have been identified in past surveys.
- **Twin Lakes and Wetland Fringe area** are described together here. The lakes consist of two deepwater, former borrow pits, with an emergent wetland fringe composed primarily of cattails (*Typha* sp.) and spike rushes. Small re-growth Australian pines from a prescribed burn still surround the lake and provide some roosting areas for wildlife.
- **Wetland Marsh area** consists primarily of cattail and spike rushes with an open canopy of Australian pine. Vegetation includes small-leaved melanthera, Bahama ladder brake fern, Christmas berry, and wild potato morning glory (*Ipomoea microdactyla*).

3.11.3 Federally Listed Plant Species

This section provides a summary of federally designated endangered and threatened plant species known to occur in Miami-Dade County as determined by data provided by the USFWS (USFWS 2000). The potential for listed plant species to occur on HARB, along with known occurrences, is also discussed.

Federally designated threatened and endangered plants are protected under the ESA of 1973 (16 U.S.C. §§ 1531-1544, as amended). The listings of these species are maintained and periodically updated by the USFWS. All federally designated threatened and endangered plant species listed in Miami-Dade County also are protected by the State of Florida. (Additional state-protected species occurring in Miami-Dade County not otherwise protected by federal jurisdiction under the ESA are described in Section 3.11.4.) Habitat loss and water management practices generally are considered to be the primary significant threats to most of these protected species in Florida. Installations that are known to support federally listed threatened and endangered species or habitat critical for these species must address their conservation in the HARB INRMP. While candidate species are not afforded the same protection under the ESA, installations should provide for their protection, when practicable. No federally protected plant species are known to occur on HARB.

Eight federally listed threatened and endangered plant species currently are known to occur in Miami-Dade County (USFWS, 1999). Six additional plant species are designated as candidates for potential listing (see Volume II, Appendix G, Table G-2). Candidates are those species for which

federal agencies have sufficient information on biological vulnerability and threats to support proposing that a species become “listed” as threatened or endangered.

Volume II, Appendix G, Table G-2, summarizes the habitats preferred by the federally designated threatened and endangered species in Miami-Dade County. All but two of the federally listed species are associated with the pine rocklands ecosystem. Three of these federally protected species in Miami-Dade County also are described in a multi-species recovery plan that was developed by the USFWS to recover 68 federally listed species in south Florida through the restoration of 23 diverse ecological communities (USFWS, 1999). This plan contains all the known information (at the time the document was prepared) regarding the distribution, abundance, biology and ecology of these species, as well as their natural communities. The recovery and restoration practices in the multi-species plan focus on land management practices that would benefit the survival of these imperiled species and their habitats.

Volume II, Appendix G, Table G-2, indicates whether the federally designated species in Miami-Dade County have the potential to occur on HARB. The analysis used to determine whether HARB could provide appropriate habitat to support protected species was based upon existing literature, current and past surveys, and discussions with biologists from the USFWS, the FFWCC, and the Florida Natural Areas Inventory (FNAI). This analysis relied upon several sensitive species surveys that have been conducted over the years on or near HARB. While this information can be used to assess the likelihood of protected plant species occurring on HARB, direct comparisons between surveys to determine the presence or absence of species over the years and their current distribution are not possible because the surveys covered different areas and extents of HARB. Surveys were usually conducted between November and January when most species are fruiting or in flower, which allows for appropriate identification (Hilsenbeck, 1993). For example, Hilsenbeck (1993) conducted surveys over the entire former Homestead AFB (2,938 acres) between December 1992 and October 1993, while the 1996/1997 surveys (Argonne, 1997) occurred in November 1996 and January 1997, and covered 852 acres of the Homestead ARS. The 1997 survey (Post, Buckley, Schuh, and Jernigan [PBS&J], 1998) occurred in November 1997 and covered the “disposal area” of the former Homestead AFB, but included some lands that remain within the HARB boundaries (i.e., primarily around the Southwest Clear Zone). A survey was conducted in December 2001 that was comprised of 33 vegetation plots within all natural community types present on the current 1,943-acre area of HARB (HARB, 2002c; see Volume II, Appendix F). This combined information provides reliable documentation on the potential presence or absence of plant species on HARB.

In Volume II, Appendix G, Table G-2, if a plant has been known to occur on the Base from previous surveys, it was assigned a probability of “high” that the habitat on HARB provides

appropriate conditions to support this species, even if subsequent surveys did not confirm the presence of these species. If suitable natural habitat (such as pine rockland) exists, but the plant has not been surveyed previously on the Base, it was determined to have a “medium” likelihood that appropriate habitat exists for that species. If a plant is believed either to have been extirpated from Miami-Dade County or is known not to be present on HARB because its preferred natural habitat type is not present on the Base, it was determined to have no potential to occur and was given a “low” probability that the natural communities on HARB could support this plant.

Based on the rare plant surveys conducted since 1993, only one federally endangered plant species has been observed within the area. During a 1997 survey, the endangered Small’s milkpea (*Galactia smallii*) was observed in a remnant pine rockland area located within former Homestead AFB, but subsequent survey reports did not document this species being within HARB (Argonne, 1997; PBS&J, 1998; HARB, 2002c). However, as noted earlier, in May 2009, Small’s milk pea, and a federal candidate endangered species to be listed, Sand flax (*Linum arenicola*), were found in a remnant pine rockland tract within former HAFB property on the east side of HARB. This would suggest that both species might also be present on the remnant pine rockland tract within HARB. There also is the possibility that these species could be reestablished in the pine rockland habitat if restoration and management practices are implemented (Hofstetter, 2002).

Habitat Requirements of Federally Designated Species

Pine Rockland Species

The crenulate lead-plant (*Amorpha crenulata*), Blodgett’s silverbush (*Argythamnia blodgettii*), Florida brickell bush (*Brickellia mosieri*), deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), pineland sandmat (*C. deltoidea* ssp. *pinetorum*), Garber’s spurge (*C. garberi*), Florida prairie clover (*Dalea carthagenensis*), Florida pineland crabgrass (*Digitaria pauciflora*), Small’s milkpea, tiny polygala (*Polygala smallii*), Carter’s small-flowered flax (*Linum carteri*), and Carter’s mustard (*Warea carteri*; Volume II, Appendix G, Table G-2) are all associated with pine rockland communities and formerly existed throughout the pine rockland range in Miami-Dade County. Garber’s spurge, Florida prairie clover, and Florida pineland crabgrass also are known within transitional areas between the pine rockland ecosystem and other community types. Garber’s spurge occurs between hardwood hammocks and pine rocklands and on beach ridges in saline coastal areas. Florida prairie clover occurs in pine rockland, along the edge of rockland hammocks, and in marl prairie and coastal strand. Florida pineland crabgrass occurs most commonly between pine rockland and marl prairie (USFWS, 2002).

The known populations of these pine rockland species are extremely limited within their former range and typically exist on mostly small, isolated sites, except for Carter's mustard, which is believed to have been extirpated from Miami-Dade County. Pine rockland species depend upon periodic fire every three to ten years to maintain the habitat and prevent succession to hardwoods. While some species can tolerate limited amounts of disturbance, they are typically shade intolerant and periodic burning helps to reduce competition from woody vegetation. Pine rockland plants also are threatened by invasion of exotic plants and this type of dense vegetative growth can create intense fire temperatures and longer burning periods. Pine rockland species cannot tolerate these extreme conditions and alternate methods should be used to reduce the fuel load (USFWS, 2002).

The 5-acre Remnant Pine Rockland community (see Figure 2-2) at HARB could potentially support some protected plant species if appropriate habitat restoration occurs, which would likely necessitate active planting and reseeding efforts, especially if fire is not used as a management tool. If suitable sites can be found, federally and state-designated plant species possibly could be reestablished in new areas. For example, Metro-Dade County's Fairchild Tropical Garden is currently working to propagate and reintroduce the crenulate lead-plant to South Florida pinelands (DERM, 2002).

Coastal and Marine Plants

Other federally designated protected plants in Miami-Dade County include Johnson's seagrass (*Halophila johnsonii*) and beach jacquemontia (*Jacquemontia reclinata*). Johnson's seagrass is a marine plant that only occurs in shallow coastal waters. Beach jacquemontia occurs in coastal strand or maritime hammock areas (USFWS, 2002). There is no suitable habitat on HARB for these species.

3.11.4 State-Listed Plant Species

In addition to the federally protected species known to occur in Miami-Dade County, the State of Florida also provides protection for other flora in the county. State-listed plants are categorized as endangered, threatened or commercially exploited, and are protected under the jurisdiction of the Florida Department of Agriculture and Consumer Services (Chapter 5B-40, F.A.C.). There are 144 endangered and 54 threatened state protected species in Miami-Dade County (see Volume II, Appendix G, Table G-3). As noted in the 2004 INRMP, the State of Florida's lists of threatened and endangered plants were updated in 2000; therefore, some species have changed to a different state-designated status than was indicated in earlier surveys.

Of the nearly 200 threatened and endangered species in Miami-Dade County, 21 have been known to occur on HARB and generally have been found throughout the natural communities on

HARB (Table 3-6; see also Figure 2-2). Although installations are not required to provide similar conservation measures for species protected by state law as those required by the ESA, protection measures should be adopted when not in conflict with the military mission. The HARB INRMP outlines measures that can be taken to protect and conserve these state-protected species where practicable.

The potential for the remaining natural communities on HARB to support the state-listed species has been ranked according to general habitat preferences and past surveys on the Base. Some plants found in previous surveys were assumed to have “high” potential to occur on HARB, whether or not more recent surveys confirmed their occurrence on the Base (see Volume II, Appendix G, Table G-3). Other state-protected plants that have similar habitat preferences to those natural communities remaining on HARB but have never been documented on HARB according to the last 10 years of survey results are considered to have a “medium” potential that the communities on the Base could support these species. If a plant is believed extirpated from Miami-Dade County or is limited to a natural community not present on HARB, then these species have been determined to have “low” potential for remnant communities on HARB to support these plants.

Habitat Requirements of State-Listed Species

The habitat requirements of state-protected threatened and endangered plants believed to have been or are currently known to exist in Miami-Dade County are summarized in Volume II, Appendix G, Table G-3. Information on these rare species were obtained from Coile (2000), but plant descriptions are not always comprehensive and can be difficult to determine because Florida does not have a single manual covering the flora of the entire state. For example, Wunderlin (1998) is a statewide guide, but lacks descriptions, and Small (1933) is an excellent resource, but the nomenclature is outdated and frequently disputed. The distributions of these plant species also can be found in Wunderlin and Hansen (2002). Recently, the FNAI published the *Field Guide to the Rare Plants of Florida*, which is the first guide that provides identification, habitat information, and management information for more than 200 of Florida’s rare plant species.

The remaining natural communities on HARB could potentially support some of the state-designated species if appropriate habitat restoration and continued maintenance to control invasive exotics occurs. Since many of these species have likely been extirpated from the Base and surrounding areas, any reintroduction likely would need to include active planting and reseeded efforts. If suitable sites can be found, it is possible that some of these state-designated plant species could be reestablished in new areas.

Listed plants that prefer certain habitats such as the pine rocklands, hammocks, and wetland marshes potentially could occur on the remnant natural communities on HARB. Some of these state-

listed species are grown commercially and could be reintroduced in appropriate areas. Information on the cultivation of these species is available from the University of Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences.

Table 3-6

State-Listed Plant Species Recently Known to Occur on Homestead Air Reserve Base, Homestead, Florida

	Administrative and Industrial Support Area	Grenade Range and Reserves Area	Hush House	Munitions Area	Northeast Grasslands	Operable Unit 2	Phantom Lake and Old Grenade Range	Remnant Pine Rocklands	Southeast Triangle	Southwest Clear Zone	Twin Lakes and Wetland Fringe	Wetland Marsh
<i>Bletia purpurea</i> (pinepink orchid)										√		
<i>Byrsonima lucida</i> (locust berry)	√	√	√	√	√		√	√		√	√	
<i>Chamaesyce porteriana</i> (Porter's spurge)	√	√	√		√		√	√		√	√	
<i>Chrysophyllum oliveform</i> (satin leaf)							√					
<i>Coccothrinax argentata</i> (silver palm)	√									√		
<i>Crossopetalum ilicifolium</i> (Christmas berry)	√	√	√		√		√	√		√		√
<i>Ilex krugiana</i> (Krug's holly)	√	√					√					
<i>Ipomoea microdactyla</i> (wild potato morning glory)										√		√
<i>Jacquemontia curtissii</i> (pineland jacquemontia)	√	√	√				√	√		√		
<i>Lantana depressa</i> (Florida lantana)					√		√	√		√		
<i>Linum arenicola</i> (sand flax)										√		
<i>Linum carteri</i> (Everglades flax or Carter's small-flowered flax)		√										
<i>Melanthera parvifolia</i> (small-leaved melanthera)	√	√	√		√		√	√		√	√	√
<i>Poinsettia pinetorum</i> (Everglades poinsettia or rockland painted leaf)								√		√		
<i>Pteris bahamensis</i> (Bahama ladder brake fern)	√	√			√		√	√		√	√	√

Table 3-6

State-Listed Plant Species Recently Known to Occur on Homestead Air Reserve Base, Homestead, Florida

	Administrative and Industrial Support Area	Grenade Range and Reserves Area	Hush House	Munitions Area	Northeast Grasslands	Operable Unit 2	Phantom Lake and Old Grenade Range	Remnant Pine Rocklands	Southeast Triangle	Southwest Clear Zone	Twin Lakes and Wetland Fringe	Wetland Marsh
<i>Sachsia bahamensis</i> (= <i>S. polycephala</i> ; Bahama sachsia)							√	√				
<i>Sphenomeris clavata</i> (wedgelet fern)	√	√					√					
<i>Swietenia mahagoni</i> (mahogany)	√	√						√				
<i>Tetrazygia bicolor</i> (tetrazygia)	√	√			√		√	√		√		
<i>Tragia saxicola</i> (rocklands noseburn)								√				

Source: USAF and FAA, 2000; HARB, 2002c.

3.11.5 Invasive and Exotic Plant Species

Because of South Florida's tropical climate, invasive and exotic plants are considered one of the greatest threats to the integrity of the area's ecosystem. Nonnative species within the Base have invaded disturbed areas, displaced native vegetation, disrupted natural functions, reduced available habitat for endemic plants and animals, and created fire hazards due to increased fuel loads. Based upon recent observations (HARB, 2002c; Earth Tech/AECOM, 2009), the most damaging exotic plant species on the Base include Brazilian pepper, Australian pine, Burma reed, and Napier grass, which are described below.

Brazilian pepper quickly produces a thick monoculture that eliminates habitat for wildlife and can chemically suppress flowering in other plants. It invades disturbed areas as well as undisturbed natural environments. Brazilian pepper also can cause human health and safety concerns because the plant is related to poison ivy and when in bloom, direct contact with the sap can cause allergic reactions. The seeds are readily eaten and transported by birds and mammals. Control methods include use of heavy mechanical equipment and herbicides. While fire may affect the seeds, seedlings, and saplings, it provides little control for mature trees except during intense fires, which would be detrimental to any nearby native species. Regardless of the control method, follow up is important and treated areas must be checked periodically for any new infestations or re-growth from remaining stumps and seedbanks (Ferriter, 1997).

Australian pines colonize disturbed areas, preventing germination and growth of native plants by shading and producing a thick litter layer. Australian pines also are shallow-rooted and more susceptible to becoming uprooted during hurricanes or high winds. Probably the most efficient and cost-effective method used to remove Australian pine is to cut the tree, then apply an herbicide to the stump. Subsequent treatment of the area by prescribed burning may prevent this fire-sensitive species from reestablishing (AFRC, 1997).

Exotic grasses develop monocultures that exclude native species. Dense populations of Burma reed and Napier grass are located throughout HARB. These grasses are highly flammable and create both hazards and security issues for the Base. Both Napier grass and Burma reed can persist through changing environmental conditions due to their deep, fibrous root system, and they regenerate easily after mechanical control (Langeland and Craddock Burks, 1998). Burning, by itself, whether through prescribed or natural wildfires, may enhance the growth and spread of Burma reed if not followed up with chemical or mechanical control. Therefore, a more effective approach to removal involves a combination of cutting or prescribed burning, followed by an application of herbicides (Rasha, 1999).

Methods to effectively remove or manage invasive exotic species have the potential to negatively affect protected native species. Activities to address invasive species management should be fully integrated with management objectives developed for protecting natural resources on the Base.

3.12 Wildlife

3.12.1 Historic and Current Wildlife Conditions

Prior to urban development in south Florida, the HARB area would have supported a diverse range of wildlife species, many of which are imperiled today, such as the Florida panther, American crocodile, eastern indigo snake, and wood stork. While most of HARB has been developed and the remaining natural communities have been disturbed, other native and non-native wildlife species continue to use the habitat available on HARB.

Typical animal species found in pine rocklands include southeastern five-lined skink (*Eumeces inexpectatus*), ringneck snake (*Diadophis punctatus*), pygmy rattlesnake (*Sistrurus miliarius*), red-shouldered hawk (*Buteo lineatus*), Carolina wren (*Thryothorus ludovicianus*), Eastern bluebird (*Sialia sialis*), pine warbler (*Dendroica pinus*), opossum (*Didelphis virginiana*), marsh rabbit (*Sylvilagus palustris*), cotton rat (*Sigmodon hispidus*), cotton mouse (*Peromyscus gossypinus*), raccoon (*Procyon lotor*), and bobcat (*Lynx rufus*). Rare fauna recorded in pine rocklands of south Florida include the Florida evening bat (*Pipistrellus subflavus*), mastiff bat (*Eumops glaucinus floridanus*), Florida burrowing owl (*Athene cunicularia floridana*), gopher tortoise (*Gopherus polyphemus*), Eastern indigo snake (*Drymarchon carais couperi*), rim rock crowned snake (*Tantilla ooltica*), and Florida atala butterfly (*Eumaeus atala*; USAF and FAA, 2000).

Animal species recorded on HARB include state-protected species such as burrowing owls in the Munitions area, Northeast Grasslands, along Flightline Road, and possibly the Administrative and Industrial Support area (see Figure 2-2). Additional species commonly seen on HARB are wading birds that utilize the Airfield wetlands, Wetland Marsh, Boundary Canal and the lakes, including egrets and herons (*Egretta* sp.), and white ibis (*Eudocimus albus*). Other birds include double-crested cormorant (*Phalacrocorax auritus*) and red-shouldered hawk (*Butea lineatus*). On HARB, freshwater wetlands, lakes (which were former borrow areas) and canals provide foraging and nesting habitat for a variety of fish, amphibians, reptiles, and mammals including largemouth bass (*Micropterus salmoides*), warmouth (*Lepomis gulosus*), bluegill (*L. macrochirus*), striped mullet (*Mugil cephalus*), Florida gar (*Lepisosteus platyrhincus*), and common snook (*Centropomis undecimalis*). The American alligator (*Alligator mississippiensis*) and exotic spectacled caiman (*Caiman crocodiles*)

also are common inhabitants of the freshwater canals and lakes on HARB. In addition, there have been several individual sightings of the American Crocodile (*Crocodylus acutus*) at the Twin Lakes . Other reptiles and amphibians include rough grass snake (*Opheodrys aestivus*), corn snake (*Elaphe guttata*), checkered garter snake (*Thamnophis marcianus*), Florida slider (*Trachemys scripta*), Florida soft shell turtle (*Apalone ferox*), snapping turtle (*Chelydra serpentina*), Florida chorus frog (*Pseudacris nigrita verrucosa*), tree frogs (*Hyla* sp.), and two-toed amphiuma (*Amphiuma means*). Raccoons and marsh rabbits are the two most abundant mammal species observed on the Base (USAF and FAA, 2000).

3.12.2 Federally Listed Wildlife Species

This section provides a summary of federally designated endangered and threatened wildlife species known to occur in Miami-Dade County as determined by data provided by the USFWS (USFWS, 2000). The potential for listed species to occur on HARB, along with known occurrences, is also discussed. The determination of whether HARB has appropriate habitat to support protected species was derived from existing literature, surveys, and past discussions with biologists from the USFWS, FFWCC, and FNAI. This determination also relied upon a number of sensitive species surveys that have been conducted over the years (USAF and FAA, 2000) and a recent qualitative survey that covered representative areas of each natural community type on the Base (HARB, 2002c; see Volume II, Appendix F). While direct comparisons between these surveys are not possible because the survey areas and methodologies differed, the combined survey information provides reliable documentation on the potential presence or absence of species on HARB. Information on these surveys is discussed where relevant and the surveys are summarized later in this section.

Federally designated threatened and endangered wildlife are protected under the ESA of 1973 (16 U.S.C. §§ 1531-1544, as amended). The listings of these species are maintained and periodically updated by the USFWS. Some federally listed wildlife species are also protected by other federal laws such as the Marine Mammal Protection Act (16 U.S.C. §§1361-1421h), the Migratory Bird Treaty Act (16 U.S.C. 701-715s), and the Bald Eagle Protection Act (16 U.S.C. §§ 668-668c). The State of Florida also protects all federally designated threatened and endangered species listed in Miami-Dade County. (Additional state-protected wildlife species occurring in Miami-Dade County that are not otherwise covered by the federal jurisdiction under the ESA are described in section 3.12.3.) Habitat loss and fragmentation are generally considered to be the primary significant threats to most of these protected species in Florida.

Installations that are known to support federally listed threatened and endangered species or habitat critical for these species must address these species' conservation in the INRMP. While

federal candidate species are not afforded the same protection under the ESA, installations should provide for their protection, when practicable. Based on past wildlife surveys and recent field observations, the only federally protected wildlife species confirmed to occur regularly on HARB is the American crocodile (*Crocodylus acutus*), which has been seen on base in the Twin Lakes area since 2007. However, the Base currently provides limited habitat for attracting and sustaining federally protected species (primarily birds such as the wood stork, which has been observed occasionally on the Base). HARB is also surrounded by land uses that are similarly limited or unsuitable as habitat and is located several miles from park lands and other undeveloped areas that provide conditions favorable to the continued existence of this wildlife.

Sixteen (16) federally listed threatened and endangered animals are currently known to occur in Miami-Dade County, consisting of two mammals, one fish, six birds, six reptiles, and one invertebrate (Volume II, Appendix G, Table G-4; USFWS, 2000). These animals also have been thoroughly described in a multi-species recovery plan developed by the USFWS to recover 68 federally listed species in south Florida through the restoration of 23 diverse ecological communities (USFWS, 1999). This plan contains all the known information regarding the distribution, abundance, biology and ecology of these species, as well as their natural communities. The recovery and restoration practices in the multi-species plan focus on land management practices that would benefit these imperiled species and their habitats.

