U. S. AIR FORCE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

UPDATE

Keesler Air Force Base

FINAL
(2022 Review)

2019

KEESLER AIR FORCE BASE

2019 REVIEW AND UPDATE OF THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

2019–2023

Prepared in accordance with the Update of the
Military Lands Withdrawal Act of 1999 (Public Law 106-65 § 3031(b)(5)(A))

Prepared in support of the
2019 Keesler Air Force Base Integrated Natural Resources Management Plan Update

Prepared by
Colorado State University
Center for Environmental Management of Military Lands

Prepared for
U.S. Department of the Air Force, Keesler Air Force Base

In cooperation with
U.S. Department of the Interior, Fish and Wildlife Service
Mississippi Department of Wildlife, Fisheries, and Parks
Mississippi Department of Marine Resources

2019

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ABOUT THIS PLAN

This installation-specific Environmental Management Plan is based on the United States Air Force's (USAF) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which may include Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Non-United States (U.S.) territories will comply with applicable Final Governing Standards (FGS). Where applicable, external resources, including Air Force Instructions (AFIs); Air Force (AF) Playbooks; and federal, state, local, FGS, biological opinion, and permit requirements are referenced.

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

NOTE: The terms 'Natural Resources Manager' (NRM) and 'NRM/Point of Contact' (POC) are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in Department of Defense Instruction (DoDI) 4715.03.

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DOCUMENT CONTROL

Record of Review—The INRMP is updated no less frequently than annually or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. In accordance with the Sikes Act and AFI 32-7064, *Natural Resources Management*, the INRMP is required to be reviewed for operation and effect at least every five years. Annual reviews and updates are accomplished by the base NRM and/or an Installation Support Team Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of the United States Fish and Wildlife Service (USFWS), the state fish and wildlife agency, and the National Oceanic and Atmospheric Administration (NOAA) Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signature to the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

INRMP APPROVAL/SIGNATURE PAGES

This five-year review and update of the Integrated Natural Resources Management Plan was prepared by the United States Air Force— Keesler Air Force Base in cooperation with the United States Department of the Interior, Fish and Wildlife Service, and the Mississippi Department of Wildlife, Fisheries, and Parks. The signature below indicates concurrence with and acceptance of the following document. This plan has been prepared pursuant to the Sikes Act Improvement Act of 1998 (U.S. Code § 670a et seq., as amended through 2014).

Debra A Lovette

DEBRA A. LOVETTE, Colonel, USAF
Commander, 81st Training Wing

19 Mar 19

Date

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STEPHEN RICKS Digitally signed by STEPHEN RICKS
Date: 2019.02.06 13:38:20 -06'00'

Signature *Date*

Stephen Ricks, United States Fish and Wildlife Service, Mississippi Ecological Services Field Office

Title: Field Supervisor

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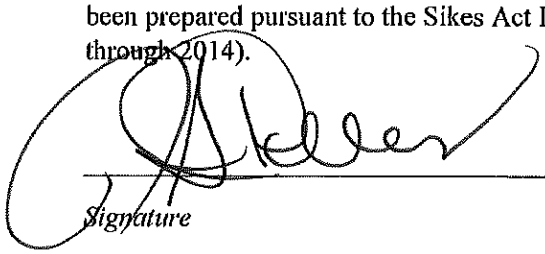


Signature

2/12/2019

Date

Sam Polles, Mississippi Department of Wildlife, Fisheries, and Parks

Title: Executive Director

EXECUTIVE SUMMARY

The INRMP sets the agenda for managing the natural resources of Keesler Air Force Base (AFB) for a five-year planning period (2019–2023). The INRMP is the principal tool for managing the base's natural resources and implements ecosystem management by setting goals for attaining a desired land condition. The INRMP provides a framework for managing natural resources to support and maintain consistency with the military mission while protecting and enhancing natural resources for multiple use, sustainable yield, and biological integrity. This INRMP applies to Keesler AFB.

Keesler AFB is home to one of the largest technical training centers and the third largest medical group in the USAF. The 81st Training Wing (81 TRW) is the host unit on base and is supported by the 81st Training Group (81 TRG), the 81st Mission Support Group (81 MSG), and the 81st Medical Group (81 MDG). Other units and tenants include the 2nd Air Force, the 403rd Wing, the 85th Engineering Installation Squadron, and the Mathies Non-Commissioned Officer Academy. The INRMP supports the military mission while protecting natural ecosystems. The INRMP allows future activities to occur on Keesler AFB while maintaining environmental quality, an essential part of the USAF mission.

The Keesler AFB INRMP seeks to achieve the goals listed below.

- **GOAL 1:** Assess, manage, and protect wetlands on Keesler AFB.
- **GOAL 2:** Assess, manage, conserve, and protect heritage trees and native vegetative resources on Keesler AFB.
- **GOAL 3:** Enhance and monitor wetlands and assess appropriate areas to protect and encourage populations of native species and approved nongame wildlife on Keesler AFB.

Implementation of these goals is expected to protect or enhance the natural resources found on Keesler AFB. Several projects (see Table 9-1) are intended to protect the limited wetlands and the majestic live oaks (*Quercus virginiana*), Keesler's primary natural resources. Updating the base's wetland boundaries would provide a stronger and more accurate foundation for protecting the wetlands. The majestic live oaks are being impacted by encroaching development and the long-term effects of Hurricane Katrina and several droughts.

The organization of this INRMP is in accordance with the USAF standardized INRMP template. Chapter 1.0 provides a general overview and scope of the INRMP, and Chapter 2.0 gives a profile overview of the base, including its physical environment and mission impacts on natural resources. Chapter 3.0 examines the environmental management system, and Chapter 4.0 includes the general roles and responsibilities for parties at Keesler AFB. Chapter 5.0 provides descriptions for training the base's natural resources staff, and Chapter 6.0 gives summaries of the recordkeeping and reporting practices. Chapter 7.0 is the largest section of the INRMP and includes the current status of the base's natural resources management program. Chapter 8.0 lays out the management goals and objectives for natural resources planning for the next five years at Keesler AFB, and Chapter 9.0 describes the INRMP implementation, update, and revision processes. Chapter 10.0 includes the base's annual work plans with a specific timeframe for each project and activity.

1.0 OVERVIEW AND SCOPE

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

1.1 Purpose and Scope

Military installations nationwide are known to encompass numerous natural and cultural resources. As a result of controlled access to installations, these resources have remained in relatively good-to-pristine condition. The USAF recognizes the importance of these resources and has developed a natural resources program that balances USAF mission needs with ecosystem management. Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management,* provides guidance on how to manage natural resources.

The USAF's natural resources program is responsible for the overall management, protection, restoration, and prudent use of natural resources at all installations. The program's primary objective is to ensure continued access to the land and airspace needed to fulfill the USAF's mission while also ensuring that the conditions of natural and cultural resources are maintained or improved to the extent practicable.

This INRMP is the primary tool for guiding ecosystem and natural resources management at Keesler AFB. It sets forth goals, objectives, and projects using ecosystem management concepts that focus on the interrelationships between the biotic and abiotic environment. To implement these concepts efficiently and effectively, coordination of multi-use facilities and multiple management plans is necessary. By reviewing current conditions and developing a future vision for the installation, natural resources are valued for their benefits to both the installation community and the military's mission. Protecting natural resources through good stewardship helps to ensure that existing biodiversity and use of the installation are maintained for the long run and management costs are minimized.

Key to a successful INRMP is coordination with other federal and state agencies. Coordinating with these agencies provides invaluable insights on land, wildlife, and cultural resources management that may need to be integrated into the INRMP. Comments on the Draft Keelser INRMP were provided by the USFWS; the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP); and the Mississippi Department of Marine Resources (MDMR). Subsequently, the comments were integrated into the INRMP.

1.2 Management Philosophy

The Keesler AFB INRMP is based on an interdisciplinary approach to ecosystem management that evaluates and summarizes information from pertinent programs, resources, and activities potentially impacting natural resources at the base. To better meet the needs of decision-makers at Keesler AFB, the INRMP provides a complete picture of current and future natural resource use that supports the base mission. The INRMP supports the mission by developing management goals for its resources and

integrating these management objectives into the military requirements for mission operations/support and regulatory compliance to minimize natural resource constraints. The USAF considers INRMP goals and objectives when planning Keesler AFB projects and mission changes. Consideration of these goals and objectives are reflected in the Installation Development Plan (IDP), the guiding document for all development decisions at Keesler AFB (HDR 2015).