Volume II, Appendix G, Table G-4 provides summary information on the federally listed species in Miami-Dade County, their habitat requirements, and the probability that the remaining natural communities could support these species on HARB. Further information regarding these species and their habitats is provided below.

Habitat Requirements of Federally Designated Species

Florida Panther

Florida panthers (*Puma concolor coryi*) are often found in association with a wide variety of vegetation, but prefer hardwood hammocks and pine flat woods with sufficient space ranging between 200 and 400 kilometers. Although there have been a few confirmed sightings several miles to the south of the base, the largest contiguous tract of panther habitat near HARB is the Big Cypress Swamp/Everglades region. Agricultural areas and other disturbed habitats are usually avoided, but pasture lands may be traversed at night (USFWS, 1999). In the 1980s, radio-collared panthers were tracked within 1 mile of HARB. However, HARB does not contain appropriate habitat for the panther and the adjacent lands are primarily plant nurseries that are generally unsuitable to the panther for navigating to other areas.

West Indian Manatee

The federally listed West Indian manatee (*Trichechus manatus*) inhabits coastal and inland waterways throughout Florida's east coast. Manatees require access to aquatic vegetation, freshwater sources and at least 2 meters of water depths. Biscayne Bay supports a year-round population, with the largest numbers occurring during the winter months (USFWS, 1999). Near HARB, there have been numerous observations of manatees in and near Black Creek (about 3 miles north of Military and Mowry canals) and Convoy Point (about 2 miles south of Military Canal). Three manatee sightings also occurred near Military Canal between 1989 and 1994 (USAF and FAA, 2000). More recent data show two manatees in Military Canal downstream of the salinity control structure in 1995, another one feeding in Biscayne Bay at the mouth of Military Canal in 1996, and two manatees in the freshwater portion of Military Canal in 1999 (USAF and FAA, 2000). Manatees have not been observed and are not expected to occur in the canals on HARB (USAF and FAA, 2000), largely because of the flow control structure at the storm water reservoir.

Smalltooth Sawfish

In April 2003, National Oceanic and Atmospheric Administration Fisheries Division (NOAA Fisheries), formerly the National Marine Fisheries Service (NMFS), issued a final rule to list smalltooth sawfish (*Pristis pectinata*) as an endangered species (NOAA, 2003). The smalltooth sawfish is a ray that lives in shallow coastal and estuarine habitats, but may occasionally occur in deeper neritic waters. The smalltooth sawfish grows to 5.5 meters (18 feet) in length and may live 25 to 30 years, although little is known of its life history. The sawfish used to be common throughout the Gulf of Mexico from Texas to Florida, and along the East Coast from Florida to Cape Hatteras, North Carolina. The current population has declined at least 95% from historical levels and its range has been significantly reduced. The distribution of smalltooth sawfish is now limited to peninsular Florida and is relatively common only in Everglades National Park and Florida Bay (NOAA, 2003). It is possible, but unlikely, that smalltooth sawfish could occur in the canals around HARB because they tend to associate with more pristine, mangrove fringe estuarine areas (Bernhart, 2003). If sawfish do occur near HARB, efforts to restore canal vegetation and aquatic habitat to more natural conditions, adherence to stormwater management practices, and restoration of historic flows in the area would provide benefits to this and other native species. If necessary, consultation involving this species would occur with NOAA Fisheries.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is considered common in south Florida and breeds throughout the state. 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 (USFWS, 1999). The nearest breeding pair of bald eagles is south of HARB at the south end of BNP. The next closest sites are near Florida Bay in Everglades National Park (USAF and FAA, 2000). Historic nest sites exist in the area of the Charles Deering Estate, Key Biscayne, and Key Largo, and numerous eagle sightings have occurred in the Black Point area, but nesting has never been confirmed there (USAF and FAA, 2000). Occasional sightings have occurred on HARB over the years. Based on this information, it appears that the bald eagle commonly forages along the western shoreline of Biscayne Bay north and south of Military Canal and could occur on occasions at HARB (USAF and FAA, 2000).

Cape Sable Seaside Sparrow

The present known distribution of the federally listed Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) is restricted to two areas of marl prairies east and west of Shark River Slough and flanking Taylor Slough (USFWS, 1999), areas that are distant from HARB. The preferred nesting habitat appears to be mixed marl prairie community that includes muhly grass and short hydroperiods (USFWS, 1999). HARB does not have the appropriate habitat or hydrological conditions that are needed for the Cape Sable seaside sparrow. Based on extensive surveys of known populations of the sparrow in the Everglades and from surveys conducted on HARB, it is unlikely that the remaining vegetative communities on HARB would attract or support the sparrow.

Everglade Snail Kite

The Everglade snail kite (*Rostrhamus sociabilis plumbeus*) is found in freshwater marshes and shallow, vegetated edges of natural or man-made lakes where apple snails can be found. Because of its specific dietary and hydrological requirements, the Everglade snail kite is restricted to the watersheds of the Everglades, Lake Okeechobee, Lake Kissimmee, and the upper St. Johns River. The snail kite has not been recorded in numerous surveys conducted on or near the former Homestead AFB, nor has it been recorded from BNP (USAF and FAA, 2000). Although these birds are nomadic, an occurrence on HARB would be rare and likely only for a short duration (USAF and FAA, 2000).

Roseate Tern

The roseate tern (*Sterna dougallii dougallii*) is a migratory, marine bird that forages in the nearshore surf, and is similar in appearance to other tern species. The preferred nesting habitat is open, sandy beach isolated from human activity or predators, although rooftops are also used and they have been known to nest in rooftop areas with the least tern (*Sterna antillarum*), a state-listed threatened species (Gude, 2002). Occasional transients may occur at Biscayne Bay, but they are expected to occur very infrequently there and even less frequently as a transient on HARB (USAF

and FAA, 2000). According to BASH personnel, no roseate terns have been seen on HARB during their bird management activities.

Wood Stork

The wood stork (*Mycteria americana*) is a large, long-legged wading bird that breeds in colonies with other species such as the great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), and white ibis, although the majority of nesting by the southeastern population no longer occurs in south Florida. The Everglades, however, is an important foraging area primarily in shallow wetland areas where fish have become concentrated, either through seasonal drying or local reproduction. While wood storks (about ten to 20) are seen each year flying above HARB, they seem to prefer nearby, off-Base shallow canals that have been cleaned periodically (Peterla, 2002). Single or small groups of wood storks (up to ten) have been recorded on the Base in the winter time (USAF and FAA, 2000). Even though there is marginal foraging potential on HARB, it is expected that their occurrence on the Base would be infrequent and nesting would not be likely because of human disturbances.

Piping Plover

The piping plover (*Charadrius melodus*) is a small shorebird. They do not breed in Florida but migrate to the state in winter. Winter habitat in Florida includes beaches, mudflats, and sand flats, and these birds are most often found foraging in areas adjacent to large inlets and passes on the Atlantic coast (USFWS, 1999). Annual Christmas bird counts at the national parks indicate this species used to regularly winter in Miami-Dade County, but piping plovers have been recorded only four times at BNP between 1978 and 1997 (USAF and FAA, 2000). The occurrence of this species at HARB would be considered extremely rare.

American Crocodile

Breeding and foraging of federally listed American crocodiles (*Crocodylus acutus*) regularly occur in Everglades National Park along the shoreline of Florida Bay, in mangrove habitats on North Key Largo, and at Florida Power and Light's Nuclear Electrical Generating Facility at Turkey Point (USFWS, 1999). American crocodiles occupy the same range as other crocodylians and the adults can disperse great distances. While the crocodiles tend to inhabit more saline waters than other species, they also have been found in inland ponds and creeks. Access to deep water (greater than 1 meter) is also an important habitat component (USFWS, 1999). The American alligator is often confused with the crocodile, but can be distinguished from the alligator by its brown rather than black color and its narrower snout with the fourth tooth of the lower jaw projecting outside the upper jaw. Because of the difficulty differentiating between these species, the American alligator is listed as threatened due to

similarity of appearance (see Section 3.12.3 for further discussion regarding the American alligator). In 1998, extensive crocodile surveys were conducted on the former Homestead AFB, along 37 miles of canals near the former Base, and along 7 miles of the western shoreline of Biscayne Bay (USAF and FAA, 2000). Each location was surveyed three times. No crocodiles were observed on the former Homestead AFB, but the spectacled caiman was common and a few American alligators were observed. During these surveys, the American crocodile was recorded along the coast of Biscayne Bay and at the entrances of Florida City Canal (approximately 3 miles southeast of HARB), Goulds Canal (approximately 3 miles northeast of HARB), Military Canal, and the Fender Point area (USAF and FAA, 2000). Other surveys in 1997 recorded one crocodile each at the mouths of North Canal, Florida City Canal, and Princeton Canal, and in the Black Point and Fender Point areas (USAF and FAA, 2000). There have been recent individual sightings of crocodiles on base at the Twin Lakes since 2007, and there were also periodic sightings within Military Canal during the 2003 CERCLA liner emplacement activities.

Eastern Indigo Snake

The Eastern indigo (*Drymarchon carais couperi*) is a large, black, non-venomous snake that is widely distributed throughout central and south Florida, although not commonly seen (USFWS, 1999). Over most of its range, the snake frequents a variety of habitat types including pine flat woods, scrubby flat woods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. They require a sheltered refuge, such as gopher tortoise holes, hollowed root channels, animal burrows, or hollow logs, that can protect them from winter cold and drying conditions. Monitoring studies in the Everglades and Florida Keys indicate that the snakes prefer hammocks and pine forests (USFWS, 1999). Indigo snakes, particularly the males, also are known to range over large areas throughout the year (perhaps as much as 224 hectares) with most activity occurring in the summer and fall (Moler, 1992). The FNAI reports that indigo snakes were observed in March 1980 and in January 1981 along the Florida City canal, which is located approximately 2 miles south of HARB and an indigo snake was observed along the berm of Military Canal in July 1998 (USAF and FAA, 2000). Biological surveys for the snake were conducted on the former Homestead AFB in 1992, 1993, 1997, and 1998. No indigo snakes were observed during these surveys or during the 2001 survey (USAF and FAA, 2000; HARB, 2002c). While this indicates that potential habitat is available along the canals, mangrove swamps, wetlands, and vacant land on or near HARB, these areas are considered to be marginal habitat for the indigo snake. Because HARB is highly developed, it is unlikely that indigo snakes inhabit much of the area on base except along the boundary fringes, where there have been several unconfirmed sightings or within the Phantom Lake-Old Grenade Range Area.

Sea Turtles

Four species of sea turtle are known to forage and breed in the coastal areas of Miami-Dade County: the green sea turtle (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and hawksbill (*Eretmochelys imbricata*). While the loggerhead and hawksbill may occur occasionally in the salt water portion of Military Canal (USAF and FAA, 2000), HARB offers no appropriate nesting or foraging habitat for these and the other sea turtles.

Schaus Swallowtail Butterfly

The Schaus swallowtail (*Heraclides aristodemus ponceanus*) is a large, dark brown and yellow butterfly. The only known location for this butterfly is on islands within BNP that contain tropical hardwood hammocks, and on Key Largo. It has not been seen on the mainland since 1924 (Deyrup and Franz, 1994). Habitat preferences are restricted to undisturbed areas with particular types of vegetation such as torchwood (*Amyris elemifera*) and wild lime (*Zanthoxylum fagara*; Gude, 2002). There is no appropriate habitat on HARB to support the Schaus swallowtail butterfly.

3.12.3 State-Listed Wildlife Species

In addition to the federally protected species documented to occur in Miami-Dade County, the State of Florida also provides protection for other fauna in the county. Animals on the state's list of protected species are maintained by the FFWCC and are categorized as endangered, threatened, or of special concern (rules 68A-27.003, 68A-27.004 and 68A-27.005, respectively, of the F.A.C.).

There is one endangered, seven threatened and seventeen state species of special concern (SSC) that are known to occur in Miami-Dade County. Volume II, Appendix G, Table G-5, lists their habitat preferences and whether the habitat on HARB could potentially support these species. Of the state-protected wildlife in Miami-Dade County, ten are known to occur on HARB, two of which are threatened and eight are species of special concern (Table 3-7). Although installations are not required to provide similar conservation measures for species protected by state law as those required by the ESA, protection measures should be adopted when not in conflict with the military mission. The HARB INRMP outlines measures that can be taken to protect and conserve these state-protected species, where practicable.

Table 3-7	
State-Listed Wildlife Species Recently Known to Occur on Homestead Air Reserve Base, Homestead, Florida	
Common Name	Species Name
Birds	
Limpkin	<i>Aramus guarauna</i>
Little blue heron	<i>Egretta caerulea</i>
Reddish egret	<i>Egretta rufescens</i>
Snowy egret	<i>Egretta thula</i>
Tricolor heron	<i>Egretta tricolor</i>
White ibis	<i>Eudocimus albus</i>
Southeastern American kestrel	<i>Falco sparverius paulus</i>
Florida burrowing owl	<i>Athene cunicularia floridana</i>
Least tern	<i>Sterna antillarum</i>
Reptiles	
American alligator	<i>Alligator mississippiensis</i>

Habitat Requirements of State-Listed Species

Water Dependent Birds

The American oystercatcher (*Haematopus palliatus*) is a solitary ground nester that prefers to nest on sandy, pebbly beaches or on the borders of salt marshes. The oystercatcher forages in shallow water by using its bill to probe mud below the surface and feeds almost exclusively on shellfish and marine invertebrates (Rattner *et al.*, no date). HARB is unlikely to provide appropriate habitat or feeding areas for the American oystercatcher.

Brown pelicans (*Pelecanus occidentalis*) prefer to nest on small coastal islands that provide protection from mammal predators, especially raccoons, and sufficient elevation to prevent wide scale flooding of nests. Feeding occurs primarily in shallow estuarine waters (USFWS, 1994). The brown pelican is an occasional transient in the area, but is not known to nest or feed on HARB. One brown pelican, entangled with fishing line, was seen on HARB for about two weeks, but could not be caught and eventually moved away (Peterla, 2002).

The black skimmer (*Rynchops niger*) is a colonial species that often nests with other terns. It breeds and forages in estuaries, with nests typically constructed in open spaces on beaches, salt marshes, and dredge spoil islands. The black skimmer obtains its food by skimming the water for fish (Rattner *et al.*, no date). HARB does not provide appropriate habitat or feeding areas for the black skimmer.

Limpkins (*Aramus guarauna*) feed in shallow waters and occur near slow-moving freshwater rivers and streams, marshes, and lakeshores. The limpkins largely feed on apple snails and other snails, as well as freshwater mussels, and to a lesser extent lizards, insects, frogs, worms, and

crustaceans (Kale, 1978). There is appropriate habitat for limpkins and a few are seen each year at HARB (Peterla, 2002).

The roseate spoonbill (*Ajaia ajaja*) forages for small fish in shallow marine, brackish, or freshwater sites. Wetland habitats include coastal marshes and mangrove swamps. Little blue heron, reddish egret, and snowy egret usually feed in flocks with other waders in a wide variety of shallow marshes, edges of swamps or ponds, flooded ditches, or stream banks. Tri-colored heron and white ibis use both coastal and inland habitats for nesting and foraging.

The natural habitat of least terns (*Sterna antillarum*) is open, flat beach with coarse sand or shell, usually seaward or within the foredune vegetation, but the species is opportunistic and will use any gravelly or sandy area that is devoid of vegetation and provides suitable habitat, such as spoil islands, parking lots, on bridge or building construction sites, and temporary landfills.

There is significant overlap of foraging habitat among the little blue heron (*Egretta caerulea*), snowy egret, and tricolor heron (*Egretta tricolor*). Generally, little blue herons are most common near the coast but prefer freshwater areas such as ponds, swamps, and flooded grasslands. However, snowy egrets typically prefer shallow bays, coastal marshes and mangrove habitats over inland marshes and sloughs. Tricolor herons appear to prefer small pools over lakes and bays. White ibis utilize both freshwater and estuarine wetlands such as mangrove and cypress swamps, bottomland hardwood, and marshes.

Many South Florida wading birds are year-round residents or are common on the Base, such as the snowy egret, least tern, and white ibis (Table 3-7). Some, such as the reddish egret, are more sensitive to human activity and can be found in undisturbed areas of the Base (see also Volume II, Appendix G, Table G-5; HARB, 2002c). Other birds noted during a recent survey were the little blue heron and tricolor heron. All these bird species are also federally protected under the Migratory Bird Treaty Act (MBTA).



Florida burrowing owl

Florida Burrowing Owl

The Florida burrowing owl (see photograph) is a small, distinctive, ground-dwelling bird with long legs, a white chin stripe, round head, and stubby tail. The burrowing owl is also federally protected under the United States Migratory Bird Treaty Act. Although intensive cultivation and development of grasslands pose significant threats to the population, studies have shown that owls appear to prefer disturbed sites, with the largest concentrations of owls residing in disturbed grasslands and lawns of residential and industrial areas (FNAI, 2001). Florida burrowing owls are known to occur in groups on HARB at several different perennial nesting sites near the runway in the

area of the control tower (USAF and FAA, 2000) and along Flightline Road, within the munitions area, and in grassy lawns near administrative buildings (HARB, 2002c).

Southeastern American Kestrel

Southeastern American kestrels (*Falco sparverius paulus*) inhabit mostly open pine forests and clearings where snags occur. The decrease of isolated or scattered pine snags in open habitats used by Southeastern American kestrels was closely correlated with the decline in the number of breeding pairs. Nest boxes can provide nest sites for American kestrels in areas of declining availability of natural cavities (USDA, 2002). The Southeastern American kestrel is common on HARB during the winter migratory months (Peterla, 2002) and it is federally protected under the Migratory Bird Species Act.

Florida Sandhill Crane

The habitat of the Florida sandhill crane (*Grus canadensis pratensis*) includes freshwater marshes dominated by pickerelweed and maidencane. These birds also require upland forests and grasslands, and often eat seeds, leaves and roots of various plants. The Florida sandhill crane has been seen flying over the Base, but is not known to forage or nest there (Peterla, 2002).

White-Crowned Pigeon

White-crowned pigeons (*Columba leucocephala*) nest only in extreme south Florida, mainly in mangrove forests. These birds move inland daily to feed on the dull yellow, clustered fruit of the poisonwood tree. In addition, they eat strangler fig, mastic, pigeon plum, sea grape, and other tropical fruits, plus some seeds and insects (Kale, 1978). The white-crowned pigeon has been seen once on the Base, indicating that it is an occasional transient species, but does not appear to forage or nest on HARB (Volume II, Appendix G, Table G-5; Peterla, 2002).

Mammals

Southern minks (*Mustela vison*) occur in a wide variety of plant communities, but are associated with water rather than with particular habitat types. They are most often found in coniferous and mixed forests and in grassland environments if open water or marshland is present (Allen, 1986). They are primarily nocturnal hunters, which feed on small mammals, insects, birds, fish, crayfish, and snails (Rattner *et al.*, no date). Only the Everglades mink population is listed by the state as threatened. This subgroup has a disjunct distribution in southern Florida with one population near Lake Okeechobee and another in the Big Cypress Swamp-Everglades National Park area (Sullivan, 1996). While suitable habitat is available for the Everglades mink on HARB, site surveys have not detected the animal or signs of them (i.e., tracks or dens) on the Base.

The Florida mastiff bat (*Eumops glaucinus floridanus*) occurs in urban residential areas of Miami, Coconut Grove, and Coral Gables. Most are found in buildings, low shrubbery, and where there are lush growths of tropical flowers and shrubs. A favored roosting place in Miami is under the shingles of Spanish tile, but they have also been found in royal palm leaves in Coral Gables (Best *et al.*, 1997).

Florida mice (*Podomys floridanus*) are found in xeric upland communities with sandy soils, including scrub sandhill and ruderal sites where they inhabit burrows of the gopher tortoise. In the absence of gopher tortoises, the mice will dig their own burrows or use those of oldfield mice (*Peromyscus polionotus*).

Florida black bears (*Ursus americanus floridanus*) use a wide variety of forested types, pine Flatwoods, hardwood swamp, cypress swamp, hammocks, xeric oak scrub, and mixed hardwood-pine, although seasonal changes in habitat use occur in response to food availability. Historically, Florida black bears occurred throughout the Florida mainland and on some coastal islands, often associated with large forested tracts. Currently, the black bear remains widespread in Florida, but its distribution has been reduced and its habitat fragmented (Kale, 1978).

HARB lacks suitable habitat to support the state-listed mammalian species of Florida mastiff bat, Florida mouse, and Florida black bear. While marginal habitat for the Southern mink is available, they are unlikely to occur on the Base given their rarity and limited distribution.

Fish

The mangrove rivulus (*Rivulus marmoratus*) usually occurs in areas adjacent to mangrove swamps and high salt marshes and is found in the burrows of land crabs (*Cardisoma* sp.) and other crab species. Rivulus are typically found in brackish and marine waters (Gilbert, 1992). Because of its habitat preferences for crab burrows adjacent to coastal areas, the canal system and lakes on HARB are not suitable to support the mangrove rivulus.

Reptiles and Amphibians

Gopher tortoises require well-drained loose soil for their burrows, adequate low-growing herbs for food, and open sunlit sites for nesting. They are primarily associated with xeric scrub oak, coastal strand and dune, live oak hammocks, dry prairie, pine flatwoods, and mixed hardwood-pine communities. Disturbed habitats, such as roadsides, fencerows, clearings, and old fields, often support relatively high densities (Moler, 1992). HARB does not provide appropriate habitat for the gopher tortoise and burrows have not been seen on the Base.

The distribution of the gopher frog (*Rana capito*) appears to be in native, upland habitats associated with gopher tortoise. Preferred breeding habitats include seasonally flooded, grassy ponds

and cypress heads that lack fish populations (Moler, 1992). Based on the lack of gopher tortoises on HARB, the gopher frog is not expected to occur on the Base (Zambrano, 2002).

The Florida pine snake (*Pituophis melanoleucus mugitus*) prefers open, sandy areas and often is found in association with pocket gophers and gopher tortoises (Moler, 1992). Based on the lack of gopher tortoises on HARB, the Florida pine snake is not expected to occur on the Base, but the pine rockland area could provide appropriate habitat.

The American alligator population (see photograph) has responded favorably to protection efforts and was reclassified as threatened because of its similarity in appearance to the American crocodile in 1985. In 1987, the State of Florida introduced managed harvests of alligators and their eggs to create conservation incentives by enhancing economic value of wild alligator (LaRoe, 1995). The canals and lakes on HARB provide habitat for American alligators and they are known to occur here.



American alligator

Rim rock crowned snakes are typically found from sandy and rocky soils in slash pine flatwoods, tropical hardwood hammocks, and vacant lots and pastures with shrubby growth and scattered slash pines (Moler, 1992). Surveys were conducted for the rim rock crowned snake in the two remaining patches of second growth, unmowed uplands on the former Homestead AFB in 1998 (Denton and Godley, 1999; Mazzotti, 1999). One area was around the reservoir near the north end of the runway and the other was at the southwest end of the runway. The surveys consisted of installing 2-meter drift fences with small funnel traps. The fences were checked daily over a period of two weeks and searches for the snake were also conducted by overturning trash, logs, and other debris in the two study areas. The rim rock crowned snake was not recorded on HARB during these species-specific surveys (USAF and FAA, 2000). These surveys did not appear to include, however, the pine rockland site, which also would provide appropriate habitat. It is possible, but considered unlikely, that the Remnant Pine Rockland habitat on the Base could support the rim rock crowned snake given the limited acreage of habitat available.

3.12.4 Neotropical Migratory Birds

Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds” (66 *Federal Register* 3853, January 17, 2001), prohibits federal agencies from taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations. In addition, it directs federal agencies to develop and implement, within two years, an MOU with the USFWS to promote the conservation of migratory bird populations (FAA, 2001). Federal agencies are required within permitted law, availability of monies, budgetary limits and agency missions to:

- Support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities, and by avoiding or minimizing adverse impacts on migratory bird resources.
- Restore and enhance migratory bird habitats.
- Prevent or abate pollution or detrimental alteration of the environment for the benefit of migratory birds.
- Design migratory bird habitat and population conservation principles, measures, and practices into agency plans and planning processes, and coordinate with other agencies and nonfederal partners in planning efforts.
- Ensure that environmental analyses of federal actions required by NEPA and other established review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern. Provide notice to the USFWS in advance of conducting an action that is intended to take migratory birds.
- Minimize the intentional take of species of concern.
- Identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations.
- Provide training and information to appropriate employees on methods and means of avoiding or minimizing the take of migratory birds and conserving and restoring their habitat.
- Develop partnerships with non-federal entities to further bird conservation.
- Promote migratory bird conservation in international activities (FAA, 2001).

In Florida, neotropical migratory birds also receive special attention from state and local government agencies. Land bird species observed at BNP have been recorded sporadically from 1973 through 1998. A total of 87 species of neotropical land birds have been recorded, including 28 species of warblers, eight species of flycatchers, and six species of vireos. Based on the number of observations there are twelve common species and seven abundant species, including the black-whiskered vireo (*Vireo altiloquus*), blue-gray gnatcatcher (*Polioptila caerulea*), black-throated blue warbler (*Dendroica caerulescens*), prairie warbler (*D. discolor*), American redstart (*Setophaga ruticilla*), and ovenbird (*Seiurus aurocapillus*; USAF and FAA, 2000).

Winter Water Birds and Raptors

Winter water birds, raptors, and other species have been observed at BNP during thirteen Christmas bird counts since 1997 and at Everglades National Park during nineteen Christmas bird counts from 1978 through 1998. A total of 981 species of water birds and raptors were recorded at

BNP with observations of over 27,000 individuals. Fourteen species were abundant, ten species were common, and the remaining species were rare or uncommon. Two species (bald eagle and wood stork) are federally listed. State-listed species observed included the brown pelican, tricolor heron, little blue heron, reddish egret, great white heron (*Ardea herodias*), great egret, white ibis, and roseate spoonbill.

A total of 121 species totaling over 616,000 individuals were tallied during counts at Everglades National Park. Twenty-one species were abundant, 35 were common, eighteen were uncommon, and 47 were rare. The most abundant groups were shorebirds and wading birds. The federally listed bald eagle and wood stork were observed, as well as a number of state-listed species that were seen at BNP (USAF and FAA, 2000).

3.12.5 Nuisance Wildlife Species (Terrestrial and Aquatic)

Like many other places in South Florida, the natural communities on HARB provide habitat for an assortment of exotic, invasive wildlife species such as reptiles, amphibians, and birds. These animals often out-compete native species and modify their habitats to the detriment of native wildlife.

The spectacled caiman (see photograph) is present throughout the canals and lakes of HARB. It was originally imported into the United States in large quantities by the pet trade industry (King and Krakauer, 1966). In Florida, caimans were observed as early as the late 1950s in Miami. In 1974, a breeding population was discovered within Homestead AFB and by 1980 caimans were reported to be present from Seminole County to Miami-Dade County. The caiman is presently considered established and relatively common, especially in drainage canals of south Florida and efforts to extirpate them have been unsuccessful (Ellis, 1980). The caiman is capable of maintaining viable populations in disturbed areas and out-competing existing alligator and crocodile populations. This species is of particular concern since it appears to be adapting well to conditions in southern Florida, and has the potential to further impact the fauna of the area.



Spectacled caiman

In recent years, a number of specimens of Nile monitor lizards have been sighted on base along the canal levees and drainage canals along the southern and northern portions of the Boundary Canal system. The Nile monitor is presently considered established in two other areas in South Florida (Ft. Myers and West Palm areas), has been sighted in the Florida Keys (e.g., Grassy Key) and are becoming more common in drainage canals which are a preferred means of travel. The National Park Service has been working with the BASH representative to prevent the establishment of a viable

population in disturbed areas on base. Like the caiman, this species is of particular concern since it appears to be adapting well to conditions in southern Florida, and has the potential to further impact the fauna of the area.

Monk parakeet (*Myiopsitta monachus*) is the most abundant naturalized parrot species in the United States. These birds build their nests in any tall structure, natural or artificial. Monk parakeets were seen as early as the 1970s at feeders amid flocks of another exotic caged-bird species, the canary-winged parakeet (*Brotogeris versicolurus*; Spreyer and Bucher, 1998). Other exotic species that occur on or near the Base include the hill myna bird (*Gracula religiosa*) and Eurasian collared dove (*Streptopelia decaocto*). The house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*) are the most common introduced bird species in upland areas of the Base (USAF and FAA, 2000).

Cuban tree frogs (*Osteopilus septentrionalis*) are believed to have been introduced into Florida in 1931 in cargo imported from Cuba. Since then they have spread to 27 counties in Florida and are known to prey on many native frog species, including the southern toad (*Bufo terrestris*), the narrow-mouthed toad (*Gastrophryne carolinensis*), the southern leopard frog (*Rana sphenoccephala*), the green treefrog (*Hyla cinerea*), and the squirrel treefrog (*Hyla squirella*). In some areas, Cuban tree frogs have caused power outages. They are attracted to the buzzing noise of electrical transformers and there have been incidences where these frogs have climbed into and short-circuited transformers causing localized blackouts (Fuller and Benson, no date).

Basilisks lizards (*Basiliscus vittatus*) are typically found in low density suburban developments, peripheral to core urban areas, agricultural habitat, and recently disturbed areas. They are found along the canals in Miami-Dade County (Butterfield *et al.*, 1997) and have been reported at a number of locations on the Base (USAF and FAA, 2000).

Green iguanas (*Iguana iguana*) are popular pets that are frequently released or escape. They have been found on Key Biscayne and in urban and suburban areas elsewhere in southern Florida, especially where trees form dense canopies near water (Dalrymple, 1994). They are regularly seen to occur on HARB (Earth Tech/AECOM, 2009), especially along the canal banks.

Exotic fish that occur in the canals on and near HARB include the Oscar (*Astronotus ocellatus*), a South American cichlid that was established in Florida waters in the late 1950s as a result of a Miami-Dade County fish farm release and is now a common sport fish (Fuller and Nico, 1999). Another exotic fish is the spotted tilapia (*Tilapia mariae*), an African cichlid introduced into Florida as a result of escapes or releases from fish farms in Miami-Dade County, probably during the



Source: FFWCC

Butterfly peacock fish

early 1970s. It is now one of the most abundant species in many South Florida canals (Fuller and Nico, 1999). The pike killifish (*Belonesox belizanus*) is native to Central America, but was introduced into south Florida in 1957 when individuals reared for medical research purposes were released into a local canal. It is now firmly established (Fuller and Nico, 2002). One of the most popular gamefish in southeast Florida canals is the butterfly peacock (*Cichla ocellaris*; see photograph), which was intentionally introduced by scientists with the FFWCC Non-Native Fisheries Laboratory. The butterfly peacock is a tropical fish from South America and because of its intolerance to water temperatures below 60°F, their distribution is mostly limited to the canals from metropolitan Miami to the West Palm Beach area. The purpose of this introduction was to help reduce the number of undesirable exotic fishes and to increase recreational angler opportunities (Shafland, 1999). Other exotic fish species found in the canals include walking catfish (*Clarias batrachus*) and sailfin catfish (*Pterygoplichthys multiradiatus*; USACE, 1998).

4

Goals, Objectives, and Strategies

The following three goals have been identified:

- Goal 1: Conserve and enhance the land and water resources of HARB through a program of conservation management that is compatible with the military mission.**
- Goal 2: Improve and maintain the quality of native vegetation communities and threatened and endangered (T/E) species habitats while supporting the military mission.**
- Goal 3: Promote stewardship values for natural resources quality and diversity at HARB by fostering knowledge and awareness and encouraging active participation in natural resources conservation.**

4.1 The Purpose and Relationships of the INRMP Goals, Objectives, and Strategies

The three goals developed for this HARB INRMP are the focal point for implementation of natural resources management over the next five years. The goals reflect the desired results of natural resources management efforts at HARB. These goals were developed with consideration given to existing executive orders (EOs), AFIs, natural resources issues and challenges at the installation, identified stewardship opportunities, as well as concern for the need to proceed in a direction compatible with the continued military mission of HARB.

Each goal is supported by one or more objectives. Each objective provides a more specific management action, that when combined with success in accomplishing other objectives, will serve to achieve the stated goal. To accomplish each objective, one or more strategies have been identified. The strategies identified for accomplishing INRMP objectives require certain actions to be undertaken by HARB, such as the completion of specific projects and/or follow-through on other management initiatives.

In summary, completion of projects and other management initiatives fulfills the strategies for accomplishing natural resources management objectives. When the objectives are accomplished, the INRMP goal has been achieved.

Where “management initiatives” are commonly identified for incorporating the planning process into the day-to-day functioning of HARB operations and management, “projects” tend to be actions that require discrete stand-alone efforts and require additional budget expenditures, and thus are presented as line items in the proposed budget for INRMP implementation. In accordance with AFI 32-7064 (17 SEP 2004) projects must be completed within the period covered by the plan. Projects are actions that become line items in the proposed budgets for plan implementation. Volume II, Appendix A provides a more detailed description and cost estimate for each project.

The Purpose of “Cross-Referencing” in the INRMP

Many of the natural resources management issues at HARB, and the actions contemplated in the INRMP for addressing them, are interrelated. Therefore, by design, many of the management strategies offered in the INRMP (including the discrete projects and initiatives proposed) may support the efforts to accomplish multiple objectives, or the achieving of multiple goals. In order to make note of these interrelationships where they occur, a system for cross-referencing those actions that serve multiple purposes is used within this section. For example, if

the strategy for accomplishing objective A lends benefit for accomplishing objective B, then the strategy for objective A will be cross- referenced.

Goal 1: Conserve and enhance the land and water resources of HARB through a program of conservation management that is compatible with the military mission.

Present-day and future development of facilities to serve the military mission requires commitment to management of land and water resources of HARB. Applied conservation measures and best management practices are important aspects of good stewardship and effectively supporting ecosystems. Important land and water resource management issues at HARB include: 1) wetlands and drainage; 2) water quality and conservation; and 3) vegetation control and management.

To conserve and enhance the land and water resources of HARB while ensuring the continuation of the military mission, various programs need to be implemented to meet the following objectives.

Objective 1.1: Continue existing and establish new programs and procedures to monitor and maintain wetland functions and values and water quality.

Objective 1.2: Implement environmentally beneficial landscaping and grounds maintenance practices.

Objective 1.3: Evaluate land management practices to ensure the safety of the military mission.

Objective 1.4: Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to native communities.

Objective 1.5: Implement appropriate practices and procedures for reducing demand for water through water conservation measures.

Objective 1.1: Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values.

Executive Order (EO) 11990, Protection of Wetlands, 24 May 1997, directs all federal agencies, including the military, to avoid the destruction, loss, or degradation of wetlands whenever there is a practical alternative. The wetlands of HARB play an important role in storm water runoff infiltration, ground water recharge, and water quality improvement. The following management strategies have been developed to protect water quality and maintain wetland functions and values and to comply with EO 11990.

Strategy 1.1.1: Establish a wetland inventory and monitoring program to assess wetland functions and values over time.

Project: *Project No. 1: Updated Wetland Identification Report and Management Component Plan.*

- Initiatives:**
- (1) Update the baseline jurisdictional wetland delineation performed as part of the 2004 INRMP (see Volume II, Appendix D) every five years in conjunction with INRMP revisions, or for any project where wetlands are proposed to be affected.
 - (2) In place of using WRAP (developed by the SFWMD and which was used for the 2004 INRMP), the recently developed Florida Unified Wetland Delineation Methodology (Chapter 62-340 FAC) should be used to perform updates to the 2004 baseline wetland functional assessment (see Volume II, Appendix D) every five years as part of INRMP revisions.

Strategy 1.1.2: Maintain the functions and values of the wetland system south of the airfield to provide storm water runoff filtration and retention, ground water recharge, and other water quality and/or water supply benefits.

Project: None.

- Initiatives:**
- (1) Periodically remove accumulated debris and sediments from outfall culverts to enhance circulation and settling properties.
 - (2) Cross-Reference:
 - Section 2 - Milcon Project KYJM019020 - Repair Flood Control System Building 875.
 - Section 2 - Milcon Project KYJM019023 - Clear Vegetation Boundary Canal.
 - (3) Monitor water quality in wetland areas to determine their ability to perform wetland functions (i.e., runoff filtration and retention, ground water recharge, and other water quality/water supply benefits).

Strategy 1.1.3: Establish wetland mitigation policy and procedures at HARB to offset wetland impacts associated with planned and/or proposed development activities.

Project: None.

- Initiatives:**
- 1) Using the results of the wetland assessment performed in preparation of the 2004 INRMP (Volume II, Appendix D), along with updated field surveys, develop a base-wide wetland mitigation policy and procedures to address planned or proposed development actions and the regulatory requirement to offset impacts.
 - 2) Periodically update the wetland mitigation policy and procedures based on new information and guidelines adopted by DoD, Air Force, and regulatory agencies.
 - 3) Cross Reference: Strategy 1.2.1.

Strategy 1.1.4: Continue ongoing compliance and restoration program actions contributing to water quality protection.

Project: None.

- Initiatives:**
- 1) Continue to implement and review annually (update as needed) the SWPPP for HARB to reflect changes in BMPs; training, inspection, sampling, monitoring, and training protocol; and industrial activities.
 - 2) Continue ground water monitoring activities at IRP sites, as scheduled.

Objective 1.2: Evaluate land management practices to ensure the safety of the military mission.

Strategy 1.2.1: Evaluate the removal and/or modification of wetland areas within the infield and southeast of the runway to improve airfield drainage and support safe flight operations.

Project: *Project No. 2: Infield/Airfield Wetlands Removal Feasibility Study:* feasibility study to evaluate the potential removal/modification of wetlands in the infield and area adjacent to the runway. Focus of the study would be to evaluate the needs and opportunities for improved airfield drainage, including:

- Modification of wetlands contributing to runway flooding;
- Modification of wetlands adjacent to the runways for aircraft safety considerations and to support emergency vehicle access and operations;
- any potential changes to BASH conditions that may result from wetland modifications;
- The potential for any downstream drainage or water quality concerns that would have to be addressed for the above actions; and
- Environmental regulatory permit requirements of project implementation, including mitigation measures (Cross-Reference: Strategy 1.1.4 Wetland Mitigation).

Initiatives: Cross-Reference:

- Section 2 - MILCON Project KYJM019020 - Repair Flood Control System Building 875.
- Section 2 - MILCON Project KYJM019023 - Clear Vegetation, Boundary Canal.
- Strategy 1.1.2 Maintain the functions and values of the wetlands south of the airfield.

Strategy 1.2.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces in accordance with *Chapter 3, Unified Facilities Criteria 3-260-01, Airfield and Helicopter Planning and Design.*

Projects: None.

Initiative:

- 1) Following the implementation of ongoing base projects for removing trees contributing to the vegetation height obstructions within airfield clear zones, primary surface area, and transitional surfaces, implement a program of monitoring the clear zones in order to proactively address regeneration of vegetation and prevent these problems from occurring in the future.
- 2) Cross-Reference: Strategy 1.4.1 – Update the Invasive and Exotic Species Management Plan.

Objective 1.3: Implement environmentally sound landscaping and grounds maintenance practices.

EO 13148, Green the Government through Leadership in Environmental Management, 22 April 2002, promotes sustainability in management of federal facility lands through implementation of environmentally sound landscaping practices and programs. AFI 32-7064, Chapter 11 directs installations to make maximum use of regionally native plants, avoid invasive and exotic species, reduce chemical use, minimize effects on natural habitats, and reduce maintenance. By using native species and xeriscaping concepts, HARB will support EO 13148 and AFI 32-7064.

The following strategy is developed to accomplish Objective 1.3.

Strategy 1.3.1: Prepare and implement a landscape management plan using the principle of xeriscaping, including the use of native species in the design of the plan.

Project: *Project No.3: Landscape Management Plan.*

- Initiatives:**
- 1) Use the resources of AFCEE and HQ AFRC for technical support in the development of the plan.
 - 2) Identify the possible use of volunteer groups and/or interested installation personnel to assist in plan implementation. Cross-Reference: Strategy 3.2.1 Awareness and stewardship.
 - 3) Integrate the concept of xeriscaping into the grounds maintenance contract and promote worker awareness of the benefits of xeriscaping.
 - 4) Ensure that BASH issues are considered in the plan. Consider using xeriscaping for replacement landscaping and for restoration initiatives.

Objective 1.4: Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities.

Efforts for accomplishing this objective will serve to minimize any further deterioration of native plant communities and wildlife habitats on HARB; reduce accumulation of fire fuel loads that could otherwise burn and cause interruption of airfield operations; and, enhance visibility for security of the Base perimeter. These efforts will also be consistent with the intent of Section 2 of *EO 13112, Invasive Species, February 3, 1999*, that requires (within budget limitation) the implementation of programs and authorities for the prevention, detection, and monitoring of invasive species as well as restoration of invaded habitats.

Strategy 1.4.1: Prepare an Updated Invasive and Exotic Species Management Plan (IESMP) consistent with the direction and intent of Section 2 of EO 13112. The IESMP will consist, at a minimum, of nine component plans. The component plans will be coordinated and integrated with the projects identified in the INRMP, and discussed below:

Project: *Project No. 4: Updated IESMP.*

- (1) The Twin Lakes and Wetland Fringe area.
 - Primary invasive exotic plants of concern in this area are the Australian pine and Brazilian pepper.
 - Cross-Reference: Project No. 7 (Strategy 2.3.1).
- (2) The Grenade Range.
 - Primary invasive exotic plants of concern in this area are the thickets of Burma reed and Napier grass.
- (3) Remnant Pine Rockland.
 - Primary invasive exotic plants of concern in this area are the thickets of Burma reed and Napier grass.
 - Cross-Reference: Project No. 5 (Strategy 2.1.1).
- (4) Phantom Lake and Old Grenade Range area.
 - Primary invasive exotic plants of concern in this area are the thickets of Australian pine, Burma reed and Napier grass.
 - Cross-Reference: Project No. 6 (Strategy 2.2.1).
- (5) IRP Operable Unit 2.
 - Primary invasive exotic plants of concern in this area are the thickets of Burma reed, Napier grass, and Brazilian pepper.
- (6) Wetland Marsh area.
 - Primary invasive exotic plants of concern in this area are the thickets of Brazilian pepper and stands of Australian pine.

(7) Southeast Triangle.

- Primary invasive exotic plants of concern in this area are the thickets of Burma reed and Napier grass.

(8) Base perimeter.

- Primary invasive exotic plants of concern in this area are the thickets of Burma reed and Napier grass.

Initiatives:

Consider working with the DoD Legacy Program for ridding base of exotic vegetation.

Objective 1.5: Implement appropriate practices and procedures for reducing demand for water through water conservation measures.

EO 12902, Energy Efficiency and Water Conservation at Federal Facilities, 8 March 1994, requires all federal agencies to assess and, where cost-effective, implement measures to improve the efficiency of federal water use. Efforts for accomplishing this objective will be in accordance with EO 12902.

Strategy 1.5.1: Evaluate potential water conservation measures for HARB related to supply and demand conservation, landscaping, and education and training.

Project: None.

Initiatives:

- 1) Consider consultation with AFCEE, HQ AFRC, and the SFWMD.
- 2) Cross-Reference: Strategy 1.3.1 – Xeriscaping.

Goal 2: Improve and maintain the quality of native vegetation communities and threatened and endangered (T/E) species habitats while supporting the military mission.

Near and within the boundaries of HARB, few of the native natural communities including T/E plant and animal species occur today. In addition, nuisance wildlife species have increased in population and/or have concentrated in areas where they are now a serious threat to T/E species populations, human health, and/or the military mission. Regional ecosystem management initiatives for south Miami-Dade County are designed to protect, maintain, and restore the natural communities for plant and animal life. Efforts for achieving this goal will contribute to a more diversified native plant and animal population at HARB and to the overall restoration efforts for south Miami-Dade County.

Objective 2.1: Enhance and protect the remnant Pine Rockland to support native plant communities and associated wildlife, including T/E species habitat.

Objective 2.2: Enhance and maintain the natural communities surrounding Phantom Lake to support native fish and wildlife species.

Objective 2.3: Enhance and maintain the natural communities surrounding Twin Lakes to support native fish and wildlife species.

Objective 2.4: Protect and maintain known and potential burrowing owl habitat.

Objective 2.5: Enhance and maintain the Grenade Range and Reserves Areas to support wildlife species in a manner that is compatible with the military mission.

Objective 2.6: Enhance and conserve the diversity of the native fish community within the Boundary Canal.

Objective 2.7: Conserve and protect the habitats for federal- and state-listed T/E species, and species of concern.

Objective 2.8: Institute controls for nuisance wildlife that may adversely affect the health of the ecosystem and/or military mission.

Objective 2.1: Enhance and protect the remnant Pine Rockland to support native plant communities and associated wildlife, including T/E species habitat.

Strategy 2.1.1: Develop a Pine Rockland Restoration and Management Plan.