1.3 Authority

This INRMP is in compliance with resource protection laws and promotes ecosystem conservation. The following federal laws, regulations, and directives authorize the development and implementation of this INRMP (see the Appendix for a comprehensive list of applicable laws, regulations, directives, and their associated descriptions). Also applicable to Keesler AFB are Mississippi Department of Environmental Quality (MDEQ) regulations (Table 1-1).

The Sikes Act, 16 United States Code (U.S.C.) 670 et. seq., specifies that each military department must carry out a natural resources program to conserve and rehabilitate natural resources, ensure sustainable multi-purpose use of the resources, and allow for public access to the extent appropriate and applicable to the military mission. To facilitate this, each military installation is required to prepare and implement an INRMP, in coordination with the USFWS and the applicable state fish and wildlife agency, to ensure proper consideration of fish, wildlife, and habitat needs.

DoDI 4715.03, *Natural Resources Conservation Program*, implements policy, assigns responsibilities, and prescribes procedures to guarantee the DoD continued access to its land, air, and water resources for realistic military training and testing and to ensure the long-term ecological integrity of the resource base and the multiple-use management of natural resources.

AFI 32-7064 explains how to manage natural resources on USAF installations in accordance with federal law and applicable state and local standards. This instruction provides the framework for planning, implementing and documenting natural resources programs and the instructions for preparing an INRMP. Under AFI 32-7064, National Environmental Policy Act (NEPA; 42 U.S.C. § 4321 et seq.) documentation is required to be developed at the same time the INRMP is prepared. Under NEPA regulations, an Environmental Assessment (EA) must be prepared that serves to provide brief but sufficient evidence and analysis to determine whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact. This INRMP is an update to the 2013 INRMP, and there have been no significant changes; therefore, a Request For Environmental Impact Analysis, Form AF-813, has been prepared and is considered the NEPA clearance for this document.

Air Force Policy Directive (AFPD) 32-70, *Environmental Quality*, documents the USAF's commitment to achieving and maintaining environmental quality. Under this directive, the USAF will clean up environmental damage from past activities, meet all environmental standards applicable to present operations, plan future activities to minimize environmental impacts, responsibly manage irreplaceable natural and cultural resources, and eliminate pollution from activities wherever possible.

Table 1-1. Mississippi Department of Environmental Quality regulations applicable to Keesler Air Force Base (Mississippi Commission on Environmental Quality and Mississippi Environmental Quality Permit Board Regulations 2018).

Environmental Regulation Category	Mississippi Regulatory Code
Air Quality	11 Miss. Admin. Code Pt. 2, Ch. 1–11
Hazardous Waste	11 Miss. Admin Code Pt.3 Ch. 1–5
Nonhazardous Solid Waste Management	11 Miss. Admin Code Pt.4 Ch. 1–10
Underground Storage Tank	11 Miss. Admin Code Pt. 5 Ch. 1–3
Wastewater Pollution Control	11 Miss. Admin Code Pt.6 Ch. 1–7
Land and Water Resources	11 Miss. Admin Code Pt.7 Ch. 1–3

1.4 Integration with Other Plans

This INRMP was developed using an interdisciplinary approach and is based on existing information about the physical and biotic environments, mission activities, and environmental management practices at Keesler AFB. Goals and objectives were developed from analysis of all the gathered information and were reviewed by Keesler AFB personnel involved with or responsible for various aspects of natural resources management. Information was obtained from a variety of documents, interviews with installation personnel, on-site observations, and communications with both internal and external stakeholders. Keesler-specific management plans were reviewed to ensure compatibility with this INRMP and its goals and objectives. These plans, listed below, are referenced throughout this INRMP.

- General Plan (Black & Veatch 2004)
- IDP (HDR 2015)
- Bird/Wildlife Aircraft Strike Hazard (BASH) Plan (81st Training Wing 2016a)
- Spill Prevention, Control, and Countermeasure (SPCC) Plan (81st Training Wing 2018a)
- Storm Water Pollution Prevention Plan (SWPPP) (Keesler Air Force Base 2011a)
- Storm Water Management Plan (81st Training Wing 2016b)
- Pollution Prevention Plan (81st Training Wing 2011)
- Drinking Water System Master Plan (Keesler Air Force Base 2013a)
- Hazardous Waste Management Plan (81st Training Wing 2018b)
- Water Contingency Response Plan (Air Force Institute for Operational Health 2004)
- Integrated Cultural Resources Management Plan (Keesler Air Force Base 2013b)

By integrating these plans and coordinating with internal and external stakeholders, this INRMP captures any issues or constraints for developing Keesler AFB while supporting the military mission. Additionally, this INRMP serves as a tool for monitoring management strategies and provides the flexibility to adjust these strategies as necessary. Goals and objectives require monitoring on a continuous basis, and management strategies are updated whenever there are changes in mission requirements, adverse effects to or from natural resources, or changes in regulations governing management of natural resources.

2.0 INSTALLATION PROFILE

Table 2-1. Installation profile of Keesler Air Force Base.

Office of Primary Responsibility	Keesler Base Operating Services Base Environmental (BOS/CEV) has overall responsibility for implementing the natural resources management program and is the lead organization for monitoring compliance with applicable federal, state, and local regulations.
NRM/POC	Name: Aaron T. Brownell Phone: 228-377-1262 Email: aaron.brownell.ctr@us.af.mil
State and/or Local Regulatory POC	**MDMR:** Office of Coastal Resources Management , Coastal Resource Management Specialist V **MDWFP**: Fisheries/Environmental Coordinator, Field Supervisor **USFWS**: Mississippi Ecological Field Services Field Office, Supervisory Fish and Wildlife Biologist
Total Acreage Managed by Installation	1,636 acres
Total Acreage of Wetlands	25 acres
Total Acreage of Forested Land	0 acres
Does installation have any Biological Opinions?	No
Natural Resource Program Applicability	☑ Invasive Species ☑ Wetlands Protection Program ☑ Grounds Maintenance Contract/Statement of Work (when necessary) ☐ Forest Management Program ☐ Wildland Fire Management Program ☐ Agricultural Outleasing Program ☑ Integrated Pest Management Program ☑ BASH Program ☑ Coastal Zones/Marine Resources Management Program ☑ Cultural Resources Management Program

2.1 Installation Overview

2.1.1 Location and Area

Keesler AFB is located along the scenic Gulf Coast of Mississippi (MS) within the boundaries of the city of Biloxi. The base is situated on a narrow peninsula bordered by the Back Bay of Biloxi to the north and the Gulf of Mexico to the south. U.S. Highway 90 runs parallel to the southern border of the base and provides access to Interstate 110 to the east of the base (Figures 2-1 and 2-2).

The majority of Keesler AFB land is heavily developed and urbanized. It includes buildings for administration, education, medical treatment, aircraft operation, housing, and other support functions (Table 2-2). Less heavily developed lands are associated with recreation, such as playing fields, the marina park, and the golf course. Open spaces are associated with aircraft runway easements and wetlands.

There is an extensive utility and transportation infrastructure at Keesler AFB, including approximately

- 45 miles of electrical lines,
- 42 miles of sewer lines,
- 65 miles of water lines, and
- 46 miles of gas lines.