Project: *Project No. 5: Pine Rockland Restoration and Management Plan. Include an invasive and exotic species removal component plan. Cross-Reference: Project No. 4 – Updated IESMP (Strategy 1.4.1[3]).*

- Initiatives:**
- 1) Explore potential partnership opportunities with other entities involved in the restoration of remnant Pine Rockland ecosystems in South Florida.
 - 2) Promote stewardship of the native ecosystems within the Base among the HARB community. Cross-Reference: Strategy 3.2.1 Awareness and stewardship.
 - 3) Consider consultation with AFCEE, HQ AFRC, and the Miami-Dade County Department of Environmental Resource Management (DERM) for plan development.
 - 4) Evaluate the compatibility of restoration efforts with the BASH reduction objectives.

Objective 2.2: Enhance and maintain the natural communities surrounding Phantom Lake Area to support native fish and wildlife species

Strategy 2.2.1: Evaluate the focus for native habitat restoration in the Phantom Lake area. Major issues to be addressed include roadway access into the site, safety restrictions of the ESCZ arcs, BASH demands and capital improvement and O & M funding priorities.

Project: *Project No. 6: Phantom Lake and Old Grenade Range Improvements and Constraints Evaluation. Cross-Reference: Project No. 4- Updated IESMP (Strategy 1.4.1[4]).*

Initiatives:

- 1) Promote stewardship of the natural communities and develop support within the HARB community for the restoration of the Phantom Lake area. Cross-Reference: Strategy 3.2.1 Awareness and stewardship.
- 2) Evaluate the compatibility of restoration efforts with the BASH reduction objectives.

Objective 2.3: Enhance and maintain the natural communities surrounding Twin Lakes to support native fish and wildlife species.

Strategy 2.3.1: Evaluate limitations and constraints for habitat enhancement in the Twin Lakes and Wetland Fringe area. Factors to address include access, security and safety aspects; the airfield storm water drainage system function and performance; the airfield primary and transitional zone clearance requirements; and BASH plan objectives for reducing potential for bird strikes.

Project: *Project No. 7: Twin Lakes Feasibility Study.* Cross-Reference: Project No. 4: Updated IESMP (Strategy 1.4.1 [1]).

- Initiatives:**
- 1) Promote stewardship of the natural communities and develop support within the HARB community for the restoration of the Twin Lakes and Wetland Fringe area. Cross-Reference: Strategy 3.2.1 Awareness and stewardship.
 - 2) Evaluate the compatibility of restoration efforts with the BASH reduction objectives.
 - 3) Cross-Reference:
 - Strategy 1.1.2 Maintain functions and values of wetlands south of the airfield.

Objective 2.4: Protect and maintain known and potential burrowing owl habitat

Strategy 2.4.1 Continue to protect owl burrows from harassment and/or disturbances by people.

Project: None.

Initiatives:

- 1) During the nesting season, burrows would be flagged (with signs) and/or mapped to highlight areas where buffer distances for activity are required.
- 2) Promote stewardship for the conservation of burrowing owls by distributing information on this species to HARB personnel that may work in or near these protected areas.
- 3) Conduct qualitative surveys of active burrows during nesting season, as funds are available.

Objective 2.5: Enhance and maintain the Grenade Range and Reserves Areas to support wildlife species in a manner that is compatible with the military mission.

Strategy 2.5.1: Evaluate the feasibility of enhancing the natural functions of these areas through the removal of invasive and exotic plant species.

Project: Cross-Reference: Project No. 4: Updated IESMP (Strategy 1.4.1 [2]).

- Initiatives:**
- 1) Ensure the continuation of ongoing training activities in the area.
 - 2) Evaluate the compatibility of restoration efforts with the BASH reduction objectives.

Objective 2.6: Enhance and conserve the diversity of the native fish community within the Boundary Canal.

Strategy 2.6.1: Evaluate the populations and distribution of exotic fish species versus and native fish species within the Boundary Canal system to promote the existence and diversity of native fish communities at HARB. Efforts for accomplishing this objective will be consistent with the community's regional plans and programs.

Project: *Project No. 8: Boundary Canal System Fish Population Study.*

- Initiatives:**
- 1) Promote awareness of the problems associated with exotic aquatic species within the Boundary Canal among the HARB community. Cross-Reference: Strategy 3.2.1 Awareness and stewardship.
 - 2) Cross-Reference:
 - Section 2 - MILCON Project KYJM019020 - Repair Flood Control System Building 875.
 - Section 2 - MILCON Project KYJM019023 - Clear Vegetation, Boundary Canal.

Objective 2.7: Conserve and protect the habitats for federal and state listed T/E species, and species of concern.

Strategy 2.7.1: Maintain and protect natural communities supporting populations of endangered plant and animal species.

Project: None.

- Initiatives:**
- 1) Maintain maps of natural features that occur within the Base (e.g., wetlands, surface water bodies, natural communities, etc.) The maps will be used to:
 - Increase the awareness of HARB personnel toward the location and importance of natural features and T/E species that are present on the installation.
 - Provide information to installation personnel on conservation measures that can be implemented to avoid adverse impacts to protected species and their habitats.
 - Identify baseline conditions for comparison purposes in order to monitor HARB efforts for providing conservation management of habitats for protected species and for preparation of endangered species management plan(s).
 - 2) For any newly identified federally listed plant and animal species on HARB, coordinate with AFCEE and HQ AFRC to evaluate the need for modifications or initiation of habitat conservation plans.
 - 3) Evaluate the compatibility of restoration efforts with the BASH reduction objectives.

Strategy 2.7.2: At a minimum, conduct reconnaissance surveys to update information regarding the presence of listed T/E species and their habitats every five years, and concurrent with efforts to revise the INRMP, if possible.

Projects: None.

- Initiatives:**
- 1) Review any new information from resources agencies, when available, regarding the status for T/E species in the region. Determine whether special requirements for T/E species surveys are required or changes in survey frequency are warranted.
 - 2) Routinely review the BASH-potential database maintained at HARB for occurrences of any listed species of concern.

Strategy 2.7.3: Maintain American alligator habitat at HARB in a manner that is compatible with the military mission.

Project: Cross-Reference: Project No. 9: Base Caiman Removal/Control Feasibility Study.

Initiatives:

- 1) Implement initiatives to minimize and control invasive and exotic plants species as well as the competing exotic caimans within the habitats that are required for alligator populations.
- 2) Cross-Reference:
 - Strategy 2.8.1: Eliminate or minimize presence of nuisance animals.
 - Section 2 - MILCON Project KYJM019023 - Clear Vegetation, Boundary Canal.
 - Section 2 -MILCON Project KYJM019020 - Repair Flood Control System Building 875.

Objective 2.8: Control nuisance wildlife populations that may adversely affect human health, welfare and/or the military mission.

Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.

Project: *Project No. 9: Base Caiman Removal/Control Feasibility Study.*

- Initiatives:**
- 1) Determine the population density and distribution of the caiman within the Base. Evaluate the potential airfield hazard posed by caiman activity. Identify potential sources of introduction (access points into HARB) from adjacent properties.
 - 2) As a BASH reduction measure, consider the reduction or elimination of nuisance wildlife attractants (e.g., fruit bearing trees) to reduce the incidence of exotic parrot flocks and iguanas frequenting the Base.
 - 3) Eliminate fire ant colonies, rodents, and other pests on the grounds of the Base through continued implementation of the Integrated Pest Management Program.

Goal 3: Promote stewardship values for natural resources quality and diversity at HARB by fostering knowledge and awareness and encouraging active participation in natural resources conservation.

Management of a sustainable conservation program requires knowledge, awareness, education, training, and responsible participation of all individuals potentially effecting, or affected by the natural system. In addition, adjustments must be made to management practices in response to new knowledge and/or changing conditions. In working toward accomplishing the following objectives, HARB will continue to build upon efforts for achieving a sustainable conservation program.

- Objective 3.1: Incorporate the concept of ecosystem management into all planning and management processes.**
- Objective 3.2: Implement training programs for effective natural resources conservation, measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives.**
- Objective 3.3: Ensure that ongoing and future land use activities at HARB are compatible to the greatest extent possible with the conservation of natural resources.**
- Objective 3.4: Coordinate with government agencies and non-government organizations engaged in the implementation of region-wide plans for ecosystems restoration and natural resources management in South Miami-Dade County.**

Objective 3.1: Incorporate the concept of ecosystem management into all planning and management processes.

Strategy 3.1.1: Integrate ecosystem management concepts of the INRMP into all working programs, department plans (i.e., SWPPP, Grounds Maintenance, BASH, IPMP, IRP, etc.), and day-to-day management practices at HARB.

Project: Cross-Reference: Project No. 10: Develop an ecosystem management training/education program (Strategy 3.2.1).

- Initiatives:**
- 1) Determine implementation mechanism for the INRMP.
 - 2) Develop a working team at HARB to integrate the concepts in the INRMP in to existing plans and programs at the installation. The team will consist of a representative from each department that is tasked with the responsibility of implementing the key programs, plans, or policies for integration with INRMP objectives.
 - 3) Continue the work of the HARB ESOHC in accordance with AFI 90-801.
 - 4) Use the ESOHC and the Base's EMS to establish a training program to implement ecosystem management principles in all planning and management processes.

Objective 3.2: Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives.

Strategy 3.2.1: Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.

Project: *Project No. 10: Develop an ecosystem management training/education program.*

- Initiatives:**
- 1) For program development support, enlist the services of the HARB ESOHC, AFCEE, and HQ AFRC.
 - 2) Encourage participation of installation personnel by providing information about HARB's natural resources and providing motivation through communication of important contributions and success stories. Use pamphlets, flyers, command units, and the internet to disseminate information to installation personnel and visiting commands. Initiate an annual environmental awareness achievement award for contributions such as project suggestions, proactive participation, ingenuity, and cost savings.
 - 3) Identify projects or use public events (e.g., Earth Day) to offer hands-on training and individual participation in activities to better demonstrate the concept, application, and importance of conservation and ecosystem management.
 - 4) Encourage participants in the technical education and training program to conduct orientation, training and/or education classes for tenant commands and departments.

Strategy 3.2.2: Within the limitations of the mission and installation security requirements, implement programs and initiatives that provide continuity with the surrounding community's efforts in education and stewardship for natural resources restoration, conservation, and ecosystem management.

Projects: None.

- Initiatives:**
- 1) Support and play a participatory role in region-wide and local initiatives of restoration, conservation, and ecosystems management.

Objective 3.3: Ensure that ongoing and future land use activities at HARB are compatible to the greatest extent possible with the conservation of natural resources.

Strategy 3.3.1: Develop basic environmental review criteria for the siting and managing of any proposed new facilities and training activities and basic guidelines for consideration of INRMP goals and objectives as part of any proposed new land uses on the installation.

Project: Cross-Reference: Project No. 10: Develop and ecosystem management training/education program (Strategy 3.2.1).

- Initiatives:**
- 1) Use the knowledge and expertise of the HARB ESOHC to develop the criteria. Criteria should focus on the following topics: preference for reuse of previously disturbed areas; intensity of site disturbance for building footprints; flood-prone areas; alternatives to the use of impervious surfaces; T/E species habitat requirements; ongoing ecological restoration projects; and BASH concerns.
 - 2) Determine the need for compliance with Florida Coastal Zone Management Program as required by AFI 32-7064, Chapter 5.

Objective 3.4: Coordinate with government agencies and non-government organizations engaged in the implementation of region-wide plans, programs, and projects for ecosystems restoration and natural resources management in South Miami-Dade County.

Strategy 3.4.1: Evaluate South Miami-Dade County ecosystem management initiatives being undertaken by other government and non-government entities, and identify and evaluate opportunities for appropriate participation by HARB.

Project: None.

- Initiatives:**
- 1) Identify programs that may be applicable to HARB, especially in terms of potential partnership initiatives to promote stewardship plans, foster conservation awareness, and provide or receive technical assistance.
 - 2) Monitor changes to and actions completed for ecosystem management initiatives undertaken by the government and non-government entities. Modify HARB's role and participation in programs as necessary.

4.2 Monitoring

Monitoring and evaluation are at the heart of adaptive management and serve as a check mechanism for the implementation of the INRMP. Although the INRMP establishes direction for the next five years, it may require more time to achieve some of the goals, objectives, and projects. Monitoring will determine whether:

- Projects are implemented in compliance with the INRMP, AFI, and DoD requirements;
- Goals and objectives are met;
- Assumptions, relationships, and decisions are valid considering new information or changing conditions; and
- Two types of monitoring are pertinent to this INRMP: implementation and effectiveness.

Implementation Monitoring

Implementation monitoring responds to the question, “Did we do what we said that we would do?” It is the most basic level of monitoring. This level of monitoring determines whether or not projects and activities are designed and conducted in compliance with the INRMP and other direction. The monitoring questions in Table 4-1 address the goals and objectives for the next five years.

Effectiveness Monitoring

Effectiveness monitoring answers the question “Did we accomplish our goals and objectives and are we moving toward the desired future conditions?” Once we have done what we said that we would do, effectiveness monitoring indicates whether or not we are on the right track to achieving the goals. The items to measure are taken from the initiatives and strategies identified under each goal. These measurements ensure the implementation of the goals and objectives. Table 4-1 also provides an estimated time to complete these initiatives.

Table 4-1

HARB 2009 INRMP Monitoring Program

Objective	Monitoring Question (Strategy; Project)	Item to Measure (Initiative)	Completion Time	Objective Achieved?	Date or % Success Completed; Comments
1.1 Protect water quality	Are compliance and restoration program actions continuing? (1.1.4)	<ul style="list-style-type: none"> ▪ SWPPP Reviewed and Updated ▪ Ground water monitoring at IRP sites. 	<ul style="list-style-type: none"> ▪ Annual review. Update, as needed. ▪ Complete as scheduled. 		
1.1 Wetland functions and values	Has a wetland inventory and monitoring program been implemented? (1.1.1; Project #1)	Update wetlands delineation.	Conduct during planning of any project impacting wetlands or at a minimum every 5 years.		
1.1 Wetland functions and values	Have the quality of wetlands been assessed? (1.1.1)	Complete wetland functional assessment	Every 5 years.		
1.1 Wetland functions and values	Are wetlands being maintained? (1.1.2; Project #1)	Debris removed from outfall canals	Every 2 years or immediately following major storm events.		
1.1 Wetland functions and values	Have base-wide wetland mitigation policies/procedures been established? (1.1.3)	Wetland Mitigation Policies and Procedures approved and implemented.	Establish within 2 years and then updated when new information or guidelines are received.		
1.2 Wetland removal and/or modification	Has evaluation of the potential for wetland removal/modification been completed?	Complete the wetlands removal feasibility study.	1 year.		
1.2 Vegetation encroachment	Have the areas and implementation actions for removal of encroaching vegetation been completed?	Complete the assessment of encroaching vegetation.	1 year.		
1.3 Grounds Maintenance	Has a landscape management plan been developed? (1.3.1; Project #3)	Plan completed and implemented.	1 year.		
1.3 Land Management Practices	Can airfield drainage be improved? (1.2.1; Project #2)	Feasibility study completed.	2 years.		
1.3 Land Management Practices	Has airfield clear zone vegetation been removed to enhance safety? (1.2.2)	Areas identified and actions implemented to remove encroaching vegetation in airfield clear zones.	1 year.		
1.4 Invasive and Exotic Control	Has an Updated Invasive and Exotic Species Management Plan been completed? (1.4.1; Project #4)	Updated IESMP completed and implemented.	1 year.		

Table 4-1

HARB 2009 INRMP Monitoring Program

Objective	Monitoring Question (Strategy; Project)	Item to Measure (Initiative)	Completion Time	Objective Achieved?	Date or % Success Completed; Comments
1.5 Water Conservation	Are appropriate actions occurring to conserve water? (1.5.1)	Evaluate landscaping practices, and education and training procedures.	Annual review. Implement, as appropriate.		
2.1 Pine rockland	Has the Pine Rockland Restoration and Management Plan been completed? (2.1.1; Project #5)	Updated Plan completed and initiatives implemented.	2 years.		
2.2 Phantom Lake Area	Have improvements to Phantom Lake been evaluated? (2.2.1; Project #6)	Improvements and Constraints evaluation completed	3 year.		
2.3 Twin Lakes	Has the feasibility for the enhancement of the natural environment at the Twin Lakes been completed? (2.3.1; Project #7)	Feasibility study completed.	3 years.		
2.4 Burrowing Owls	Are burrowing owls protected? (2.4.1)	Implement protection measures and survey active burrows.	<ul style="list-style-type: none"> ▪ Protection measures implemented within 1 year. ▪ Active burrows surveyed each nesting season. 		
2.5 Grenade Range and Reserves Area	Have natural functions been improved at the Grenade Range and Reserves Area? (2.5.1)	Removal of invasive and exotic species.	Conduct in conjunction with Project #4.		
2.6 Boundary Canal	Has the study to enhance the diversity of native fish in the Boundary Canal been completed? (2.6.1; Project #8)	Feasibility study completed.	3 years.		
2.7 Conserve and Protect Habitat	Are natural communities on HARB supporting protected species? (2.7.1 and 2.7.2)	<ul style="list-style-type: none"> ▪ Natural communities and protected species mapped. ▪ If new federally listed species identified, coordinate with AFCEE and AFRC HQ. 	<ul style="list-style-type: none"> ▪ Mapping completed within 3 years. ▪ Reconnaissance surveys conducted every 5 years. 		
2.7 Conserve and Protect Habitat	Has the habitat for American alligator been improved? (2.7.3)	Initiatives implemented to control invasive, exotic plants and animals.	Conduct in conjunction with Projects #4 and 9.		

Table 4-1

HARB 2009 INRMP Monitoring Program

Objective	Monitoring Question (Strategy; Project)	Item to Measure (Initiative)	Completion Time	Objective Achieved?	Date or % Success Completed; Comments
2.8 Control Nuisance Wildlife	Has feasibility study been completed regarding removal or control of exotic caiman? (2.8.1; Project #9)	Feasibility study completed.	3 years.		
3.1 and 3.2 Ecosystem Management	Have the concepts of ecosystem management been implemented in all programs, plans, and practices? (3.1.1 and 3.2.2)	<ul style="list-style-type: none"> ▪ Implementation mechanism established ▪ Working team developed. ▪ Programs implemented that support regional and local conservation initiatives. 	<ul style="list-style-type: none"> ▪ 1-2 years. ▪ 1 year. ▪ Conduct in conjunction with Project #10. 		
3.2 Ecosystem Management	Are HARB personnel trained in environmental and conservation stewardship practices? (3.2.1; Project # 10).	Ecosystem Management Training and Education program developed.	2 years.		
3.3 Ecosystem Management	Are land use activities compatible with conservation of natural resources? (3.3.1)	Environmental Review Siting criteria and development guidelines completed.	2 year.		
3.4 Ecosystem Management	Has HARB developed partnership initiatives to enhance stewardship actions? (3.4.1)	Evaluate opportunities to participate in Miami-Dade conservation initiatives.	2 year.		

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For planning purposes, HARB can be divided into fourteen land management units (see Figure 2-2). These separate areas have been identified because of the land uses and activities within each for supporting the military mission, the interrelationships of land use/cover conditions with requirements of the military mission, and/or the opportunities afforded on these lands for natural resources management. Subsections 5.1 through 5.14 discuss the natural resources management focus for each area, including any specific actions that have been identified for accomplishing INRMP goals and objectives. Subsection 5.15 provides direction for management actions that are programmatic and applicable base-wide.

5.1 Boundary Canal System

Natural Resources and Operational Features

The Boundary Canal (approximately 40,400 feet [7.8 miles]) is divided into two major segments: the W-S segment (approximately 25,000 feet [4.9 miles]) and the N-E segment (approximately 15,400 feet [2.9 miles]; see Figures 2-2 and 5-1). The canal delineates most of the east, south, and west boundaries of the Base and conveys most of the storm water runoff from the Base to the reservoir southeast of the runway. Within the canal and along the banks, invasive exotic plant species, as well as native species, are present (see Table 3-6). The reservoir is approximately 300 feet wide and 900 feet long; typical depths are estimated to range between 10 to 20 feet. Part of the reservoir was included in the remediation of OU-11/Military Canal (Outfall Canal). Water quality monitoring studies performed on the reservoir/canal system indicate that runoff discharging from HARB is of excellent water quality and generally meets Florida Class III surface water quality standards (see Section 3.4). Both native and invasive exotic fish, amphibians, and reptiles occur in the canal and reservoir (see Section 3.12).

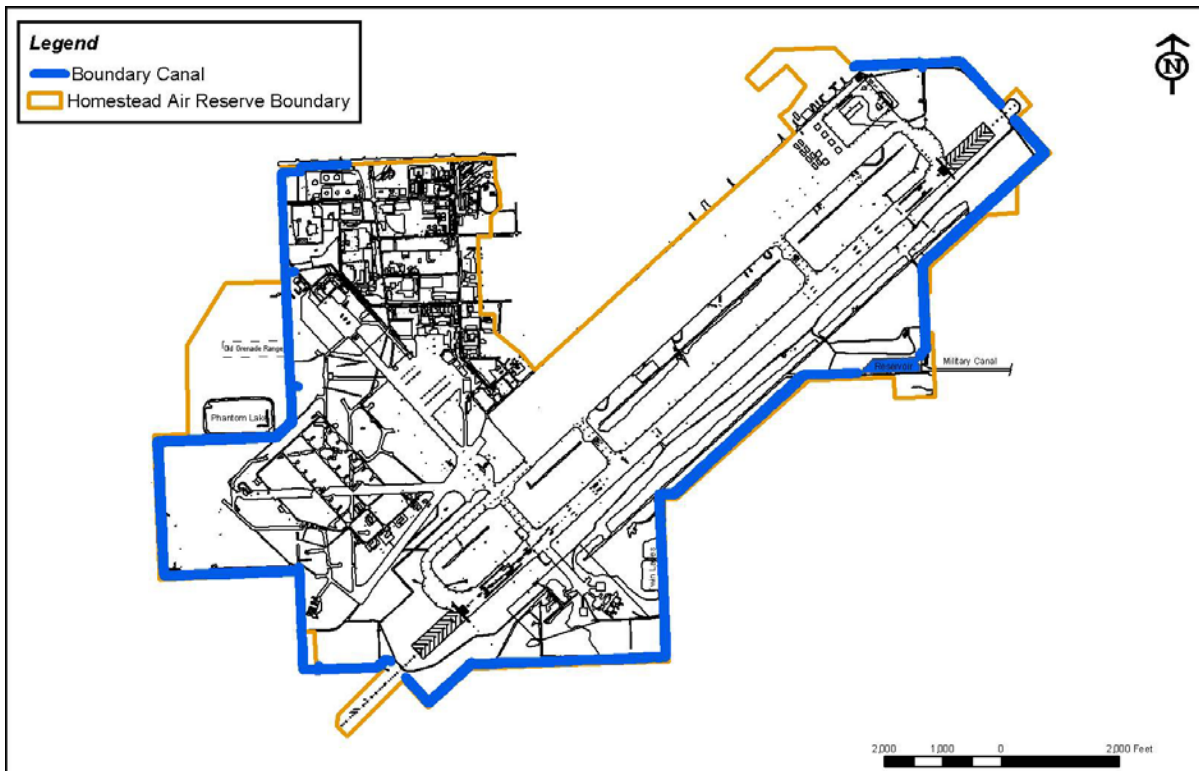


Figure 5-1: Boundary Canal

Management Practices

The INRMP objectives for Boundary Canal, as well as the management strategies and projects specific to it, are summarized in Table 5-1. Management practices will focus on maintaining the water quality and flow of the canal and possibly eliminating or minimizing the presence of nuisance plant and animals species. HARB is in the process of completing MILCON project KYJM019023 (see Section 2.4) to mechanically remove debris and excess vegetation, within and along the banks of Boundary Canal south of the runway. Vegetation in the canal has become thick enough to impede the free flow of water to the storm water reservoir.

In 2003-2004 the USAF completed a canal and sediment control project at the reservoir. The project consisted of two main components:

- Construction of a sediment control structure within the reservoir in front of the pump station to allow suspended solids to settle prior to entering the pump intake structure. This greatly reduces the transport of potentially contaminated sediment into Military Canal.
- Encapsulation of Military Canal and portions of the Boundary Canal storm water reservoir to prevent potentially contaminated sediments from migrating to BNP.

At one time, HARB was interested in exploring the possibility of removing exotic fish species from the Boundary Canal to promote the existence and diversity of native fish communities at HARB. However, based on feedback and observations at Everglades National Park, it is apparent that the major exotic fish populations have become region-wide and are here to stay. Thus, Project No. 8, *Feasibility study for considering the removal of exotic fish species from the Boundary Canal system* would not be functional project. In 2004, the efforts for accomplishing this objective would have been consistent with the community's regional plans and programs.

Table 5-1	
Boundary Canal System	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.4	<p>Reduce and control populations of invasive exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities.</p> <p>Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Update IESMP</p>
Objective 2.6	<p>Enhance and conserve the diversity of the native fish community within the Boundary Canal.</p> <p>Strategy 2.6.1: Evaluate the populations and distribution of exotic fish species versus and native fish species within the Boundary Canal system to promote the existence and diversity of native fish communities at HARB. Efforts for accomplishing this objective will be consistent with the community's regional plans and programs.</p> <p><i>Project No. 8:</i> Boundary Canal System Fish Population Study.</p>
Objective 3.2	<p>Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives.</p> <p>Strategy 3.2.2: Within the limitations of the mission and installation security requirements, implement programs and initiatives that provide continuity with the surrounding community's efforts in education and stewardship for natural resources restoration, conservation, and ecosystem management.</p>
Objective 3.4	<p>Coordinate with government agencies and non-government organizations engaged in the implementation of region-wide plans, programs, and projects for ecosystems restoration and natural resources management in South Miami-Dade County.</p> <p>Strategy 3.4.1: Obtain information on South Miami-Dade County ecosystem management initiatives being undertaken by other government and non-government entities, and identify and evaluate opportunities for appropriate participation by HARB.</p>

5.2 Administrative and Industrial Support Area

Natural Resources and Operational Features

The Administrative and Industrial Support area (approximately 334.3 acres) is located north of the airfield (see Figures 2-2 and 5-2). This urban core of the Base consists of administrative and industrial support structures and regularly mowed and maintained grasslands. The area contains a number of small canals, but it is outside the FEMA-designated 100-year-flood prone area. The burrowing owl, a state-listed species, is known to have occurred in the mowed areas of the northwest portion of the site. Several state-listed plant species are present (see Table 3-6; also Section 3.11.4) as well as invasive exotic species (Section 3.11.5). ESCZ arcs cover the southwest portion of the site. The area contains seven IRP sites and two petroleum site (OU-2, OU-4, OU-5, OU-7, OU-12, OU-15, OU-19, and SS-02A and SS-15C; see Figure 3-4; also Table 3-5).

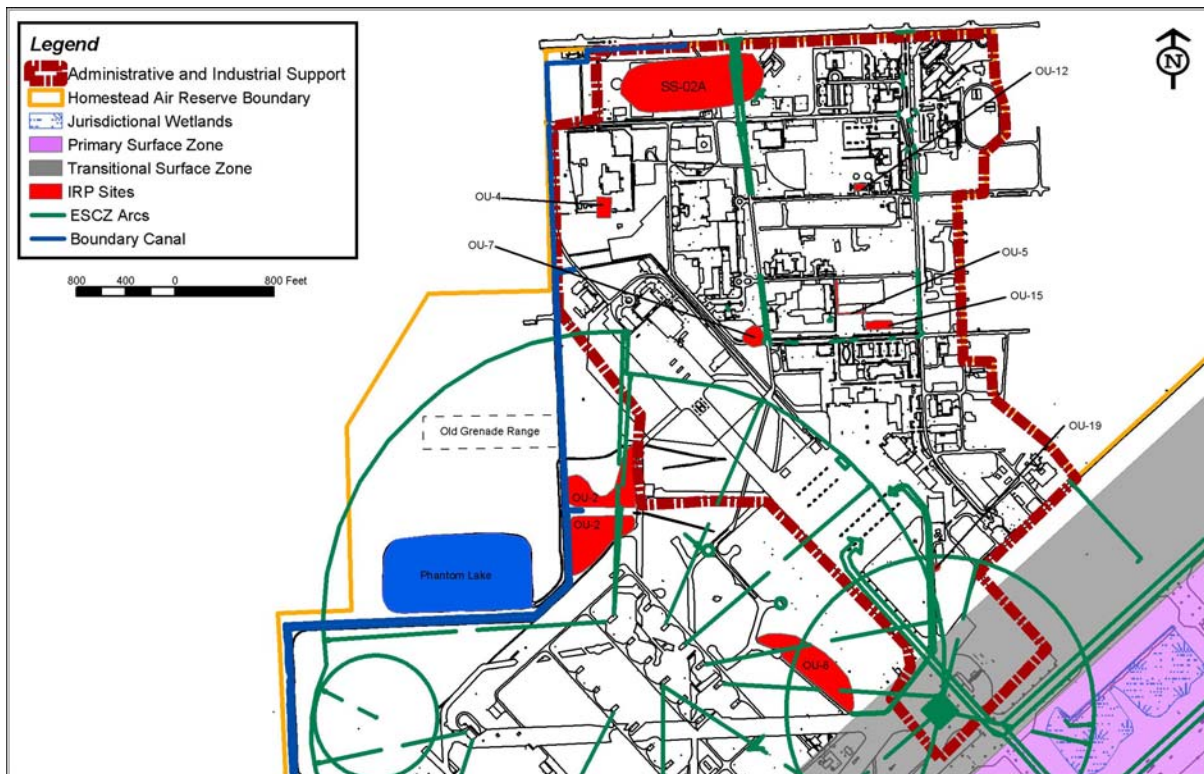


Figure 5-2: The Administrative and Industrial Support Area

Management Practices

The INRMP objectives for the Administrative and Industrial Support area, as well as management strategies and projects that are specific to it, are summarized in Table 5-2. Management practices for the Administrative and Industrial Support area will continue to include regular mowing and maintenance in accordance with safety requirements and the Grounds Maintenance SOW (see Volume II, Appendix E). HARB will continue to provide for the protection of the burrowing owl by providing protective buffers of rough grass around owl burrows. Periodic monitoring for evidence of burrowing owl presence will be conducted. Known or suspected burrows may be flagged and notifications posted. Individuals responsible for groundskeeping at HARB will be oriented in the identification of burrowing owls and their burrows, measures for avoidance, and procedures for reporting burrowing owl activity or any incidents of disturbance. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, Updated *Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1) and transitional zone clearance requirements. Management practices must also be compatible with the restoration objectives of the IRP and petroleum sites (OU-2, OU-4, OU-5, OU-7, OU-12, OU-15, OU-19, and SS-02A and SS-15C; see Figure 3-4 and Table 3-5).

Table 5-2	
Administrative and Industrial Support Area	
Natural Resource Management Objectives, Strategies and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.2	Implement environmentally beneficial landscaping and grounds maintenance practices. Strategy 1.2.1: Prepare and implement a landscape management plan using the principle of xeriscaping, including the use of native species in the design of the plan. <i>Project No. 3:</i> Landscape Management Plan
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.

Table 5-2	
Administrative and Industrial Support Area	
Natural Resource Management Objectives, Strategies and Projects	
Objective 1.4	Reduce and control populations of invasive exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities.
Objective 1.5	Implement appropriate practices and procedures for reducing demand for water through water conservation measures. Strategy 1.5.1: Evaluate potential water conservation measures for HARB related to supply and demand conservation, landscaping, and education and training.
Objective 2.4	Protect and maintain known and potential burrowing owl habitat. Strategy 2.4.1: Continue to protect owl burrows from harassment and/or disturbances by people.
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare and/or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.
Objective 3.1	Incorporate the concept of ecosystem management into all planning and management processes.

5.3 Airfield Area

Natural Resources and Operational Features

The Airfield area (approximately 945.3 acres) is the largest land area on the Base and includes the runway, taxiways, the infield, and aircraft operations and support facilities (see Figures 2-2 and 5-3). Approximately 50 acres of wetlands occur in the infield. Wetlands also occur southeast of the runway. Most of the vegetation on the site is mowed to a height of 7 to 12 inches (see Figure 3-7) to maintain airfield height restrictions and as a BASH reduction measure. The infield wetlands and the wetlands southeast of the runway function as part of the Base's overall drainage network and receive runoff from the runway and taxiway areas. Portions of the site lay within the FEMA-designated 100-year flood prone area. Wading and non-wading birds use the wetland areas for foraging and roosting (see Section 3.12).

Two ESCZ arcs encumber small portions of the site. Primary and transitional surface zones for the runway overlay the majority of the area. IRP sites OU-1 and OU-18 (see Figure 3-4; also

Table 3-5) occupy portions of the site. Resource management for BASH reduction, airfield drainage, and wetlands are primary issues for the area.

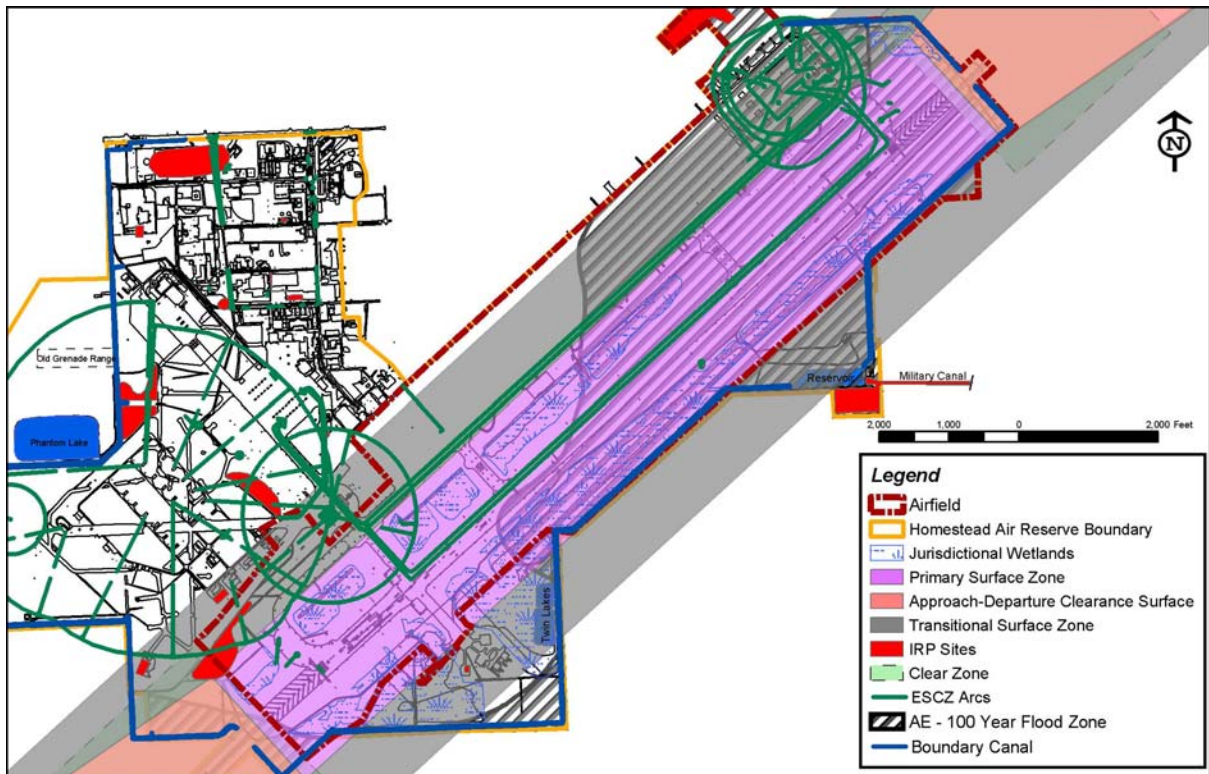


Figure 5-3: The Airfield Area

Management Practices

The INRMP objectives for the Airfield area, as well as management strategies and projects that are specific to it, are summarized in Table 5-3. Management practices for the Airfield area will continue to include regular mowing, maintaining, and monitoring vegetation in order to maintain compliance with airfield safety requirements (Unified Facilities Criteria 3-260-01, AFI 32-7063, BASH plan objectives). HARB will not manage the area for habitat improvements, but will periodically monitor the area for evidence of burrowing owl presence. Known or suspected burrows will be flagged and notifications posted. Individuals responsible for groundskeeping at HARB will be oriented in the identification of burrowing owls and their burrows, measures for avoidance, and procedures for reporting burrowing owl activity or any incidents of disturbance.

HARB is interested in exploring the potential removal/modification of infield wetlands and wetlands southeast of the runway for airfield safety. To explore the viability of this concept, HARB will request funding for Project 2, *Infield/Airfield Wetlands Removal Feasibility Study* (see Volume

II, Appendix A). The focus of the study is the removal/modification of wetlands for a reduction in bird activity in the vicinity of the airfield. It is likely that removal/modification of the infield wetlands to conditions offering less or no appeal as forage and cover would, to some degree, contribute to BASH reduction; however, the overall impact or cost of wetland removal/modification is not clear. Project 2 will be used to address issues that must be resolved before any final decision can be made. These issues include the effect wetland removal/modification would have on airfield drainage, including the management and displacement of surface water, infiltration reduction, and water quality impacts. Project 2 also will address the issues of wetland alteration for the stabilization of the primary surface of the runway for pilot and aircraft safety. Based on the results of the study, actions may be recommended for implementation, including future management practices.

Additional management practices for the Airfield area may include the eventual removal of invasive exotic species. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Invasive and Exotic Species Management Plan*. Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1) and airfield transitional zone clearance requirements. All management practice recommendations for the Airfield area also must be compatible with the restoration objectives for IRP site OU-1 and OU-18 (see Figure 3-4 and Table 3-5).

Table 5-3	
Airfield Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.2: Maintain the functions and values of the wetland system south of the airfield to provide storm water runoff filtration and retention, ground water recharge, and other water quality and/or water supply benefits. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.1: Evaluate the removal and/or modification of wetland areas within the infield and southeast of the runway to improve airfield drainage and support safe flight operations. <i>Project No. 2:</i> Feasibility study to evaluate the potential removal/modification of wetlands in the infield and area adjacent to the runway. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.

Table 5-3	
Airfield Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare an Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Updated IESMP
Objective 2.4	Protect and maintain known and potential burrowing owl habitat. Strategy 2.4.1: Continue to protect owl burrows from harassment and/or disturbances by people.
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare and or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.
Objective 3.2	Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives. Strategy 3.2.1: Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.

5.4 Grenade Range and Reserves Area

Natural Resources and Operational Features

The Grenade Range and Reserves Area (approximately 116.6 acres) is located south of the Phantom Lake area (see Figures 2-2 and 5-4) and the Boundary Canal runs along its western boundary. The area contains no surface water bodies or wetlands and is outside the FEMA-designated 100-year-flood prone area. It should be noted that the orientation and use of the grenade range area has changed considerable since the time the field work for the last INRMP was performed in 2004. The area was determined to not be conducive for enhanced habitat considerations.

The area is primarily undeveloped with a mixture of open grassland, small monotypic stands of Australian pines, and other invasive and exotic species. According to previous studies, several

state-listed plant species have been observed to be present in this area (see Table 3-6; also Section 3.11.4).

The majority of the area (approximately 90 acres) is located within the ESCZ arc associated with the adjacent Munitions area. The airfield transitional surface zone, as well as IRP site OU-27 (see Figure 3-4 and Table 3-5), occupies a portion of the area to the southeast. Reserves bivouac training is conducted in the area along the western boundary of the site, and a grenade practice range is in the north central portion of the site. ESCZ restrictions constrain the use of this land from most activities including recreation.

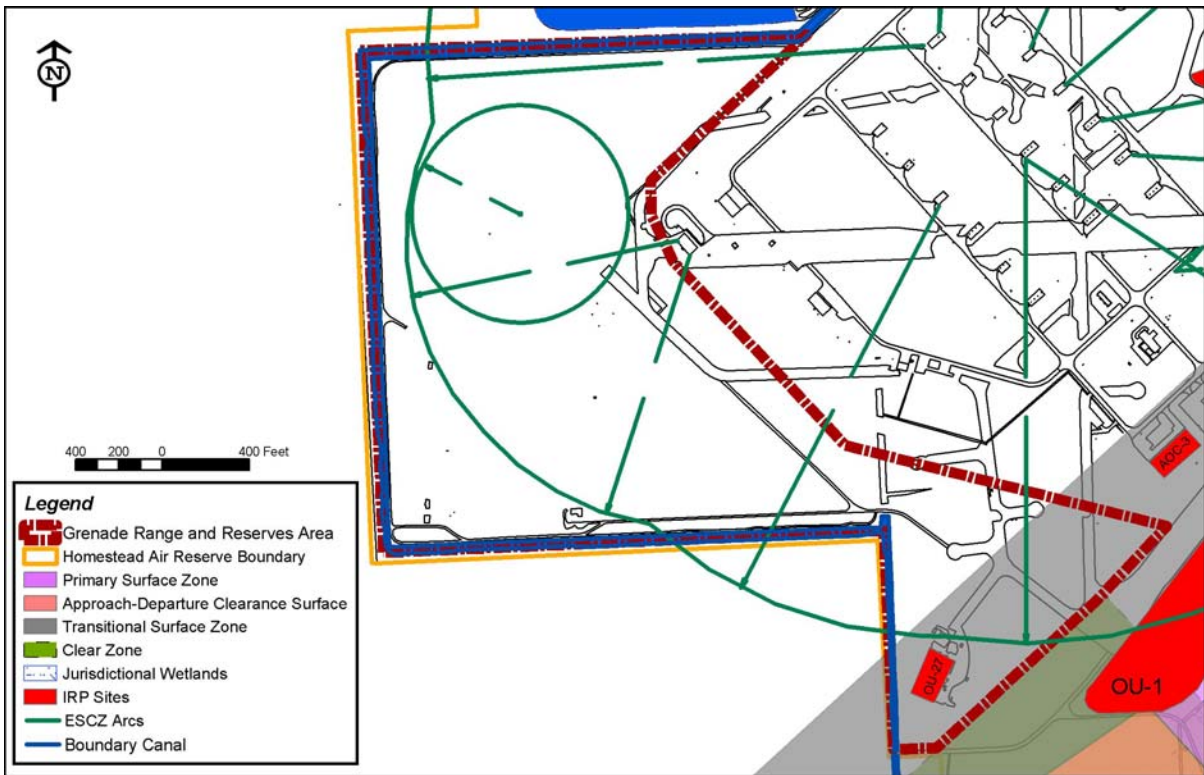


Figure 5-4: The Grenade Range and Reserves Area

Management Practices

The INRMP objectives for the Grenade Range and Reserves area, as well as management strategies and projects specific to the area, are summarized in Table 5-4. Management practices will focus on maintaining the area in accordance with current requirements for mission and safety considerations, such as mowing and cutting back vegetation for maintaining reserves training areas and the airfield transitional zone. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Updated Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). Future management

practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1) and transitional zone clearance requirements.

Table 5-4	
Grenade Range and Reserves Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Update IESMP
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species

5.5 Hush House Area

Natural Resources and Operational Features

The Hush House Area (approximately 30.6 acres) occupies the upland area located between the Twin Lakes and Wetland Fringe area and the Wetland Marsh area (see Figures 2-2 and 5-5). The Boundary Canal runs along the southern and eastern portions of the area. The improved portion of the site (northwestern section) contains a “hush house” used for reduction of noise from aircraft engine testing. Because of the proximity of these facilities to the airfield, the area is maintained by mowing vegetation to a height of 7 to 12 inches (see Figure 3-7) as a BASH reduction measure.

The remainder of the site is unimproved and dominated by invasive and exotic plants with some native herbaceous species (see Section 3.11; also Table 3-6). Approximately 12.7 acres of the

unimproved area are within the FEMA-designated 100-year flood prone area. Situated on a filled site, the area contains no surface water bodies or wetlands.

The airfield transitional surface zone covers approximately half the site. IRP site OU-25 (see Figure 3-4 and Table 3-5) is located entirely within this area. Given the proximity of the area to the airfield, management must conform to objectives for BASH reduction. Opportunities for enhancement of this area for habitat restoration or for recreational use are very limited because of the site's operational uses.