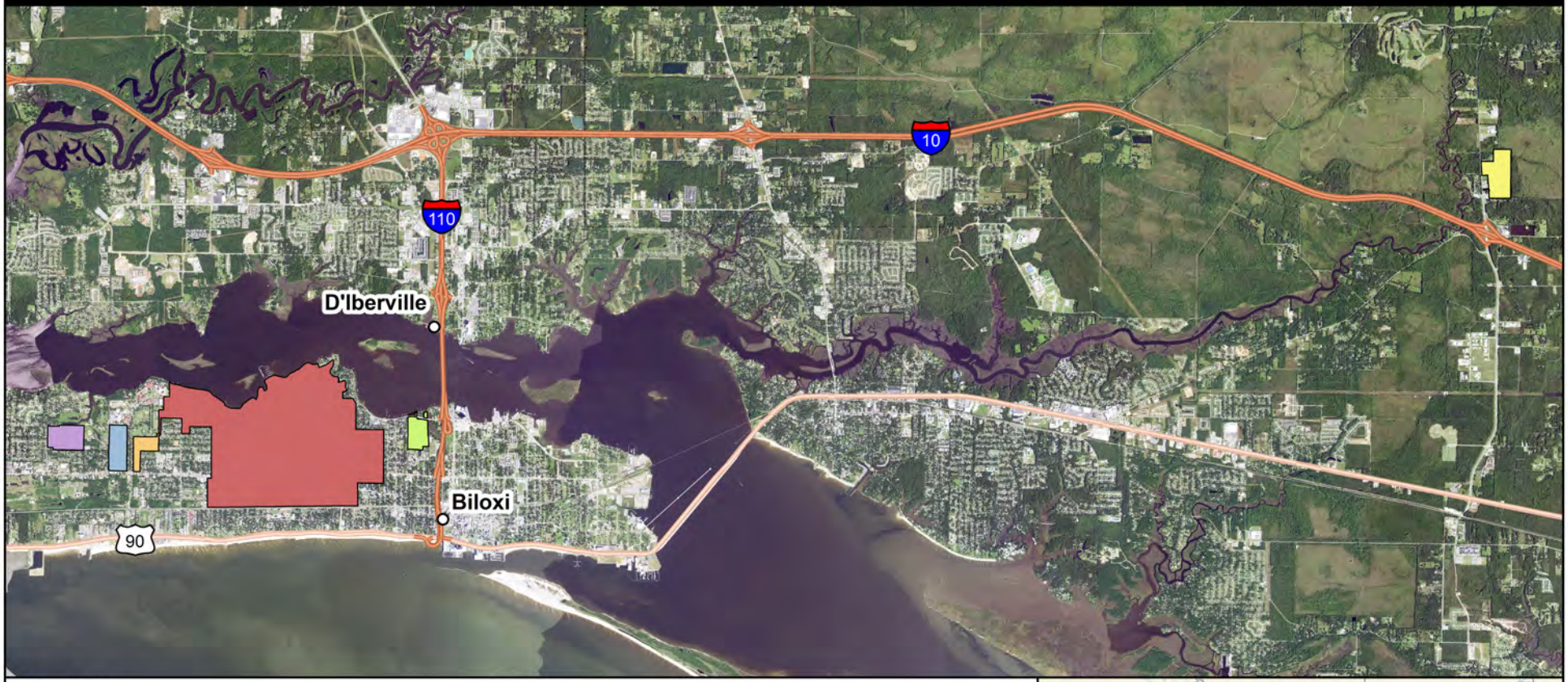
Additionally, Keesler AFB owns a 9.5-mile gas transmission line, which originates from a regulator station near Gulfport's Turkey Creek community, and the base owns and maintains approximately 35 miles of roadways, including the roads in the family housing subdivisions. Larcher Boulevard connects the main gate and the medical center and serves as the primary road, with Ploesti Drive carrying traffic from off-base areas to the west. Meadows Drive, leading from Gate 1, is another primary road.

The Keesler AFB potable water system consists of a network of 10 water-supply wells, 6 elevated storage tanks, and more than 63 miles of distribution mains containing common water system appurtenances. The Keesler AFB water system services the base population, military housing areas, the VA cemetery, and the VA hospital. With these additional areas included, the water system serves approximately 16,000 people (Keesler Air Force Base 2013a). Due to its coastal location, there is very little elevational change across the base's topography. As a result, all source wells and storage tanks are operated within a single pressure zone.

Keesler AFB military housing is privatized.

There are five family housing subdivisions on Keesler AFB: Bayridge (constructed from 2008 to 2010); Thrower Park (including the Family Camp [FamCamp]); East Falcon; West Falcon (all constructed in 2008); and Sandhill Landing Park (constructed in 2005), located nearly 20 miles to the northeast in Vancleave, MS. Harrison Court formerly provided family housing, but the land is now undeveloped. All family housing at Keesler AFB was privatized in October 2011; the contract allows the private company to own, maintain, and lease housing units in the subdivision until 2061. Hurricane Katrina damaged most of the family housing on Keesler AFB, leading to the construction of new family housing units between 2008 and 2010 in East and West Falcon, Thrower Park, and Bayridge.

Figure 2-1. General location and layout of Keesler Air Force Base, Biloxi, MS



Legend

- Major Highways
- Highways

Keesler Air Force Base

- Main Base with Bayridge
- East Falcon Housing
- Harrison Court
- SandHill Landing
- Thrower Park
- West Falcon

N

0 2 4 Miles

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS State dataset (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

81st TRAINING GROUP

Prepared by:
Center for Environmental Management
MILITARY LANDS
Colorado State University

Created: November 20, 2018

Figure 2-2. Aerial image of Keesler Air Force Base

Table 2-2. Descriptions of Keesler Air Force Base installation and geographically separated units (GSU).

Base/GSU Name	Main Use/Mission	Acreage	Where Addressed in INRMP	Describe Natural Resource Implications
Keesler Base	Electronics training, medical facility	1,636	Overview and Scope	Invasive species and pest management, grounds maintenance, BASH, water resources, and cultural resources
Bayridge	330 family housing units	180	Installation Overview	Not applicable (n/a) (privatized)
Thrower Park	198 family housing units	58	Outdoor Recreation and Wastewater	n/a (privatized)
East Falcon	194 family housing units	33	Installation Overview and Water Resources Protection	n/a (privatized)
West Falcon	306 family housing units	54	Installation Overview and Water Resources Protection	n/a (privatized)
Sandhill Landing	160 family housing units	75	Installation Overview and Water Resources Protection	n/a (privatized)
Harrison Court	Undeveloped	43	Installation Overview and Water Resources Protection	Grounds maintenance

Keesler's General Plan (Black & Veatch 2004), which provides the installation with a framework for long-range development decisions, divides the base into nine development-planning areas, as listed below.

- Flight Line
- Headquarters
- Training Vision
- Triangle Vision
- Permanent Party Dormitories
- Industrial
- Main Gate/Visitor's Center
- Division Street Improvements
- Commercial Gate

Each of the nine areas has an Area Development Plan (ADP) that provides a key to the future land-use plan classification scheme. The ADP describes the installation's planning objectives of consolidating compatible functions within the same land-use areas, improving operational efficiency and safety, improving traffic

circulation patterns, and providing aesthetic areas that enhance the quality of life for base personnel (Black & Veatch 2004). Changes in land use caused by Hurricane Katrina had created challenges and opportunities for revising the ADPs for the Permanent Party Dormitories, Main Gate/Visitor's Center, and Division Street Improvements. They were revised as part of the Katrina Redevelopment ADP to reflect changes in floodplain requirements and the additional land area available for development after housing in the North and South Pinehaven subdivision was demolished.

Since development of the 2030 General Plan (Black & Veatch 2004), Keesler AFB has added the Division Street Gate. Although the gate has not been constructed yet, it will be located near the southeast corner of the installation, and a 2014 baseline study conducted to evaluate its potential environmental impacts indicated that there is no evidence of environmental issues that would prohibit the use of the area for gate construction (Department of the Air Force 2014). The buildings in the vicinity were demolished, and the remaining live oaks and other vegetation in this area will be removed prior to construction.

Other future development includes construction of a FamCamp in Harrison Court (which already has the funding for phase one), new buildings built by contractors, various repairs in the harbor, and privatization of utilities on Keesler AFB. Although these are still in the planning and funding phases, their implementation is likely to impact natural resources on Keesler AFB.

2.1.2 Installation History

Second Lieutenant Samuel R. Keesler, Jr.

In the early 1940s, the U.S. began acquiring land for military use when it increased its involvement in World War II (WWII). In 1941, the U.S. War Department activated the Army Air Corps Station No. 8, Aviation Mechanics School, on 1,563 acres of land donated by the city of Biloxi. The school was named in honor of Second Lieutenant Samuel Reeves Keesler, Jr., who died during World War I while serving in France.

During WWII, 142,000 aviation mechanics and 336,000 recruits were trained at Keesler AFB. Other schools that operated during the war included an Air-Sea Rescue School using OA-10A amphibians and modified B-17 planes, a Chemical Warfare School, and the world's first Rotary Wing School, which trained helicopter mechanics. Most B-24 bomber mechanics during the war graduated from the base's program.