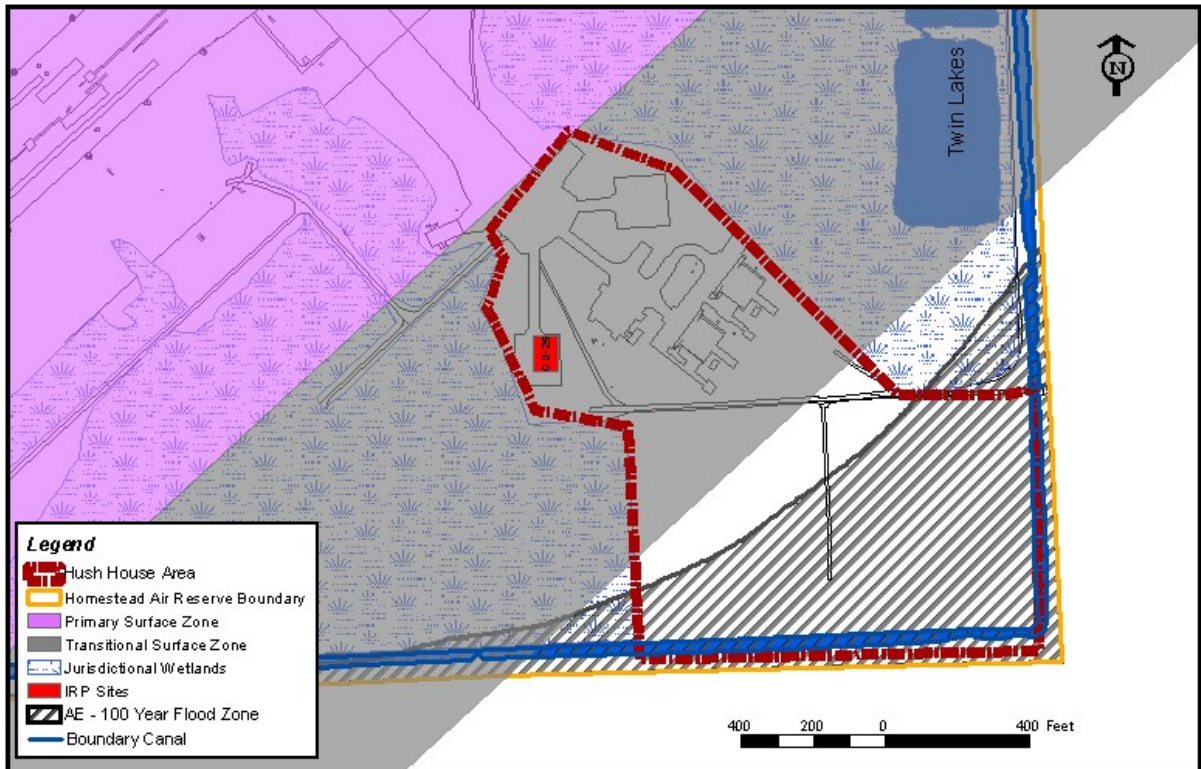


Figure 5-5: The Hush House Area

Management Practices

The INRMP objectives for the Hush House area, as well as management strategies and projects that are specific to the area, are summarized in Table 5-5. Management practices will focus on maintaining the area in accordance with current requirements for mission and safety considerations, such as mowing and cutting back of vegetation for maintaining the airfield transitional zone. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Updated Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). Future management practices for exotic species

must be compatible with BASH reduction objectives (see Section 2.4.1) and transitional zone clearance requirements.

Table 5-5	
Hush House Area	
Natural Resource Management Objectives, Strategies and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Update IESMP
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare, and or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.

5.6 Munitions Area

Natural Resources and Operational Features

The Munitions area (approximately 122.0 acres) is located on the western portion of the Base, east of the Grenade Range and Reserves area (see Figures 2-2 and 5-6). The Munitions area is a fence-line, secured area used for munitions storage and includes an open field of regularly mowed and maintained grasslands entirely within an ESCZ arc. Vegetation in this area is maintained at a height of 2 to 4 inches (see Figure 3-6) as a safety precaution. The area contains no surface water bodies or wetlands and is located outside the FEMA-designated 100-year flood prone area.

The burrowing owl, a state-listed species of concern, nests and forages in this area because of its preference for maintained grassland (see Section 3.12.3; also Volume II, Appendix F). Protected state-listed plant species also have been identified in this area (see Table 3-6; see Section 3.11.4). IRP site AOC-3 (see Figure 3-4 and Table 3-5) and the runway transitional surface zones occur over the south portion of the site. Security restrictions preclude activities such as recreation from this area.

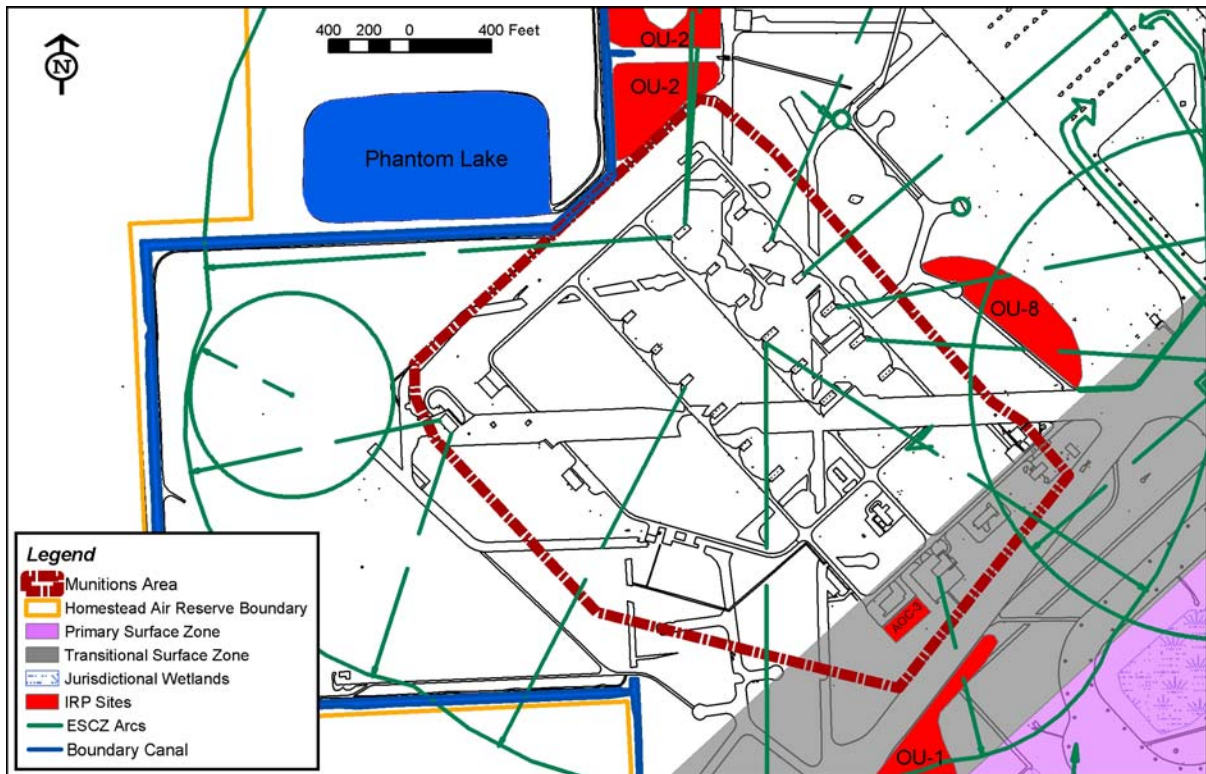


Figure 5-6: The Munitions Area

Management Practices

The INRMP objectives for the Munitions area, as well as management strategies and projects that are specific to this area, are summarized in Table 5-6. Management practices for the Munitions area will continue to include regular mowing in accordance with safety requirements. HARB will continue to provide for the protection of the burrowing owl by providing protective buffers of rough grass around owl burrows. Periodic monitoring for evidence of burrowing owl presence will be conducted. Known or suspected burrows may be flagged and notifications posted. Individuals responsible for groundskeeping at HARB will be oriented in the identification of burrowing owls and their burrows, measures for avoidance, and procedures for reporting burrowing owl activity or any incidents of disturbance. These measures should be considered for inclusion in the Grounds

Maintenance SOW (see Volume II, Appendix E). The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Update Invasive and Exotic Species Management Plan*. Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1) and transitional zone clearance requirements. Management practices also must be compatible with the restoration objectives of IRP site AOC-3 (see Figure 3-4 and Table 3-5).

Table 5-6	
Munitions Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 2.4	Protect and maintain known and potential Burrowing owl habitat. Strategy 2.4.1: Continue to protect owl burrows from harassment and/or disturbances by people.
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 3.2	Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives. Strategy 3.2.1: Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.

5.7 Northeast Grasslands

Natural Resources and Operational Features

The Northeast Grasslands area (approximately 50.5 acres) is bordered by the Munitions area to the southwest and the Administrative and Industrial Support area to the northeast (see Figures 2-2 and 5-7). This area includes open fields of regularly mowed and maintained grasslands entirely within the ESCZ arc of the Munitions area.

Several state-listed herbaceous plant species occur within the area (see Table 3-6 and Section 3.11.4). Vegetation is maintained at a height of 7 to 14 inches (see Figure 3-6) as a safety precaution. The area contains no surface water bodies or wetlands and is outside the FEMA-designated 100-year flood prone area. Burrowing owls, a state-listed species of concern, may nest and/or forage in this area based on its preference for similarly maintained grassland conditions at several other locations on the Base (see Table 3-7; also Volume II, Appendix G).

The airfield transitional surface zone covers a small portion of the area to the south. IRP site OU-8 (see Figure 3-4 and Table 3-5) is located in the south-central portion of the area. ESCZ restrictions preclude activities such as recreation from this area.

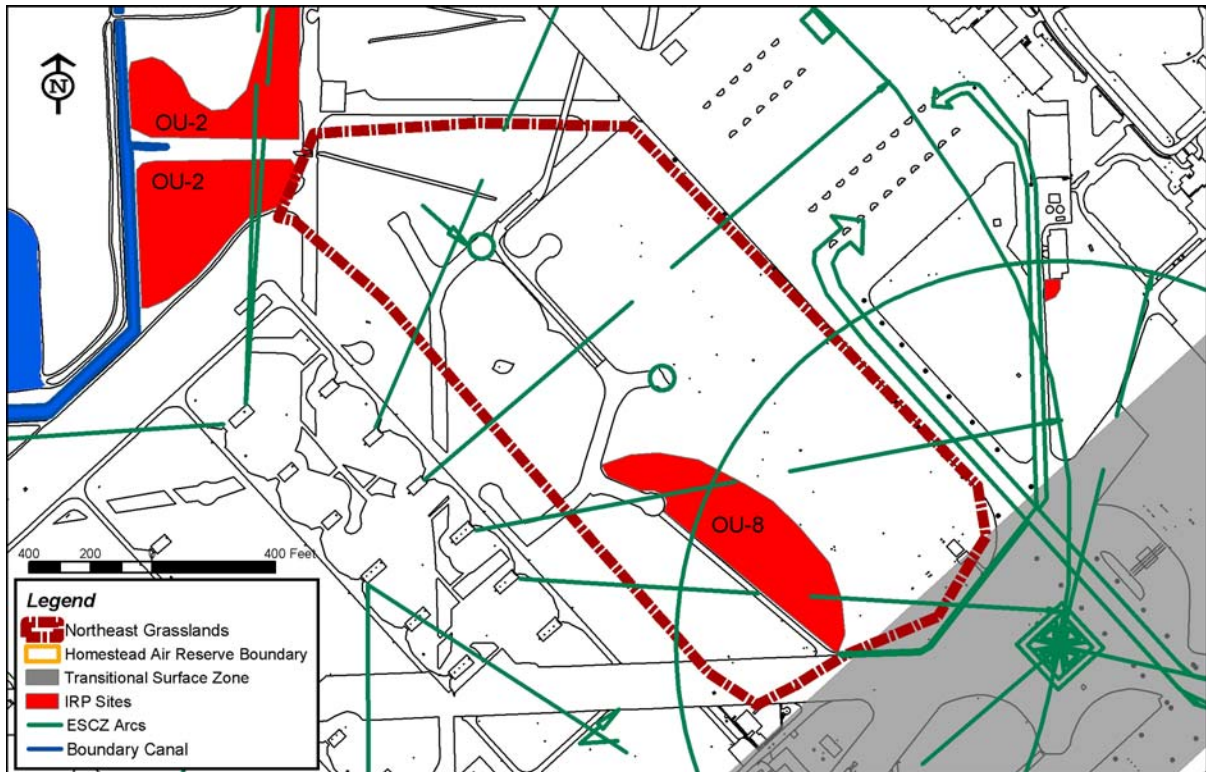


Figure 5-7: The Northeast Grasslands Area

Management Practices

The INRMP objectives for the Northeast Grasslands area, as well as management strategies and projects specific to the area, are summarized in Table 5-7. Management practices for the Northeast Grasslands area will continue to include regular mowing in accordance with safety requirements. Additional management practices may include the eventual removal of invasive exotic species. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Update Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1) and airfield transitional zone clearance requirements. The practices also must be compatible with the restoration objectives for IRP site OU-8 (see Figure 3-4 and Table 3-5).

HARB periodically will monitor the area for evidence of burrowing owl presence. Known or suspected burrows will be flagged and notifications posted. Individuals responsible for groundskeeping at HARB will be oriented in the identification of burrowing owls and their burrows, measures for avoidance, and procedures for reporting burrowing owl activity or any incidents of disturbance. These measures will be considered for inclusion in the HARB Grounds Maintenance SOW (see Volume II, Appendix E).

Table 5-7	
Northeast Grasslands Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4: Updated IESMP</i>
Objective 2.4	Protect and maintain known and potential Burrowing owl habitat. Strategy 2.4.1: Continue to protect owl burrows from harassment and/or disturbances by people.

Table 5-7	
Northeast Grasslands Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 2.7	<p>Conserve and protect the habitats for federal and state listed T/E species, and species of special concern.</p> <p>Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.</p>
Objective 3.2	<p>Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives.</p> <p>Strategy 3.2.1: Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.</p> <p><i>Project No. 10:</i> Develop Ecosystem Management Training/Education Program.</p>

5.8 Operable Unit-2 Area

Natural Resources and Operational Features

The Operable Unit 2 area (approximately 21.1 acres) includes OU-2 (the former Pesticide Rinse area; see Figure 3-4 and Table 3-5) and is located on the western portion of the Base (see Figures 2-2 and 5-8). Boundary Canal abuts the western edge of the area. Other than the adjacent canal, the area contains no surface water bodies or wetlands and it is located outside the FEMA-designated 100-year flood prone area.

The invasive and exotic species covering the area represent a fuel load and fire hazard. Based on impenetrable monocultures of exotic species, protected plant species are not expected to occur in this area (see Table 3-6 and Section 3.11.4). Primary and transitional surface zones for the runway do not overlay the area. Most of the site is within the ESCZ arc of the Munitions area and ESCZ restrictions preclude activities such as recreation in the OU-2 area.

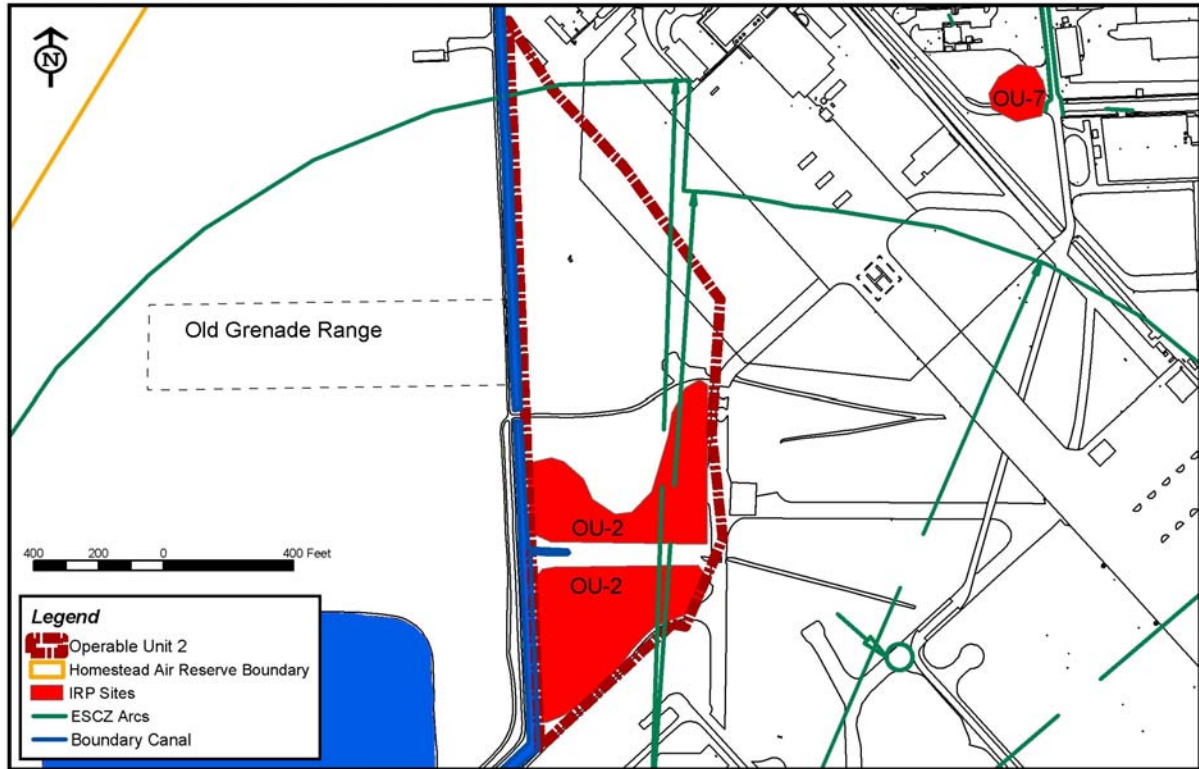


Figure 5-8: The Operable Unit 2 Area

Management Practices

The INRMP objectives for the Operable Unit 2 area, as well as management strategies and projects specific to this area, are summarized in Table 5-8. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Updated Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). An important aspect of invasive and exotic species removal is fuel load reduction. Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1). The practices also must be compatible with the restoration objectives for IRP site OU-2 (see Figure 3-4 and Table 3-5).

Table 5-8	
Operable Unit (OU)-2 Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Updated IESMP

5.9 Phantom Lake and Old Grenade Range Area

Natural Resources and Operational Features

The Phantom Lake and Old Grenade Range area (approximately 93.8 acres) is located in the western portion of HARB (see Figures 2-2 and 5-9). Approximately 71 acres of this area are within the ESCZ arc of the Munitions area. This includes the man-made Phantom Lake, which covers approximately 14 acres and is surrounded by a dirt access road. Boundary Canal passes along the area's eastern and southern boundaries. This area contains no wetlands and no IRP sites occur in the area; however, a former practice grenade range (MMRP site) is located within the central portion. During the performance of two recent MMRP environmental studies, a number of state-listed plant species were found within the center of the subject area. The area is not within the FEMA-designated 100-year flood prone area. Access, security, and safety aspects restrict the use of the area for recreational pursuits as originally proposed in the 2004 INRMP.

The middle of the lake is shallow, which supports emergent vegetation, and the nearshore areas of the lake are deep. Native and exotic fish species are known to occur in the lake (see Volume II, Appendix G; also Section 3.12). Upland area surrounding the lake is dominated by invasive exotic species, although the area continues to harbor a variety of native trees and plants, including a number of state-listed plant species (see Table 3-6 and Section 3.11.4).

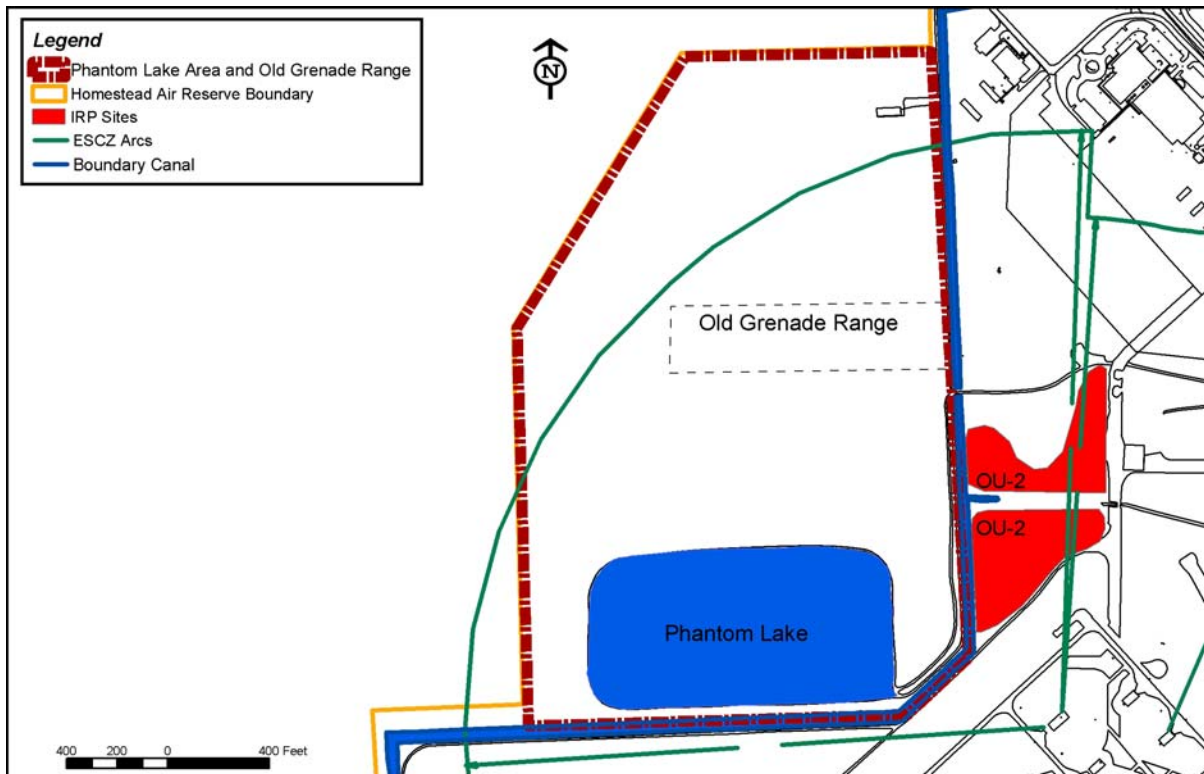


Figure 5-9: The Phantom Lake and Old Grenade Range Area

Phantom Lake and the surrounding uplands represent favorable conditions for natural resources-based recreation; however, the current ESCZ arc represents a constraint in its current configuration. Invasive exotic species are pressuring native communities that include state-listed plants, and presently diminish the quality of the area for recreational values. The Old Grenade Range may present a safety concern in the east-central portion of the area in terms of recreation suitability.

Management Practices

The INRMP objectives for the Phantom Lake and Old Grenade Range area, as well as management strategies and projects specific to the area, are summarized in Table 5-9. HARB is interested in exploring the potential for Phantom Lake and its surrounding upland area to enhance habitat conditions for native communities. In order to explore the viability of the concept, HARB will request funding for Project 6, *Phantom Lake Improvements and Constraints Evaluation* (see Volume II, Appendix A). While it is feasible for HARB to undertake habitat improvements for the area, Project 6 will be used to address issues that must be resolved before any final decisions can be made. These issues include:

- site security concerns;

- requirements for roadway access into the site;
- safety restrictions of the ESCZ arcs affecting the use of the site;
- an estimate of capital improvement funding (and prioritizing of that funding) requirements for habitat restoration; and
- operations and maintenance (O & M) funding requirements for maintaining habitat improvements.