Although basic training after the war diminished at Keesler, the base continued to be used for specialized training during the early Cold War years. In 1947, the Army Air Forces moved its Radar School from Florida to Keesler, which was later consolidated with Keesler's Airplane and Engine Mechanics School. Also in 1947, the USAF became an independent branch of the military and, in 1948, Keesler was officially designated "Keesler Air Force Base."

In 1949, Air Training Command determined that Keesler should focus on radar, radio, and electronics maintenance and repair. Also, the Radio Operations School was transferred to Keesler from Scott AFB. The base further expanded its education to include air traffic service technicians, aircraft controllers, and radar mechanics and specialists. Since the late 1940s, Keesler AFB became known as the "Electronics Training Center of the Air Force."

In 1950 and 1951, Keesler AFB facilities underwent significant upgrades with construction of a new electronics laboratory, barracks, and dining hall. Construction also included two-story academic buildings, modern family housing units, and a new hospital. Also constructed during this period was a three-story

dormitory complex, which was named "the triangle" for its layout. The 1950s also saw the addition of a fifth group to the 3380th Technical TRG, the 3380th Installations Group. In 1959, the Air Training Command re-designated the wing as Headquarters, Keesler Technical Training Center. The 1950s also saw an increase in electronics training, including television instruction methods and aircraft warning and control systems. By 1958, Scott AFB relinquished control of its training mission, and all control tower, operator, radio maintenance, and general radio operator courses were transferred to Keesler AFB.

Keesler AFB training for WWII, courtesy of Mississippi Department of Archives and History

In the 1960s, Keesler AFB lost several of its airborne training courses as several schools were transferred to other installations; however, pilot training and space systems courses were incorporated into the base's mission, with an emphasis on flying C-47 aircraft. In the 1970s, the base continued to thrive and became the largest training base for air traffic controllers. In fact, Keesler AFB's school served as the nation's primary supplier of electronics technicians. Through the 1970s, as Keesler AFB adapted to changing needs after the Vietnam War, the USAF School of Applied Aerospace Sciences was deactivated and the 3300th Technical Training Wing was activated in its place.

C-47 flight training

In the 1980s, the Keesler AFB School worked with the Air Force Communications Command's 1872d School Squadron to create prototype-training programs using interactive media. Access to this cutting-edge equipment and education allowed Keesler AFB to excel in technology training. Also, as other bases were closed down and realigned in the late 1980s and early 1990s, Keesler AFB picked up the technical training missions from Chanute AFB and Lowry AFB.

In the 1990s, there was a significant restructuring of Keesler AFB's training goals and missions. In 1992, Air Training Command designated the base's host unit as the Keesler Training Center. As part of this change, the 3300th Technical TRW was downsized to a group, the 3305th Student Group was inactivated, and all units assumed the 393d designation. Furthermore, the technical training group and support squadrons were renumbered in accordance with the new organizational arrangement.

In 1993, the Keesler Training Center was inactivated, and the 81st Tactical Fighter Wing from the Royal Air Force Bentwaters, United Kingdom, was transferred to Keesler AFB and re-designated the 81 TRW as the base's new host organization. Also, the Air Training Command was re-designated the Air Education and Training Command (AETC) and activated the Second Air Force at Keesler AFB to oversee all technical training within AETC.

In 1994, flying training returned to Keesler AFB, and pilots were trained to provide operation airlift support in C-12C/F Huron and C-21A Learjet aircraft. Meanwhile, the 53rd Weather Reconnaissance Squadron (WRS) was transferred to the reserves and its mission merged with the 815th WRS. Also, the 7th Airborne Command and Control Squadron were relocated to Davis-Monthan AFB.

After the year 2000, the 81 TRW became one of the largest technical TRWs in the USAF and AETC. The wing has become renowned for its training and specialization in avionics maintenance; comptroller, radio, and radar systems maintenance; communications electronics; computer systems; air traffic control; weather and personnel tracking systems; and command control systems. In addition to its technology core, Keesler AFB supports the 81 MDG, the third largest medical group in the USAF, which trains doctors, nurses and other medical technicians (Keesler Air Force Base 2006b).

2.1.3 Military Missions

The primary mission of Keesler AFB is to provide technical training. In fact, it is considered the "Electronics Center of Excellence" for the USAF (Keesler Air Force Base 2012a). One hundred sixty-three courses are taught at the base, with an average daily load of 3,474 students. The primary units that make up "Team Keesler" are listed below along with their corresponding missions.

- 81 TRW—The 81 TRW provides technical training to the USAF, Army, Navy, Marine Corps, and other DoD partners at Keesler AFB. The wing is under the AETC and is the overarching wing for the 81 TRW. It includes (1) the 81 TRG, which is the largest electronics training group in the USAF; (2) the 81 MSG; and (3) the 81 MDG (81st Training Wing Public Affairs 2017).
- 81 TRG—The 81 TRW supports the 81 TRW by providing the largest electronics training group in the USAF. The group trains more than 30,000 officers, airmen, and civilian employees of the USAF, Air Force Reserve, Air National Guard, Army, Navy, and Marine Corps (Keesler Air Force Base 2007).
- 81 MSG—The 81 MSG supports the 81 TRW and provides administrative, personnel, civil engineering, transportation, morale and welfare, recreational, communications, supply, base security, and contracting services to the base personnel (Keesler Air Force Base 2013c).
- 81 MDG—The 81 MDG supports the 81 TRW with the primary mission of medical readiness. It operates one of the largest medical facilities in the USAF and is the fourth largest deployment platform for the Air Force medical service. In addition to its military missions, the 81 MDG and the Veteran's Affairs (VA) Medical Campus are designated as DoD/VA Venture Partners known as "Centers of Excellence." The 81 MDG is one of three USAF medical facilities designated in support of the National Disaster Medical System as a Federal Coordinating Center (Keesler Air Force Base 2012b).
- Headquarters Second (2nd) Air Force—The 2nd AF is headquartered at Keesler AFB and is responsible for basic military and technical training for the USAF and Joint and Coalition partners. Under the 2nd AF are the 17th TRW, 517th TRG, 37th TRW, 81 TRW, 82nd TRW, 381st TRG, and 602nd TRG Provisional (81st Training Wing Public Affairs 2017).
- 403rd Wing (403 WG) (USAF Reserve Command)—The 403 WG includes the 53rd WRS, also known as the "Hurricane Hunters." The wing also includes the 815th Airlift Squadron's "Flying Jennies," which is a tactical airlift unit responsible for delivering materials to combat forces and for humanitarian relief (81st Training Wing Public Affairs 2017).
- 85th Engineering Installation Squadron (85 EIS)—The 85 EIS is an Air Force Space Command unit that provides contingency and peacetime

913th MXS training helps to keep 403rd fleet mission-ready.

engineering. The squadron is also responsible for designing, engineering, and installing commercial and industrial equipment and components (81st Training Wing Public Affairs 2017).

- Mathies Non-Commissioned Officer Academy—The academy trains noncommissioned officers from installations around the AF using the Intermediate Leadership Experience course, which incorporates distance learning (81st Training Wing Public Affairs 2017).
- Other agencies—Air Force Audit Agency, Air Force Office of Special Investigations Detachment 407, Area Defense Counsel, Defense Commissary Agency, and Army and Air Force Exchange Services (81st Training Wing Public Affairs 2017).

81 TRW Seal

81 TRG Seal

81 MSG Seal

81 MDG Seal

2nd AF Seal

403 WG Seal

85 EIS Seal

The base supports numerous tenants that are not GSUs. Most of these units are not responsible for natural resources management, but their activities may impact the base's resources. Table 2-3 outlines tenant-specific responsibilities as they relate to natural resources at Keesler AFB.

2.1.4 Surrounding Communities

Keesler AFB is located in Biloxi, Harrison County, MS, which has a population of approximately 205,000. With a population of approximately 45,900, Biloxi is the second largest city in Harrison County and the fifth largest city in Mississippi (United States Census Bureau 2017). Although population growth in the coastal counties of Mississippi decreased in the decade after Hurricane Katrina, the population is growing again and, in some cases, it has exceeded the pre-hurricane population (United States Census Bureau 2000).