Based on the results of the improvement and constraints evaluation, actions may be recommended for implementation, including future management practices. Any management actions and practices recommended for invasive and exotic species will be incorporated into Project 4, *Updated Invasive Exotic Species Management Plan* (see Volume II, Appendix A).

Table 5-9	
Phantom Lake and Old Grenade Range Area Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Update IESMP
Objective 2.2	Restore and maintain natural communities surrounding Phantom Lake. Strategy 2.2.1: Evaluate the focus for native habitat restoration in the Phantom Lake are.a. <i>Project No. 6:</i> Phantom Lake and Old Grenade Range Improvements and Constraints Evaluation.
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species. Strategy 2.7.3: Maintain American alligator habitat at HARB in a manner that is compatible with the military mission.
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare and or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission. <i>Project No. 9:</i> Feasibility of implementing the removal and/or control of the exotic caiman within HARB.

5.10 Remnant Pine Rockland

Natural Resources and Operational Features

The Remnant Pine Rockland area (approximately 5.1 acres) is located in the northwestern corner of the Base adjacent to the Fuel Farm to the east (see Figures 2-2 and 5-10). The area does not contain wetlands, surface water bodies, or IRP sites and is not located within the 100-year flood prone area. Boundary Canal abuts the property to the west.

The area contains remnants of what used to be a diverse pine rockland community (see Section 3.11). The community was largely destroyed as a result of Hurricane Andrew. Since the hurricane, invasive and exotic species have invaded the site and displaced most of the native species that survived the hurricane. Although no operational constraints occur on the site, the adjacent Fuel Farm represents a limitation for future management activities (e.g., fire management). Although the acreage is small, this area on HARB provides an excellent opportunity to re-establish a productive remnant pine rockland community. Unique habitat only found in south Florida, a restored pine rockland community may contain a diverse array of rare or listed plant and animal species. This observation was confirmed, as several state-listed species were found to be present in this area during a 2004 vegetation survey (Hi-Tech Environmental Consultants, 2004). In addition, in May 2009, a federal-listed endangered species, Small's milkpea (*Galactia smallii*), and a federal candidate endangered species to be listed, Sand flax (*Linum arenicola*) were found in a remnant pine rockland tract within former HAFB property on the east side of HARB. This would suggest that both species might also be present on the remnant pine rockland tract within HARB. There also is the possibility that these species could be reestablished in the pine rockland habitat if restoration and management practices are implemented (Hofstetter, 2002).

Restoration efforts for this area will support and enhance the regional efforts undertaken by Miami-Dade County and would help preserve the small amount of pine rockland habitat that remains of its former range. While fire is necessary for the reproductive success of certain rockland plants and it plays an important role in preventing pine rockland succession to hardwood habitat, manual activities generally can provide the needed management to support a restored community (Hofstetter 2002).

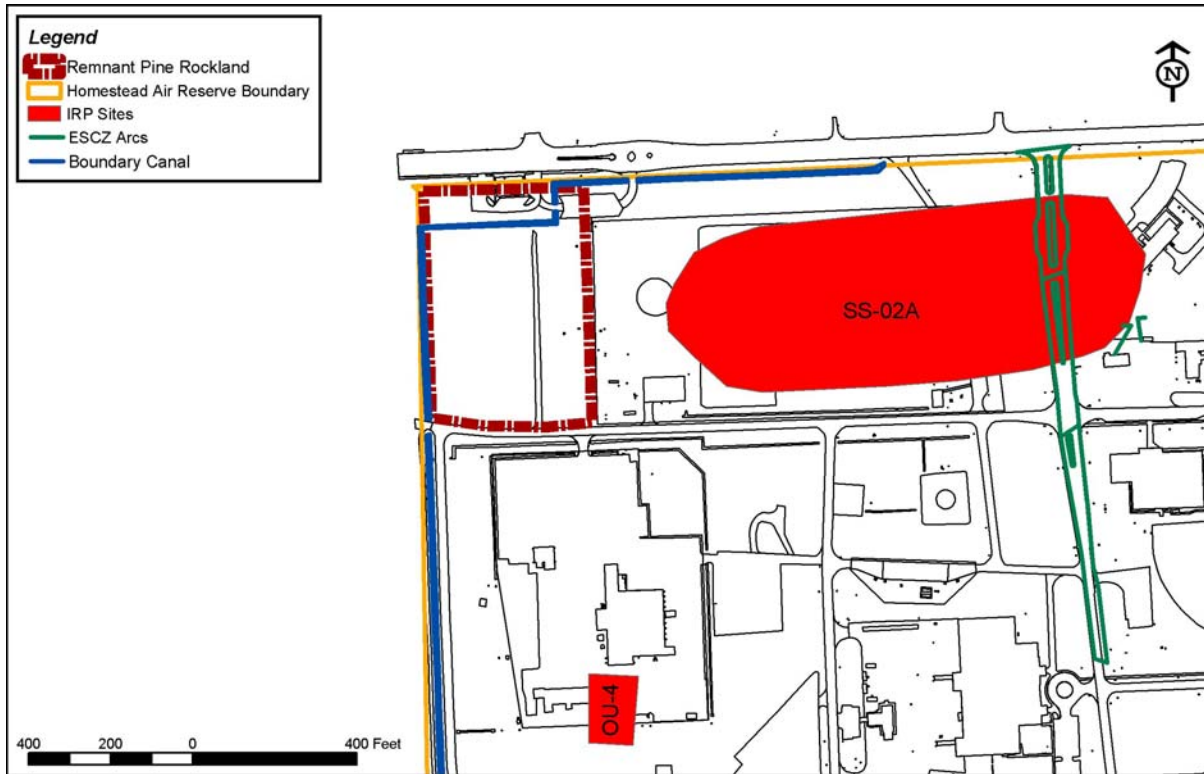


Figure 5-10: The Remnant Pine Rockland Area

Management Practices

The INRMP objectives for the Pine Rockland area, as well as management strategies and projects specific to this area, are summarized in Table 5-10. HARB will request funding for Project 5, *HARB Pine Rockland Restoration and Management Plan*, (see Volume II, Appendix A) to prepare a site-specific restoration plan to enhance habitat quality and increase wildlife diversity of the pine rockland community. This first step would be developed with input by Miami-Dade County DERM and other groups that are involved in pine rockland restoration. The plan would outline the restoration processes, which would involve aggressive efforts to remove exotic and hardwood species (to occur over approximately 3 to 5 years), then continual maintenance once maintenance conditions are established (generally considered to be 5% or less exotic coverage). If habitat management and preservation efforts are successful, state-listed plant species located in precarious habitat conditions on other parts of the Base will be evaluated for potential transplantation. While transplantation from areas where habitat has been compromised or is degraded may be warranted, every effort should first be made to protect the species in the areas where they naturally occur. Manual and mechanical techniques for removal of exotic plant species and maintenance of the proper successional forest species assemblage on the 5-acre tract would likely be required given the constraints on use of fire in proximity to the Base’s fuel tank farm.

Table 5-10	
Remnant Pine Rockland Area Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Updated IESMP
Objective 2.1	Restore and protect the remnant Pine Rockland to support native plant communities and associated wildlife, including T/E species habitat. Strategy 2.1.1: Develop a Pine Rockland Restoration and Management Plan. <i>Project No. 5:</i> Pine Rockland Restoration and Management Plan.
Objective 2.7	Conserve and protect the habitat for federal and state listed T/E species, and species of concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 3.2	Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives. Strategy 3.2.2: Within the limitations of the mission and installation security requirements, implement programs and initiatives that provide continuity with the surrounding community's efforts in education and stewardship for natural resources restoration, conservation, and ecosystem management.
Objective 3.4	Coordinate with government agencies and non-government organizations engaged in the implementation of region-wide plans, programs, and projects for ecosystems restoration and natural resources management in South Miami-Dade County. Strategy 3.4.1: Obtain information on South Miami-Dade County ecosystem management initiatives being undertaken by other government and non-government entities, and identify and evaluate opportunities for appropriate participation by HARB.

5.11 Southeast Triangle

Natural Resources and Operational Features

The Southeast Triangle area (approximately 32.7 acres) is located southeast of the runway (see Figures 2-2 and 5-11; the storm water reservoir is discussed in Section 5.1). The area contains no wetlands but the entire site is within the FEMA-designated 100-year flood prone area. Boundary Canal abuts approximately half the site.

The area is primarily undeveloped with monotypic stands of Brazilian pepper and Napier grass, and other invasive and exotic species. Large non-native hardwood trees occur throughout the

area and are commonly used by birds for roosting. Protected plant species have not been identified in this area (see Section 3.11.2).

The runway transitional zone covers most of the site. OU-11 (see Figure 3-4 and Table 3-5) is located in this area. Because of the proximity of this site to the airfield, the potential that natural resources management and decision/methods may affect BASH is a primary concern. Access, security, and safety aspects restrict the use of the area for recreational pursuits.



Figure 5-11: The Southeast Triangle Area

Management Practices

The INRMP objectives for the Southeast Triangle area, as well as management strategies and projects specific to this area, are summarized in Table 5-11. The objectives could reduce the attraction of infield areas to wading birds and other animals (i.e., lessening the frequency of runway crossings), and reduce potential fire hazards. Given the proximity of the Southeast Triangle to the runway, the potential benefit of an overall substantial reduction in bird activity in the vicinity of the airfield may be achieved.

Any management actions and practices recommended for invasive and exotic species will be incorporated into Project 4, *Updated Invasive Exotic Species Management Plan*, (see Volume II,

Appendix A). Management actions must be compatible with transitional zone clearance requirements and the restoration objectives for IRP site OU-11 (see Figure 3-4 and Table 3-5).

Table 5-11	
Southeast Triangle Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4: Updated IESMP</i>
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare and or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.
Objective 3.2	Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives. Strategy 3.2.1: Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.

5.12 Southwest Clear Zone Area

Natural Resources and Operational Features

The Southwest Clear Zone (approximately 57 acres) is located at the southwest end of Runway 5/23 (see Figures 2-2 and 5-12). This area is comprised of the runway clear zone that extends southwest from the end of the runway and is 3,000 feet long and 3,000 feet wide. The Southwest Clear Zone is part of the overall APZ for this approach to the airfield runway (the remainder of the APZ extends outside the boundaries of the Base). The approach-departure clearance surface for the runway overlays the majority of the clear zone. Much of the site is mowed to maintain a vegetation height of 7 to 12 inches (see Figure 3-6) in order to maintain airfield height restrictions and as a BASH reduction measure.

The area contains a small wetland area but no open surface water bodies. Approximately 37 acres of the site are in the FEMA-designated 100-year-flood prone area. This area has been known to provide habitat for a number of state-protected plant species (see Section 3.11; also Volume II, Appendix G).

A small area at the most northern extent of the Southwest Clear Zone is encumbered by an ESCZ arc, as well as IRP site OU-1 (see Figure 3-4 and Table 3-5). Resource management for BASH reduction is a primary issue for the area. Acceptable uses for this area are severely limited due to the restriction requirements of AFI 32 –7063, which limit land use activities and obstacles.

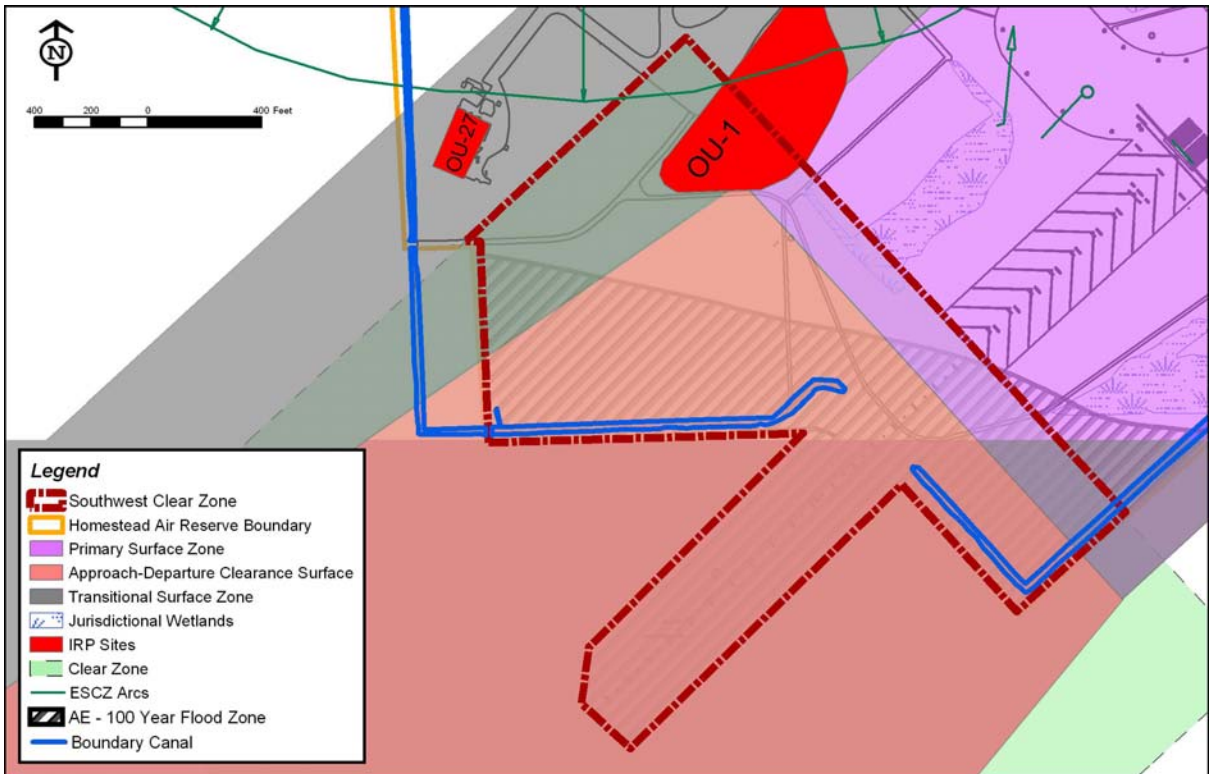


Figure 5-12: The Southwest Clear Zone Area

Management Practices

The INRMP objectives for the Southwest Clear Zone, as well as management strategies and projects specific to the area, are summarized in Table 5-12. HARB will continue its regular management practices of mowing, maintaining, and monitoring vegetation in the clear zone. Because the area is within the runway clear zone, it will not be managed for habitat enhancement. The management approach for exotic species in the clear zone will be addressed as part of Project 4, *Updated Invasive Exotic Species Management Plan* (see Volume II, Appendix A). Future

management practices must be compatible with BASH reduction objectives (see Section 2.3.1) and all clear zone requirements.

Table 5-12	
Southwest Clear Zone Area Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.5: Continue ongoing compliance and restoration program actions contributing to water quality protection.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4: Updated IESMP</i>
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.
Objective 2.8	Control nuisance wildlife populations that may adversely affect human health, welfare, and or the military mission. Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission.

5.13 Twin Lakes and Wetland Fringe Area

Natural Resources and Operational Features

The Twin Lakes and Wetland Fringe area (approximately 40.8 acres) is located southeast of the runway and adjacent to the Hush House area (see Figures 2-2 and 5-13). The two manmade lakes (also known as the North and South Flightline lakes) are about equal in size and jointly occupy approximately 16 acres, while the area known as Wetland Fringe covers approximately 25 acres. Together, the lakes comprise the largest surface water body on HARB. Jurisdictional wetlands cover nearly the entire site. Both lakes and the wetland area function as part of the Base’s overall drainage network and receive runoff from the airfield. Portions of the site lie within the FEMA-designated

100-year flood prone area. Boundary Canal abuts the east and south boundaries of the site. The area contains native vegetation and important wildlife species (e.g., American crocodile), as well as invasive exotics (see Sections 3.11 and 3.12).

The majority of the site is within the airfield operational area, and specifically within the primary and transitional surface zones of the runway. Given the existence of the lakes and semi-natural conditions in the parcel, it has the potential for providing natural resource-based benefits for HARB. However, because of the proximity of this acreage to the airfield, the possibility that natural resources management decisions/methods may affect BASH potential is a primary concern. Access, security, and safety aspects restrict the use of the area for recreational pursuits as originally proposed in the 2004 INRMP.

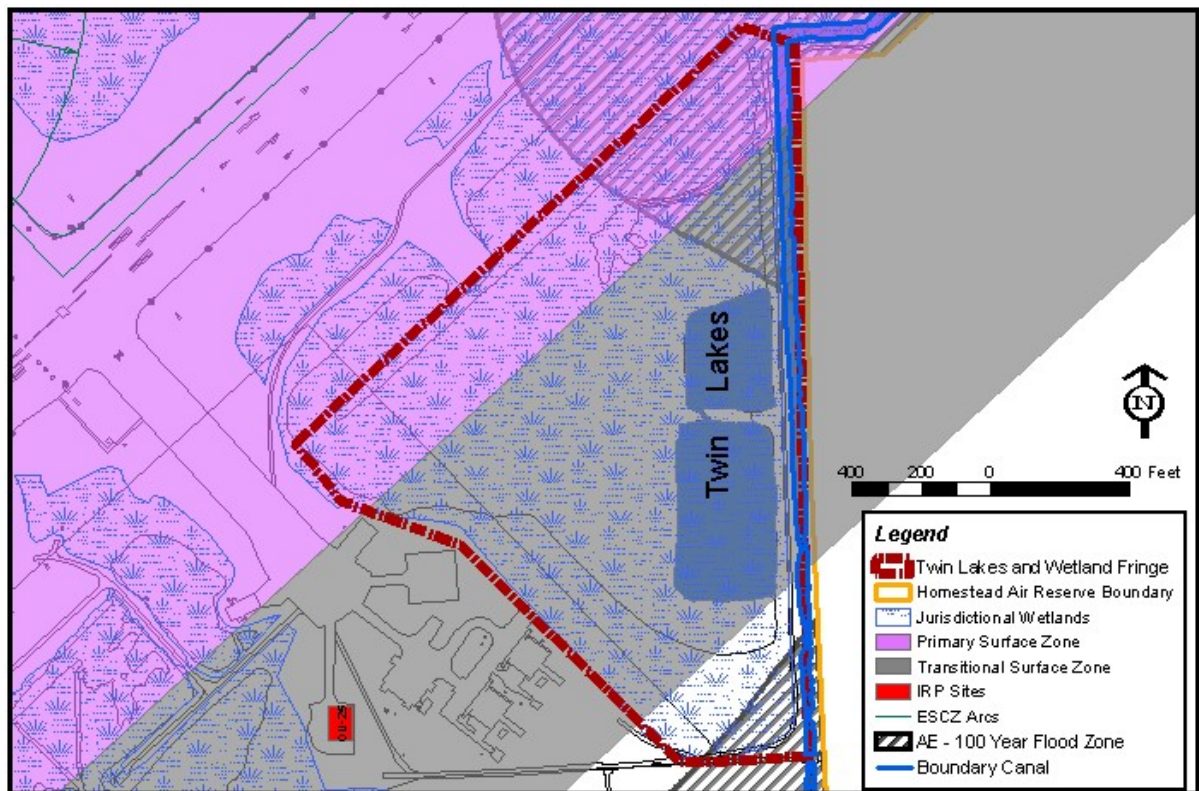


Figure 5-13: The Twin Lakes and Wetland Fringe Area

Management Practices

The INRMP objectives for the Twin Lakes and Wetland Fringe area, as well as management strategies and projects specific to the area, are summarized in Table 5-13. HARB is interested in enhancing natural communities through the control of exotic invasive species. Toward this end,

HARB will complete Project 7, *Twin Lakes Feasibility Study* (see Volume II, Appendix A) to examine whether these improvements would be compatible with various operational factors, such as:

- the airfield storm water drainage system function and performance;
- airfield primary and transitional zone clearance requirements; and
- BASH plan objectives for reducing potential for bird strikes.

The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Updated Invasive and Exotic Species Management Plan* (see Volume II, Appendix A).

Table 5-13	
Twin Lakes and Wetland Fringe Area Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality. Strategy 1.1.2: Maintain the functions and values of the wetland system south of the airfield to provide storm water runoff filtration and retention, ground water recharge, and other water quality and/or water supply benefits.
Objective 1.3	Evaluate land management practices to ensure the safety of the military mission. Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.
Objective 1.4	Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities. Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Updated IESMP
Objective 2.3	Restore and maintain the natural communities surrounding Twin Lakes to support native fish and wildlife species. Strategy 2.3.1: Evaluate limitations and constraints for habitat enhancement in the Twin Lakes and Wetland Fringe area. <i>Project No. 7:</i> Twin Lakes Feasibility Study.
Objective 2.7	Conserve and protect the habitats for federal and state listed T/E species, and species of special concern. Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.

5.14 Wetland Marsh Area

Natural Resources and Operational Features

The Wetland Marsh area (approximately 34.4 acres) is located southeast of the runway adjacent to the Hush House area (see Figures 2-2 and 5-14). Wetlands cover the entire site, functioning as part of the Base's overall drainage network and receiving runoff from the airfield. Portions of the site lie within the FEMA-designated 100-year flood prone area. Boundary Canal abuts the southern boundary.

The area contains state-listed plant species (see Table 3-6 and Section 3.11.4) as well as invasive exotic plants (see Section 3.11.5). Wildlife species observed in the area include wading and non-wading birds. The majority of the site is within the airfield operational area, and specifically within the primary and transitional surface zones of the runway. Because of the proximity of this acreage to the airfield, the potential that natural resources management decisions/methods may affect BASH potential is a primary concern. Access, security, and safety aspects restrict the use of the area for recreational pursuits.