Keesler AFB is bordered on the east, south, and west by the city of Biloxi and on the north by the Back Bay of Biloxi. Prior to Hurricane Katrina, land use in the vicinity of Keesler AFB was primarily residential, but it was mixed with commercial, public, and semi-public parcels. Major commercial and industrial areas were located several miles east of the base and consisted of boat manufacturers and seafood operations. Commercial areas in the vicinity of the base included restaurants, shopping facilities, casino and resort hotels, a fuel terminal, government buildings, and small-craft harbors. Those areas were extensively damaged in 2005 during Hurricane Katrina; however, subsequent rebuilding patterns reflect the original land-use patterns.


Back Bay of Biloxi.

Table 2-3. Keesler Air Force Base tenants and natural resource responsibilities.

Tenant Organization	Natural Resources Responsibilities
81 TRW	• The 81 TRW Commander serves as the Energy, Environmental, Safety, and Occupational Health Council (EESOHC) Chair. • The 81 TRW Commander serves as the Tree Board Chair and would review any requests for removal of the live oaks.
81 TRG	• n/a
81 MSG	• The 81 MSG Commander acts as the chair for the Cross Functional Team (CFT), which acts as a prelude to the EESOHC.
81 MDG	• n/a
Headquarters 2nd AF	• n/a
403 WG	• n/a
85 EIS	• n/a
Mathies Non-Commissioned Officer Academy	• n/a
Air Force Audit Agency	• n/a
Air Force Office of Special Investigations	• n/a
Area Defense Counsel	• n/a
Defense Commissary Agency	• n/a
Army and Air Force Exchange Services	• n/a

The Gulf Coast economy is based on a myriad of government agencies, seafood, tourism, and gaming industries and, in Biloxi, manufacturing, government services, and tourism are primary sources of employment. In Pascagoula, Ingalls Shipbuilding is the state's largest manufacturing employer and it is one of the nation's largest producers of U.S. Navy ships (Ingalls Shipbuilding 2018). In Harrison and nearby Jackson counties, Keesler AFB and Ingalls Shipbuilding are the largest employers, respectively, and Stennis Space Center is one of the largest employers in nearby Hancock County. Keesler AFB contributes significantly to the regional economy through its direct employment and support of local businesses. The total annual economic impact of Keesler AFB on the area in 2017 was approximately $1.57 billion. Approximately 7,483 military/student personnel and 3,719 civilians work on the base, and approximately 34,388 retirees reside near Keesler AFB (81st Training Wing Public Affairs 2017). In addition to the resident population, each year Keesler AFB is frequented by thousands of USAF personnel attending training classes.

The seafood industry also plays a prominent role in Biloxi's economy. The Gulf Coast has a history of access to fresh seafood and, in the early twentieth century, there were more than 40 seafood factories in two cannery districts. Despite the ups and downs from oil spills and hurricanes, the Biloxi region still retains a high distinction for its seafood industry, which also encourages tourism in the area (Boudreaux [no date {n.d.}]).

Tourism and gambling have risen to great prominence in the local economy. Indeed, 2017 revenue generated by the Gulf Coast Gaming casinos was $2,080,088,536 (Mississippi Gaming Commission 2017). Although all Mississippi Gulf Coast casinos closed immediately after Hurricane Katrina, three had reopened by December 2005. By 2012, twelve casino resorts were operating on the Mississippi Gulf Coast, nine of which were operating within the city of Biloxi.

Flooding in Biloxi from Hurricane Katrina.

Biloxi also features showplaces that pay tribute to Biloxi's historic and colorful past, including the Saenger Theatre, Mardi Gras Museum, Maritime & Seafood Industry Museum, and the Beauvoir House. All of these properties had extensive damage or were destroyed as a result of Hurricane Katrina, but since then the Saenger Theatre has been rehabilitated and reopened and the Maritime & Seafood Industry Museum was renovated. The Ohr-O'Keefe Museum, which celebrates the work of Biloxi's master potter, George Ohr, and was designed by internationally renowned architect, Frank Gehry, was in construction prior to the hurricane and then opened in 2008.

Tourism continues to expand in Biloxi. Not only are more restaurants, museums, and local sites of interest being developed, Biloxi has become a community known for its annual festivals and celebrations, such as Mardi Gras and Crusin' the Coast. Additionally, the Shuckers, a minor League Baseball team, moved to Biloxi in 2014 and continues to encourage local and regional interest in the area.

2.1.5 Local and Regional Natural Areas

A diverse array of ecosystems, including forests, beaches, rivers, and wetlands, is found along the Gulf Coast region of Mississippi, forming part of a complex landscape structure. The DeSoto National Forest, located within driving distance of the coastal areas, is characterized by gently rolling terrain covered by southern pine ridges and hardwood bottoms with extensive streams. At 378,538 acres, the DeSoto National Forest Ranger District is the largest district in Mississippi. It is situated approximately 10 miles north of Keesler AFB and its southern boundary begins five miles north of the Gulfport-Biloxi area. There are two wilderness areas located within the DeSoto National Forest: the Black Creek Wilderness Area and the Leaf Wilderness Area. Black Creek is Mississippi's only National Scenic River and is renowned for its wide, white sandbars. Two National Recreation trails, Black Creek Trail and Tuxachanie Trail, are also located in the DeSoto Ranger District and offer more than 60 miles of trails for hiking and exploring the wooded areas.

Mississippi Sandhill Crane. Photo courtesy of USFWS.

Established in 1975, the Mississippi Sandhill Crane National Wildlife Refuge is one of more than 540 national wildlife refuges administered by the USFWS. It was established to safeguard the endangered Mississippi Sandhill Crane and its unique but disappearing wet pine-savanna habitat. The refuge is located in Jackson County, Mississippi, three miles north of Gautier. The site consists of more than 19,000 acres and is now part of the Gulf Coast National Wildlife Refuge Complex. The Sandhill Landing housing area on Keesler AFB is located west of the refuge.

The natural resources of the surrounding Biloxi area are also important to the local economy and industry. The waterways of Biloxi's Back Bay are treasured for scenic views, recreational opportunities, and wildlife habitats. They also support a large number of industries, ranging from chemical manufacturers to seafood processors, which have significantly impacted the Back Bay's water quality; their individual impacts vary with the nature of their discharges and chemical-migration distances. In 2001, more than 70 federally regulated facilities were located in the Back Bay of Biloxi. It was estimated that 19 municipal, commercial, and private sewage treatment plants discharged almost 12 million gallons of treated wastewater per day into the bay.

2.2 Physical Environment

2.2.1 Climate

Keesler AFB is located in a subtropical climate zone characterized by mild winters and warm, moist summers. Air temperatures are influenced by the Gulf of Mexico, with average temperatures ranging from 83 degrees Fahrenheit (°F) in summer to 52 °F in winter. These conditions contribute to a long growing season that averages 269 days a year. High temperatures in the summer frequently exceed 90 °F but rarely exceed 100 °F. In winter, low temperatures at Keesler AFB fall below freezing an average of 11 times per year (HDR 2015).

The average annual precipitation is 64.89 inches and is relatively evenly distributed throughout the year, with the greatest amount falling in the summer months. The first and last frosts normally occur in mid-November and March, respectively, and snow is a rare occurrence. Table 2-4 summarizes average temperature and precipitation data.

Keesler AFB is frequently subjected to the winds and torrential rains of tropical cyclones. Indeed, Mississippi has been strongly affected by the powerful winds, high tides, and heavy rains from several tropical storms and hurricanes. The strongest was Hurricane Camille, which made landfall along the Mississippi coastline on 17 August 1969 as a Category 5 storm, with wind gusts reaching 229 miles per hour (mph) in Biloxi. The storm surge exceeded 20 feet above sea level in places along the coast from Pass Christian eastward to Pascagoula Hurricane Katrina, a more deadly hurricane, made landfall on 29 August 2005 as a Category 3 storm with wind speeds over 170 mph. Although Katrina's peak strength was comparable to Camille's intensity, the former was a significantly larger storm and impacted a broader area of the Gulf Coast of Louisiana, Mississippi, and Alabama. Uninsured or underinsured losses were estimated in the $100 to $150 billion range (National Centers for Environmental Information [n.d.]).

Table 2-4. Temperature and precipitation data for Biloxi, MS (United States Climate Data 2018).

Month	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Total Precipitation (inches)
January	60	43	5.08
February	63	46	5.28
March	69	52	6.10
April	76	60	4.49
May	83	68	4.57
June	88	74	7.09
July	90	75	7.13
August	90	75	6.22
September	87	71	5.59
October	79	61	3.82
November	70	52	4.76
December	62	45	4.76

2.2.2 Landforms

Keesler AFB is located within the Coastal Meadows (Flatwoods) topographical division of the Gulf Coast region. The Coastal Meadows are generally flat to slightly elevated, with elevations ranging from sea level in the marshes along the Back Bay of Biloxi shoreline to approximately 30 feet above mean sea level (AMSL) near the southwest portion of the base. Local relief is primarily the result of past depositional and more recent erosional processes. Relief, which is generally low across much of the base, is most notable near the Naval Reserve area, where the land surface gently grades toward the Back Bay of Biloxi (HDR 2015).

2.2.3 Geology and Soils

Keesler AFB is located within the Gulf Coast Geosynclines, which are large, sinking troughs of delta-deposited sediments in the Gulf of Mexico. The geologic units underlying Keesler AFB are not disrupted by faulting or other geologic discontinuities; indeed, it lies in a zone of zero seismicity and the coastal area of Mississippi has not been seismically active in recent time (HDR 2015).

The dominant soil types at Keesler AFB formed from sandy or loamy upland materials. The majority of these soils have low erosion potential, low shrink-swell potential, and are nutrient poor. They have good-to-fair drainage capacity and an estimated weight-bearing capacity of 3,000 to 5,000 pounds per square foot.

2.2.4 Hydrology

Keesler AFB is located in the Mississippi Coastal Watershed, which drains approximately 400,000 acres along the Mississippi Gulf Coast in Harrison and Jackson counties. The metropolitan areas of Biloxi, Gulfport, Ocean Springs, and D'Iberville are situated within this watershed.

There is no central stream that drains the base but, along the northern edge, small tidal creeks provide drainage into the Back Bay of Biloxi, thereby draining to the north most of the surface storm water from Keesler AFB. A portion of the base's storm water also flows south through the city of Biloxi's storm drainage system to the Mississippi Sound (Keesler Air Force Base 2011a). Principal water sources for the Back Bay of Biloxi include freshwater streams from the Biloxi and Tchoutacabouffa River basins, Bernard and Old Fort Bayou basins, Biloxi Peninsula, and the saline waters of the Mississippi Sound that enter via Biloxi Bay. The Back Bay of Biloxi, including Big Lake at its western end, encompasses an area of approximately 10 square miles.

Several major hydrological units occur in the area of Keesler AFB. These include the coastal deposits surficial aquifer, the Citronelle aquifer, and the Miocene aquifer system. Groundwater from the latter system is the principal source of drinking water for Keesler AFB and the city of Biloxi.

Two small ponds were constructed on the Bay Breeze Golf Course at Keesler AFB for irrigation purposes. The larger golf course pond covers 2.7 acres west of the runway. An outfall at the northwest end of the pond is linked to a storm water drain that discharges directly to the Back Bay of Biloxi. The smaller pond is located south of the larger pond and is approximately 0.25 acre in size.

A coastal marsh, characterized by emergent wetlands and dominated by smooth cordgrass (*Spartina alterniflora*) and needlegrass rush (*Juncus roemerianus*), borders the base along the northern shoreline adjacent to the Back Bay of Biloxi. A small island of coastal marsh is also located west of the Keesler marina in the center of the small cove. The shallow fringe marshes along the shoreline are influenced by tidal and estuarine flows and receive both monitored and unmonitored surface discharge from off-base sources, including residential, commercial, industrial, and shipping facilities.

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

Ecoregions within the *National Hierarchical Framework of Ecological Units* system delineate areas of general similarity in ecosystem type and the type, quality, and quantity of environmental resources. Ecoregions are identified through the spatial patterns and composition of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The ecoregional scale of the framework is subdivided into three hierarchical levels: Domain, Division, and Province. Keesler AFB is located within the Humid Temperate Domain, Subtropical Division, and Outer Coastal Plain Mixed Forest Province (Bailey 1995). The Outer Coastal Plain Mixed Forest Province encompasses the flat and irregular Atlantic and Gulf Coastal Plains down to the sea. This province has numerous sluggish streams, marshes, swamps, and lakes. The average annual temperature ranges from 60 to 70 °F, and rainfall occurs throughout all seasons, with an annual average of 40–60 inches. The vegetation is characteristic of a temperate rainforest and includes evergreen and laurel forests, although iconic to this land are the forests of live oaks draped with Spanish moss (*Tillandsia usneoides*).

2.3.2 Vegetation

2.3.2.1 Historical Vegetative Cover

Prior to development, the vegetation association where Keesler AFB is now located was characterized by upland pine-oak (*Pinus-Quercus* spp.) (United States Air Force 1994). For hundreds of years, the land was occupied by Native American tribal groups, which had minimal impact on the natural vegetative cover. In 1699, French explorers encountered members of the Biloxi tribe, but the area fell under the control of French, English, and Spanish authority, the associated disturbances of which began to impact the native vegetation. In 1803, the Louisiana Purchase transferred control of the region to the U.S. government and land disturbances continued.

Through the nineteenth century, the land was converted for urban and agricultural uses. In 1832, forested land near the present Keesler AFB marina became part of the national reserve. In 1870, the rail link between New Orleans, Louisiana, and Mobile, Alabama, was completed, which led to more development. Throughout the century, activity on the peninsula was based on tourism and seafood production. In 1906, the city of Biloxi was given to the Naval Reserve Park, and the city continued to acquire land for the reserve. In 1925, a small section of the Naval Reserve Park was given to the Coast Guard.

During the Great Depression in the 1930s, Biloxi officials looked for ways to encourage economic development through use of the parkland and the city provided land for a VA hospital and airport construction. In 1941, the airport was donated to the U.S. Army Air Corps technical training school, which developed into Keesler AFB. The cumulative effects of all the development significantly altered the historical vegetative cover.

2.3.2.2 Current Vegetative Cover

The present vegetation at Keesler AFB and in Biloxi is largely characterized by urban and suburban flora, with a few naturally vegetated wetlands bordering the Back Bay of Biloxi.

The majority of Keesler AFB has been developed by the construction of buildings and paving for runways, roadways, and parking. The cover types or vegetation communities that exist on the base today include areas developed for mission activities, underdeveloped grass areas, coastal wetlands, and urban forest. Many of these areas were affected by Hurricane Katrina in 2005 but have rebounded in recent years. The current vegetation cover on Keesler AFB is further described in the list below.

- Mission activities associated with developed facilities include aircraft operations and maintenance, administration, airfields, community, housing, industry, medical, technical training, and outdoor recreation. The majority of these areas include roadways, buildings, and landscaped areas.
- Undeveloped but maintained open areas are dominated by Bermudagrass (*Cynodon dactylon*), centipede grass (*Eremochloa ophiuroides*), and St. Augustine grass (*Stenotaphrum secundatum*). Buildings typically do not occupy a large percentage of these areas, but they include two manmade ponds constructed on the golf course for irrigation purposes.
- Coastal wetlands are dominated by smooth cordgrass and needlegrass rush. These areas cover approximately 28 acres along the northern border of the base adjacent to the Back Bay of Biloxi. There is also a small island of smooth cordgrass and needlegrass rush marsh just west of the marina and north of the golf course. Numerous other islands of cordgrass and rushes are located in the Back Bay of Biloxi. The shallow coastal fringe marshes along the shoreline are influenced by tidal

and estuarine flows and receive surface discharge from both Keesler AFB and off-base sources. These wetland types are valuable, highly productive coastal salt marshes that provide nursery, spawning, and feeding grounds for a large number of commercial and sport fish, shrimp, and shellfish. The wetlands on Keesler AFB are considered less productive for fisheries as a result of their narrow, linear configurations.

Invasive vegetation being evaluated to preserve wetlands on Keesler AFB.

- Urban forests on the base occupy open areas between buildings and semi-improved areas. These areas are dominated by the live oak and slash pine (*Pinus elliottii*). More than 200 of the larger live oaks have a diameter at breast height of more than 44 inches and are estimated to be more than 200–250 years old. Other common native trees include water oak (*Quercus nigra*), northern red oak (*Quercus rubra*), turkey oak (*Quercus laevis*), river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), and sweetgum (*Liquidambar styraciflua*). Common nonnative trees include Callery pear (*Pyrus calleryana*) and crapemyrtle (*Lagerstroemia indica*). Prior to Hurricane Katrina, there were more than 12,000 trees on the base but, after the storm, an estimated 5,000 trees were removed (Keesler Air Force Base 2006a). Of particular concern is the stress that was placed on the larger live oaks, which were already showing signs of stress due to drought conditions experienced during previous late summers. Compaction around the trees has added an additional stressor.