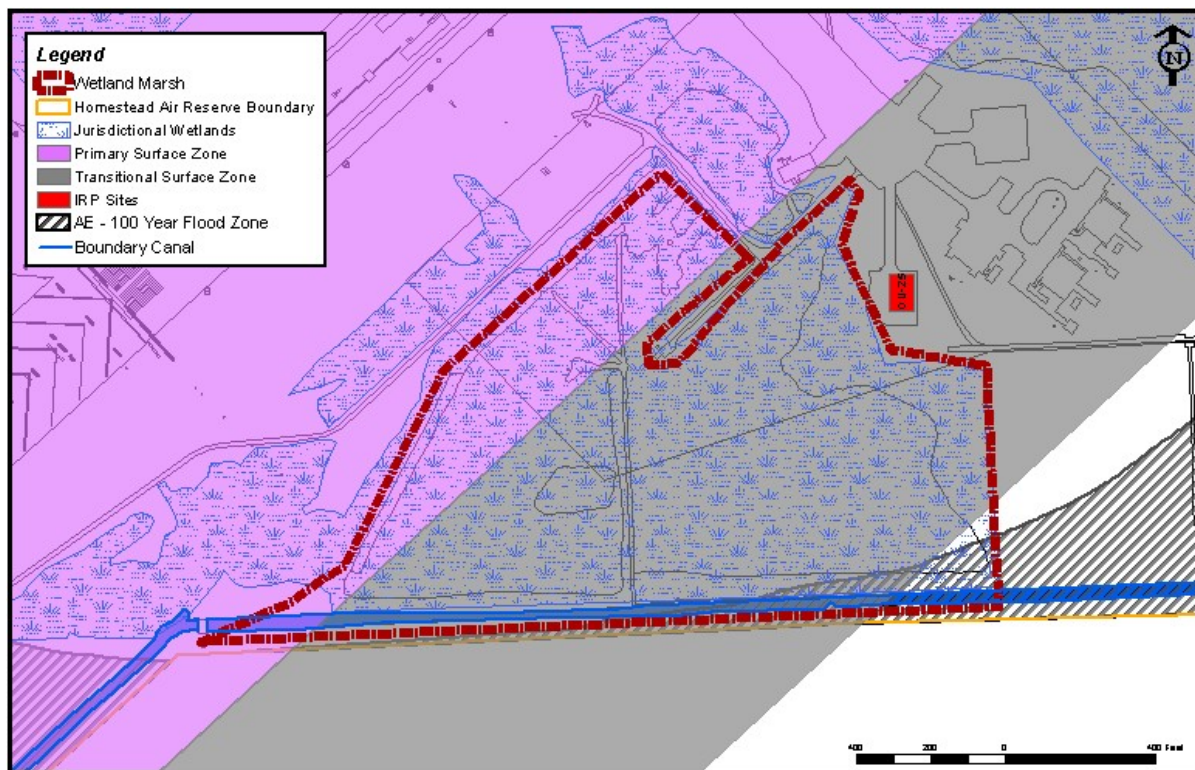


Figure 5-14: The Wetland Marsh Area

Management Practices

The INRMP objectives for the Wetland Marsh area, as well as management strategies and projects specific to this area, are summarized in Table 5-14. The appropriate measures and intensity of controls for invasive exotic species removal in this area will be explored through the completion of Project 4, *Updated Invasive and Exotic Species Management Plan* (see Volume II, Appendix A). Future management practices for exotic species must be compatible with BASH reduction objectives (see Section 2.4.1), the use of the site for airfield drainage, and primary and transitional zone clearance requirements.

Table 5-14	
Wetland Marsh Area	
Natural Resource Management Objectives, Strategies, and Projects	
Objective 1.1	<p>Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values for water quality.</p> <p>Strategy 1.1.2: Maintain the functions and values of the wetland system south of the airfield to provide storm water runoff filtration and retention, ground water recharge, and other water quality and/or water supply benefits.</p>
Objective 1.3	<p>Evaluate land management practices to ensure the safety of the military mission.</p> <p>Strategy 1.3.2: Identify areas and implement actions for the removal of vegetation encroachment conditions that are in violation of airfield clear zones, primary surface area, and transitional surfaces.</p>
Objective 1.4	<p>Reduce and control populations of invasive and exotic plant species to minimize conflicts with the military mission and to reduce adverse impacts to existing native communities.</p> <p>Strategy 1.4.1: Prepare Updated Invasive and Exotic Species Management Plan (IESMP). <i>Project No. 4:</i> Update IESMP</p>
Objective 2.7	<p>Conserve and protect the habitats for federal and state listed T/E species, and species of special concern.</p> <p>Strategy 2.7.1: Maintain and protect natural features supporting populations of endangered plant and animal species.</p> <p>Strategy 2.7.3: Maintain American alligator habitat at HARB in a manner that is compatible with the military mission.</p>
Objective 2.8	<p>Control nuisance wildlife populations that may adversely affect human health, welfare and or the military mission.</p> <p>Strategy 2.8.1: Eliminate or minimize the presence of nuisance animals and the adverse effect these have on native species populations and the military mission. <i>Project No. 9:</i> Feasibility of implementing the removal and/or control of the exotic caiman within HARB.</p>

5.15 Programmatic Management Practices

This section provides direction for management actions that are programmatic and applicable base-wide. Direction for management decision-making is generally a result of the development of plans and programs that adhere to DoD or Air Force directives, instructions, or plans. HARB effectively uses this direction to make informed daily decisions for the management, inventory, and monitoring of natural resources. As a supplement to these already established plans and programs, programmatic and base-wide INRMP objectives compatible with the Base's management initiatives are summarized in Table 5-15.

Table 5-15	
Programmatic Management Objectives, Strategies, and Projects	
Objective 1.1	<p>Continue existing and establish new programs and procedures to maintain water quality, including monitoring and maintaining wetland functions and values.</p> <p><u>Strategy 1.1.1:</u> Establish a wetland inventory and monitoring program to assess wetland functions and values over time.</p> <p><u>Strategy 1.1.4:</u> Establish wetland mitigation policy and procedures at HARB to offset wetland impacts associated with planned and/or proposed development activities.</p>
Objective 2.7	<p>Conserve and protect the habitats for federal and state listed T/E species, and species of concern.</p> <p><u>Strategy 2.7.2:</u> At a minimum, conduct reconnaissance surveys to update information regarding the presence of listed T/E species and their habitats every five years, and concurrent with efforts to revise the INRMP, if possible.</p>
Objective 3.1	<p>Incorporate the concept of ecosystem management into all planning and management processes.</p> <p><u>Strategy 3.1.1:</u> Integrate ecosystem management concepts of the INRMP into all working programs, department plans (i.e., SWPPP, Grounds Maintenance, BASH, IPMP, IRP, etc.), and day-to-day management practices at HARB.</p>
Objective 3.2	<p>Implement training programs for effective natural resources conservation measures to enhance environmental and conservation awareness on the installation, and conservation stewardship initiatives.</p> <p><u>Strategy 3.2.1:</u> Establish an ecosystems management awareness and training/education program available to all interested HARB personnel. In addition, implement a technical education and training program for all contract and installation personnel involved in activities on the installation whose jobs may directly or indirectly affect program success.</p> <p><i>Project No. 10: Ecosystem Management Training/Education Program.</i></p>

Table 5-15

Programmatic Management Objectives, Strategies, and Projects

Objective 3.3	Ensure that ongoing and future land use activities at HARB are compatible to the greatest extent possible with the conservation of natural resources.
	Strategy 3.3.1: Develop basic environmental review criteria for the siting and managing of any proposed new facilities and training activities and basic guidelines for consideration of INRMP goals and objectives as part of any proposed new land uses on the installation.
Objective 3.4	Coordinate with government agencies and non-government organizations engaged in the implementation of region-wide plans, programs, and projects for ecosystems restoration and natural resources management in South Miami-Dade County.
	Strategy 3.4.1: Obtain information on South Miami-Dade County ecosystem management initiatives being undertaken by other government and non-government entities, and identify and evaluate opportunities for appropriate participation by HARB.

6 Additional Sources of Information Pertaining to Natural Resource Management

This section contains numerous publications, internet addresses, and contact phone numbers, subdivided by resource, to assist the HARB natural resources personnel. Those organizations with information related to more than one resource are listed in a general contact information section at the end of the section.

6.1 Air Quality

Miami-Dade County Department of Environmental Resource Management, Air Quality Division - (305) 372-6925

Florida Department of Environmental Protection
Southeast District Air Program
400 North Congress Avenue
West Palm Beach, Florida 33401
<http://dep.state.fl.us/air/>

United States Environmental Protection Agency
Region IV
Sam Nunn Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303-3104
<http://www.epa.gov/region04/>

6.2 Geology, Soils, and Topography

Dade County Cooperative Miami-Dade Department of Planning,
Extension Service Development and Regulation
18710 SW 288 Street 111 NW 1 Street, Suite 1200
Homestead, FL 33031 Miami, FL 33138
<http://miami-dade.ifas.ufl.edu/>
(305) 248-3311

United States Department of Agriculture and Natural Resources Conservation Service, *Soil Survey of Dade County Area Florida*, January 1996. The National Erosion Research Laboratory:
<http://tosoil.nserl.purdue.edu/nserlweb>

USDA NRCS
Post Office Box 2890
14th and Independence Avenue, SW
Washington, D.C. 202050
<http://www.nrcs.usda.gov/>
(202) 720-2520

United States Geological Survey, – focus on Florida Geology and Water Resources
http://sofia.usgs.gov/publications/papers/wsp1255/PDF/wrsf_5.htm

United States Geological Survey 7.5 Minute Quadrangle Maps for Homestead Air Reserve Base, Homestead, Florida:

- Homestead – 1987 (majority of the Base)
- Goulds – 1987
- Perrine – 1988
- Arsenicker Key – 1982

6.3 Surface Water

Florida Department of Environmental Protection Stormwater Treatment – (850) 595-8320

Miami-Dade County Department of Environmental Resource Management, Stormwater Planning and Design Section, (305) 372-6888.

South Florida Water Management District- ERP Stormwater/Engineering Permitting – (561) 682-6505

South Florida Water Management District – Water Use Permitting – (561) 682-6944

United States Environmental Protection Agency Nonpoint Source – (404) 346-2126

Nonpoint Source Pollution of Surface Waters with Phosphorus and Nitrogen, 1998:
<http://esa.sdsc.edu/carpenter.htm>

Issues in Ecology summary report from the Ecological Society of America.

South Florida Water Management District, January 2001, *Basis of Review for Environmental Resource Permit Applications Within The South Florida Water Management District*

United States Environmental Protection Agency Office of Water: www.epa.gov.owow/

United States Geological Survey Water Resources Home Page: <http://h2o.usgs.gov>

United States Geological Survey, Water Resources District
9100 NW 36th Street, Suite 107
Miami, Florida 33178
(305) 717-5800
<http://fl.water.usgs.gov/Miami/index.html>

6.4 Wetlands

Miami-Dade County Department of Environmental Resource Management, Wetland and Forest Resources Section, (305) 372-6585.

The Center for Wetlands, University of Florida – (352) 392-2424

South Florida Water Management District – Environmental Resource Permit (Wetland Permitting)
(561) 682-6866

Wetland Science Institute, USDA/NRCS, Wetland National Practice Standards, Wetland restoration, mitigation, construction, enhancement, and wildlife: www.pwrc.usgs.gov/wli/constds/wlicps.htm,
(301) 497-5938.

Florida Department of Environmental Protection
Southeast District Office
400 North Congress Avenue
West Palm Beach, Florida 33401
(561) 681-6600
<http://dep.state.fl.us/secretary/dist/maps/sedist.htm>

Florida Department of Environmental Protection, Wetlands Restoration Information Center -
<http://www.dep.state.fl.us/water/wetlands/fwric/index.htm>

Florida Department of Environmental Protection Division of Water Facilities:
www.dep.state.fl.us/stland/bapm

Kusler, Jon A. and Mary E. Kentula, eds., 1989, *Wetland Creation and Restoration: The Status of the Science*, Island Press, Washington, DC.

Tobe, Dr. John D. et al., 1998, Florida Department of Environmental Protection, *Florida Wetlands Plants, An Identification Manual*, January 1998.

United States Army Corps of Engineers
Jacksonville Regulatory District
PO Box 4970
400 West Bay Street
Jacksonville, Florida 32232-0019
904-232-2568
<http://www.saj.usace.army.mil/index.html>

United States Environmental Protection Agency – Wetlands, Oceans and Watersheds
<http://www.epa.gov/OWOW/>

United States Environmental Protection Agency – Wetlands,
<http://www.epa.gov/OWOW/wetlands/vital/toc.html>

6.5 Flooding

Miami-Dade Department of Environmental Resource Management, Floodplain Assessment Section –
(305) 372-6685

Miami-Dade County Building Department – (786) 315-2000

FEMAs Floodplain Management Summary – <http://www.fema.gov/mit/fldmit.htm>

Floodplain Management – <http://www.fws.gov/directives/613fwl.html>

Strategies for Floodplain Management – <http://floodplain.org/c-overvi.htm>

On-line floodplain maps – <http://www.esri.com/hazards/makemap.html>

6.6 Vegetation

Florida Natural Areas Inventory – (850) 224-8207

The Nature Conservancy Florida Office – (407) 682-3664

Miami-Dade County Department of Environmental Resource Management, Environmentally
Endangered Lands Program (EEL) – (305) 372-6754

Austin, Daniel F., 1997, *Pine Rockland Plant Guide, A Field Guide to the Plants of South Florida's Pine Rockland Community*, Department of Environmental Resource Management, Environmentally Endangered Lands, Miami-Dade County, Florida.

Chafin, Linda, 2000, *Field Guide to the Rare Plants of South Florida*, Florida Natural Areas Inventory, Tallahassee, Florida.

Department of Environmental Management for Miami-Dade County, August 1995, *Restoration Plan for Dade County's Pine Rockland Forest Following Hurricane Andrew*,

Myers, R., and J. Ewel, 1990, *Ecosystems of Florida*, University of Central Florida Press, Orlando, Florida.

Wunderlin, R.P., 1998, *Guide to the Vascular Plants of Florida*, University Press of Florida, Gainesville, Florida.

Herndon, A., 1998, Life History Studies of Plants Endemic to South Florida, Final Report to the National Park Service, April 30, 1998.

Small, J.K., 1993, *Manual of Southeastern Flora*, University of North Carolina Press, Chapel Hill, North Carolina.

Fairchild Tropical Garden: www.ftg.org

Virtual Herbarium, www.virtualherbarium.org

Florida Plants Online – www.floridaplants.com

University of South Florida, Institute for Systematic Botany, USF Herbarium – <http://www.plantatlas.usf.edu/isb/herbarium.htm>

Wunderlin et al., 1996, *Atlas of the Florida Vascular Flora*, www.plantatlas.usf.edu

Institute for Regional Conservation, Rare Plants of South Florida: Their History, Conservation, and Restoration, Floristic Inventory of South Florida Database, <http://www.regionalconservation.org/ircs/aboutus/IRC.cfm>

Effects of Fires on Threatened and Endangered Plants – <http://fire.r9.fws.gov/ifcc/T&Eplants/T&Eplants.htm#Abstract>

Vegetation Management – www.sfrc.ufl.edu/extension/vegman.htm

Florida Fish and Wildlife Conservation Commission – <http://fcn.state.fl.us/gfc/>

United States Fish and Wildlife Service – <http://www.fws.gov/>

United States Fish and Wildlife Service, 1999, South Florida Multi-Species Recovery Plan, <http://www.sfrestore.org/crogee/ra17/ra17.html>

Weed Management – <http://tncweeds.ucdavis.edu>

Florida Exotic Pest Plant Council – www.fleppc.org

Invasive Plant Management – <http://refuges.fws.gov/FICMNEWFiles/NatlWeedStrategyTOC.html>

Weeds Gone Wild Project, Plant Conservation Alliance – <http://www.nps.gov/plants/alien/>

Florida Department of Environmental Protection Bureau of Invasive Plant Management – www.dep.state.fl.us/stland/bapm

University of Florida, Center for Aquatic and Invasive Plants – <http://aquat1.ifas.ufl.edu/welcome.html>

University of Florida Extension, Institute of Foods and Agricultural Sciences – Native Plants, Landscaping, and Pesticide training - <http://miami-dade.ifas.ufl.edu/publications.htm>

Association of Native Nurseries – <http://www.afnn.org/>

Xeriscaping – <http://www.xeriscape.org>

Florida Native Plant Society – <http://www.fnps.org>

6.7 Wildlife

Florida Natural Areas Inventory – (850) 224-8207

The Nature Conservancy Florida Office – (407) 682-3664

United States Department of Agriculture, Animal, Plant, Health Inspection Service (APHIS) – (904) 375-2229

Humphrey, Stephen R., 1992, *Rare and Endangered Biota of Florida, Volume I, Mammals*, University Press of Florida, Gainesville, Florida.

Gilbert, Carter R., 1992, *Rare and Endangered Biota of Florida, Volume II Fishes*, University Press of Florida, Gainesville, Florida.

Moler, Paul, E., 1992, *Rare and Endangered Biota of Florida, Volume III, Amphibians and Reptiles*, University Press of Florida, Gainesville, Florida.

Deyrup, Mark and Richard Franz, 1994, *Rare and Endangered Biota of Florida, Volume IV Invertebrates*, University Press of Florida.

Hipes, D., D. R. Jackson, K. NeSmith, D. Printiss, and K. Brandt, 2001, *Field Guide to the Rare Animals of Florida*, Florida Natural Areas Inventory, Tallahassee, Florida.

Kale, Herbert W. II, *Rare and Endangered Biota of Florida, Birds*, University Press of Florida, Gainesville, Florida.

Kale, Herbert W. II, David S. Maehr and Karl Karalus, 1990, *Florida's Birds: A Handbook and Reference*, Pineapple Press, Sarasota, Florida.

Spreyer, Mark F. and Enrique H. Bucher, 1998, *The Birds of North America, No. 322*, The Birds of North America, Inc., Philadelphia, Pennsylvania.

Wyly Hall, Francis, 1994, *Birds of Florida*, Great Outdoor Publishing Company, St. Petersburg, Florida.

U.S. Fish and Wildlife Service, Environmental Conservation Online System (ECOS), <http://ecos.fws.gov/>, last updated March 7, 2002.

Multi-Species Recovery Plan for the Threatened and Endangered Species of South Florida, U.S. Fish and Wildlife Service, 1998, <http://www.sfrestore.org/crogee/ra17/ra17.html>

Florida Fish and Wildlife Conservation Commission – <http://fcn.state.fl.us/gfc/>

United States Fish and Wildlife Service– <http://www.fws.gov/>

Wildlife damage and diseases information provided by University of Nebraska Cooperative Extension Service, Great Plains Agricultural Council, and the United States Department of Agriculture – <http://www.ces.ncsu.edu/nreos/wild/wildlife/prevent.html>

United States Geological Service National Wildlife Health Center Web – <http://www.emtc.usgs.gov/nwhhome.html>

Nuisance Wildlife Control Information – <http://www.aphis.usda.gov/ws>

Wildlife Disease/Health Related Links – http://www.emtc.nbs.gov/http_data/whip/links.html

The Birds of North America – 888-373-7900 – www.birdsofna.org

6.8 General Contact Information

Miami-Dade County Contacts

Miami-Dade County Department of Environmental Resource Management
701 NW 1st Court
Miami, Florida 33136-3912
(305) 372-6925
<http://www.co.miami-dade.fl.us/derm/home.htm>

Miami-Dade County Department of Planning and Zoning
Downtown Office
Stephen P. Clark Center
111 NW 1st Street, Suite 1210
Miami, Florida 33128
(305) 375-2800
<http://www.co.miami-dade.fl.us/planzone/>

Miami-Dade County Department of Planning and Zoning
West Dade Office
11805 SW 26th Street
Miami, Florida 33175
(305) 375-2800
<http://www.co.miami-dade.fl.us/planzone/>

State of Florida Contacts

Florida Department of Environmental Protection
3900 Commonwealth Blvd. M.S. 49
Tallahassee, Florida 32399
(850) 245-2118
<http://www.dep.state.fl.us/>

Florida Department of Environmental Protection
Florida Coastal Zone Management Program
3900 Commonwealth Boulevard

Tallahassee, Florida 32399
<http://www.dep.state.fl.us.htm>

Florida Department of Environmental Protection
Southeast Regulatory District Office
400 North Congress Avenue
West Palm Beach, Florida 33401
(561) 681-6600
<http://dep.state.fl.us/secretary/dist/maps/sedist.htm>

Florida Department of State
Division of Historical Resources
RA Gray Building
500 South Bronough Street
Tallahassee, Florida 32399-0250
(850) 245-6300
<http://www.flheritage.com>

Florida Fish and Wildlife Conservation Commission
South Region
8535 Northlake Blvd.
West Palm Beach, FL 33412
(561) 625-5122
<http://www.floridaconservation.org/>

South Florida Regional Contacts

Florida Keys National Marine Sanctuary
PO Box 500368
Marathon, Florida 33050
(305) 743-2437
<http://www.fknms.nos.noaa.gov/>

South Florida Water Management District Headquarters
3301 Gun Club Road,
West Palm Beach, Florida 33416-4680
(561) 686-8800 or 1-800-432-2045 (Florida Only)
<http://www.sfwmd.gov/>

South Florida Water Management District
Miami-Dade Regional Service Center
172-A West Flagler Street
Miami, FL 33130
(305) 377-7274, (800) 250-4300
<http://www.sfwmd.gov/>

South Florida Regional Planning Council
3440 Hollywood Boulevard
Hollywood, Florida 33021
(954) 985-4416

<http://www.sfrpc.com/>

South Florida Ecosystem Restoration Task Force
Office of the Executive Director
c/o: Florida International University
University Park, O.E. Building Room 148
Miami, Florida 33199
305/348-1665
<http://www.sfrestore.org>

Everglades National Park
40001 State Road 9336
Homestead, Florida 33034- 6733
(305) 242-7700
<http://www.everglades.national-park.com/>

Biscayne National Park
9700 SW 328 Street
Homestead, Florida 33033-5634
(305) 230-7275
<http://www.biscayne.national-park.com/>

Biscayne Bay Foundation
2964 Aviation Avenue, Suite 300
Coconut Grove, Florida 33133-4599
(305) 447-4566
<http://www.ficus.usf.edu/orgs/bbf/>

1000 Friends of Florida
18014 SW 83 Court
Miami, Florida 33157
(305) 255-5275
<http://www.1000friendsofflorida.org/>

Tropical Audubon Society
5530 Sunset Drive
Miami, Florida 33143
(305) 666-3111
<http://www.tropicalaudubon.org>

The Nature Conservancy
319 Clematis Street, Suite 611
West Palm Beach, Florida 33401
(561) 833-4226
<http://nature.org/>

Citizens for a Better South Florida
2025 SW 32nd Avenue
Miami, Florida 33145
(305) 441-0123
<http://www.mindspring.com/~holding4/cfabsf/eeanda.html>

Trust for Public Lands
Miami Office
7900 Red Road, Suite 25
South Miami, Florida 33143
(305) 667-0409
<http://www.tpl.org/>

Federal Contacts

United States Army Corps of Engineers
Jacksonville Regulatory District
PO Box 4970
400 West Bay Street
Jacksonville, Florida 32232-0019
904-232-2568
<http://www.saj.usace.army.mil/index.html>

United States Environmental Protection Agency
Region 4
61 Forsyth Street, SW
Atlanta, GA 30303-3104
(404) 562-9900
<http://www.epa.gov/region4/>

United States Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
<http://verobeach.fws.gov>

United States Geological Services
9100 NW 36th Street, Room 107
Miami, Florida 33178
(305) 717-5817

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