2.3.2.3 Turf and Landscaped Areas

There are turf and landscaped areas in the improved and semi-improved areas on the base. Improved grounds require intensive maintenance and include lawns, landscaped areas/flower beds, portions of the golf course, and recreational areas. Grass varieties found on the base (introduced and native) include centipede and St. Augustine grass, Bermudagrass, and bahiagrass (*Paspalum notatum*). Landscaped areas contain trees, shrubs, flowers, vines, ground covers, rocks, and mulch. Predominant grass varieties on the golf course include Bermudagrass, bahiagrass, and common carpetgrass (*Axonopus fissifolius*). Bermudagrass covers the tees and greens, whereas Bermudagrass and common carpetgrass cover the fairways. In the winter months, the fairways are over-seeded with perennial ryegrass (*Lolium perenne*), and a ryegrass mixture is used on the golf course greens (81st Training Wing 2016a).

Semi-improved grounds generally require less maintenance than improved grounds. These areas include picnic areas, urban forested areas, ammunition storage areas, airfields, and golf course roughs. The most common varieties of grasses used on these areas are Bermudagrass and bahiagrass. Beds and other planted areas typically are not established on semi-improved grounds at Keesler AFB. The golf course roughs are mostly covered with bahiagrass; however, some Bermudagrass and common carpetgrass are present.

The Keesler AFB BASH Plan calls for the management of grass height near the flight line and flight safety zones. The 81 TRW agrees that the grass will be mowed adjacent to the runways and completed in the infield or outermost areas of the grassy areas to a standard height of 10 inches. It has been determined that these criteria effectively discourage birds from using the aircraft takeoff and landing areas (81st Training Wing 2016a).

2.3.3 Fish and Wildlife

The primary fish and wildlife management areas on Keesler AFB are the coastal salt marsh wetlands along the Back Bay of Biloxi, the marina, and the airstrip. Issues concerning fish and wildlife management include the licensing program for fishing, wetland habitat conservation, nuisance wildlife species management, and the BASH program. No hunting or trapping programs are in place for Keesler AFB. Additionally, no significant fossil resources have been identified on the base. Table 2-5 describes the habitat types and locations within the base, per the INRMP classification scheme.

Table 2-5. Fish and wildlife management habitat classification at Keesler Air Force Base.

Habitat	INRMP Classification	Mississippi Natural Heritage Program Classification	Rank[1]
Airfield	Semi-Improved and Improved	Urban/Industrial/Residential Habitat Conversion	SW
Wetlands and Ponds	Unimproved	Brackish Marsh	S3
		Irregularly Flooded Saline Marsh	S3
		Saltmeadow Cordgrass Herbaceous	S2
		Coastlands Pond	S1
Urban Forest Areas[2]	Semi-Improved	Maritime Oak Forest	S1
Other Nuisance Wildlife Species Management Areas[3]	Semi-Improved and Improved	Urban/Industrial/Residential Habitat Conversion	SW

[1] S1=Critically imperiled in Mississippi; S2=Imperiled in Mississippi; S3=Rare or uncommon in Mississippi; SW=Invasive (ruderal).

[2] Urban Forest Areas include designated city of Biloxi Heritage Trees and the Naval Reserve Oaks.

[3] Other Nuisance Wildlife Species Management Areas include storm drain ditches and residential, golf course, and commercial areas.

Note: For fish and wildlife management purposes, applicable habitats have been described using the classification scheme developed by the Mississippi Natural Heritage Program.

2.3.3.1 Bats

On 28 April 2017, Tetra Tech established four Wildlife Acoustics Song Meter 4 full spectrum acoustic bat detector stations to inventory bats and establish a baseline for monitoring local and migratory bat species at Keesler AFB (Schwab 2018). Each detector station consisted of a battery-powered detector and tripod-mounted microphone. To maximize sound-data quality, microphones were situated at least three meters above the ground, at least three meters from vegetation and other obstructions, and at least 15 meters from known or potential roost sites. To capture overall bat diversity, including threatened and endangered species, the detectors were placed in habitats/locations recommended by the USFWS's *2017 Range-Wide*

Indiana Bat Summer Survey Guidelines (United States Fish and Wildlife Service 2017) (e.g., forest canopy openings, woodland edges, near water sources).

The inventory and monitoring effort yielded a total of 255 detector nights from 28 April through 29 July 2017 to include the summer maternity period and portions of the spring and fall migration periods. Echolocation-sequence data were standardized to number of bat passes per detector night and then analyzed via Kaleidoscope Pro (Wildlife Acoustics, Inc., ver. 4.2.0) and the "Bats of North America 4.2.0" classifier (for expected species). Expected species were determined by referring to records, known and expected distributions, and whether or not there was suitable habitat in the area. SonoBat ver. 4.2.1 (SonoBat, Inc.) was used to manually review a subset of echolocation sequences to verify auto classifications. For additional methods and equipment detail, please refer to Schwab (2018).

The study results yielded an average mean activity rate of 580.7 bat passes per detector-night at Keesler AFB. Activity rates greatest at detector station MSKE-03 and nearly twice that recorded at the other three stations; however, only 16 (April 28–May 14) of the 255 detector nights (6.3 percent) were represented by station MSKE-03. It isn't clear, therefore, whether the high detection rates at MSKE-03 resulted from a few intensely busy nights or whether the area was used more heavily by bats than the other three areas. Twelve bat species were auto-classified, but four of those were suspected errors (species not expected to occur in the Biloxi region), and the other eight species were identified manually. Any echolocation files auto-classified as those from threatened or endangered species were reviewed internally and verified by bat acoustics experts. Table 2-6 lists the eight species confirmed at Keesler AFB and the mean activity rates of each species at Keesler AFB. Readers should refer to section Integrated Pest Management Program of this report for information on bat management protocols used at Keesler AFB.

Table 2-6. Mean activity rates (bat passes per detector-night) recorded per species at each detector station, Keesler Air Force Base (Schwab 2018).

Species	Station				Overall Mean Activity Rate	Standard Error
	MSKE-01[1]	MSKE-02[1]	MSKE-03[1]	MSKE-04[1]		
Big Brown Bat (*Eptesicus fuscus*)	5.4	14.4	119.5	13.5	17.5	2.9
Brazilian Free-Tailed Bat (*Tadarida brasiliensis*)	20.6	128.5	231.3	53.3	77.5	10.4
Eastern Red Bat (*Lasiurus borealis*)	60.6	8.8	28.6	16.2	30.6	3.1
Evening Bat (*Nycticeius humeralis*)	456.2	140.5	448.9	293.3	311.5	31.0
Hoary Bat (*Lasiurus cinereus*)	24.7	26.6	129.4	10.7	28.4	4.0
Northern Yellow Bat (*Lasiurus intermedius*)	15.9	42.8	95.9	14.2	29.4	3.7
Southeastern Myotis (*Myotis austroriparius*)	0.1	0	0.1	0	0.1	<0.1
Tri-Colored Bat (*Perimyotis subflavus*)	19.2	2.6	4.8	10.9	10.8	1.1

[1] MSKE = reference to individual monitoring stations.

2.3.4 Threatened and Endangered Species and Species of Concern

Threatened and Endangered Species (TES) surveys were conducted at Keesler AFB in 2006 and 2012. For the former survey, a list of federally threatened and endangered species with potential to occur in the vicinity of the base was obtained from the USFWS and NOAA Fisheries. Additionally, a list of state threatened and endangered species potentially occurring in the vicinity of the base was obtained from the Mississippi Natural Heritage Program (MSNHP). A list of all species and their legal status is provided in Table 2-7.

Only one federally listed species, the brown pelican, was observed in Back Bay. Potential habitats for one federally listed species, the bald eagle, and one state listed species, Bewick's wren, were found near the base. Six other federally listed species (Florida manatee [*Trichechus manatus latirostris*], gulf sturgeon, loggerhead sea turtle, Kemp's ridley sea turtle, hawksbill sea turtle, and leatherback sea turtle) may occur in the open waters of the Back Bay of Biloxi. Additionally, five species of concern (Mississippi diamondback terrapin, gulf salt marsh snake, rainbow snake, Alabama red-bellied turtle, and green sea turtle) may occur in the Back Bay of Biloxi, Keegan Bayou, and adjacent wetlands.

In 2012, a monitoring and biological survey was conducted at the Sandhill Landing housing area for the Mississippi Sandhill Crane, which had been noted in the Navy Biological Survey when the area was developed. The survey yielded no evidence that the Mississippi Sandhill Crane nests in the area (Keesler Air Force Base 2012c). USFWS officials with the Mississippi Sandhill Crane National Wildlife Refuge concurred with the report's findings.

2.3.5 Wetlands and Floodplains

A wetlands delineation project was conducted for Keesler AFB in November 2006 to update the original delineation conducted by the U.S. Army Corps of Engineers (USACE) in 2002. It is estimated that the base encompasses approximately 28 acres of jurisdictional wetlands (i.e., ones that fall under Section 404 of the Clean Water Act) along the shore of the Back Bay of Biloxi (Figure 2-3). In general, the 2006 delineation line aligns with the original delineation. A wetland delineation is valid for five years and an updated delineation is required if the base requires a Section 404 permit for construction activities involving placement of fill in U.S. waters or wetlands. The new wetland lines were verified by base personnel and the MDMR in 2012 but, because more than five years have passed since the last delineation was conducted, an update may be required for activities requiring a permit.

Keesler AFB wetlands.

The USFWS has completed large-scale (7.5-minute topographic quadrangle, in which 1 inch = 2,000 feet) National Wetlands Inventory (NWI) maps, which include the wetlands associated with Keesler AFB. Table 2-8 summarizes the types, descriptions, relative natural value, acreage, and percent of the total acreage of NWI wetlands on Keesler AFB. The formal delineation along the shore of the Back Bay of Biloxi resulted in an estimate of 28 acres of wetlands in this area, but the NWI maps estimate a total of 15.4 acres of wetlands on the entire base. This difference is attributed to the fact that the survey was conducted via field verification, an acceptable methodology, whereas the NWI maps are estimates generated from aerial photographs.

Table 2-7. Threatened and endangered species and their occurrence at and in the vicinity of Keesler Air Force Base.

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Occurrence at Keesler AFB
Fishes				
Giant ocean manta ray	*Manta birostris*	T	None	Not likely to occur in Back Bay
Gulf Sturgeon	*Acipenser oxyrhynchus desotoi*	T	E	May occur in Back Bay
Smalltooth sawfish	*Pristis pectinata*	E	None	Not likely to occur in Back Bay
Reptiles				
Eastern Indigo Snake	*Drymarchon corais couperi*	T	E	Not likely to occur on base
Gulf Salt Marsh Snake	*Nerodia clarkii*	None	C	May occur in Back Bay, Keegan Bayou and adjacent wetlands
Rainbow Snake	*Farancia erytrogramma*	None	E	May occur in Back Bay, Keegan Bayou and adjacent wetlands
Southern Hognose Snake	*Heterodon simus*	None	E	Not likely to occur on base
Black Pine Snake	*Pituophis melanoleucus lodingi*	T	E	Not likely to occur on base
Alabama Red-Bellied Turtle	*Pseudemys alabamensis*	T	E	May occur in Back Bay, Keegan Bayou and adjacent wetlands
Gopher Tortoise	*Gopherus polyphemus*	T	E	Not likely to occur on base
Mississippi Diamondback Terrapin	*Malaclemys terrapin pileata*	None	C	May occur in Back Bay, Keegan Bayou and adjacent wetlands
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	E	May occur in Back Bay, but no habitat exists for nesting on the base
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E	May occur in Back Bay, but no habitat exists for nesting on the base
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	E	May occur in Back Bay, but no habitat exists for nesting on the base

Table 2-7. Threatened and endangered species and their occurrence at and in the vicinity of Keesler Air Force Base.

Common Name	Scientific Name	Federal Status[1]	State Status[1]	Occurrence at Keesler AFB
Green Sea Turtle	*Chelonia mydas*	T	E	May occur in Back Bay, but no habitat exists for nesting on the base
Loggerhead Sea Turtle	*Caretta caretta*	T	E	May occur in Back Bay, but no habitat exists for nesting on the base
Amphibians				
Dusky Gopher Frog	*Rana Capito sevosa*	E	E	Not likely to occur on base
Birds				
Red-Cockaded Woodpecker	*Picoides borealis*	E	E	Not likely to occur on base
Brown Pelican	*Pelecanus occidentalis*	None	E	Observed on Back Bay
Red Knot	*Calidris canutus rufa*	T	None	Not likely to occur on base
Bald Eagle	*Haliaeetus leucocephalus*	None[2]	E	May forage on Back Bay
Piping Plover	*Charadrius melodus*	T	E	May forage along sandy area of Back Bay in winter
Bewick's Wren	*Thryomanes bewickii*	None	E	May forage along the coast of the Back Bay in winter
Mississippi Sandhill Crane	*Antigone canadensis pulla*	E	E	Not likely to occur on base
Wood Stork	*Mycteria americana*	T	E	Not likely to occur on base
Mammals				
West Indian Manatee	*Trichechus manatus*	E	E	May occasionally occur in Back Bay
Plants				
Louisiana Quillwort	*Isoetes louisianensis*	E	E	Not likely to occur on base

[1] E = Endangered; T = Threatened; C = Candidate species.
[2] Protected by the Bald and Golden Eagle Protection Act.

Table 2-8. National Wetlands Inventory (NWI)-classified wetlands located at Keesler Air Force Base.

NWI Code	Full Description of NWI Type	Relative Natural Value[1]	Acreage	Percent of Total Acreage[2]
E1UBL	Estuarine, sub tidal, unconsolidated bottom	High	5.59	0.33
E2EM1P	Estuarine, intertidal, emergent, persistent	High	6.50	0.38
E2EM1Pd	Estuarine, intertidal, emergent, persistent, partially drained/ditched	High	0.17	0.01
PEM1Bd	Palustrine emergent, persistent, saturated, partially drained/ditched	High	0.20	0.01
PFO1R3	Palustrine forested, broad-leaved deciduous, seasonal-tidal	Low	1.78	0.11
PFO3/1 Ad[2]	Palustrine forested, broad-leaved evergreen/broad-leaved deciduous, temporarily flooded	Low	0.02	<0.01
PFO3B[2]	Palustrine forested, broad-leaved deciduous, saturated	Low	0.27	0.02
PUBHx	Palustrine unconsolidated, permanently flooded, excavated	Low[3] (manmade golf course pond)	0.78	0.05
PUBVx	Palustrine unconsolidated, permanent tidal, excavated	Low[3] (manmade golf course pond)	0.12	<0.01
TOTALS			**15.43**	**0.92**

[1] Wetland values are relative estimates of value to society based on their natural functions. Coastal salt marsh wetlands are among the most valuable habitats. Their values include high rates of plant production, food chain support, shoreline stabilization, filtration of pollutants, endangered species habitat, and wildlife habitat.

[2] All forested wetlands along the northern shore of the base were eliminated by Hurricane George in 1998. Because the extent of wooded and manmade debris in this area was significant, the area had to be cleared of all trees. The area currently consists entirely of emergent wetlands.

[3] Although the golf course ponds on the base are highly modified open water habitats, they are mapped as wetlands under the NWI classification system.

2.3.6 Other Natural Resource Information

The majority of the base has been developed with buildings, roads, and runways. Therefore, except for the 28 acres of coastal wetlands, Keesler AFB does not support an abundance or variety of natural habitats. Open areas on the base consist primarily of mowed lawns, clear zones, or semi-wooded lots between the facilities, including a large number of old live oaks. These trees and their management are discussed in greater detail in Section 7.7.2.

2.4 Mission Impacts on Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Keesler AFB is located in a coastal area with property boundaries bordering the Back Bay of Biloxi and near the Mississippi Sound. Coastal resources at stake on Keesler AFB include valuable shoreline properties that are threatened by erosion and the estuarine and barrier island ecosystems and associated resources that were affected by past construction activities. Although these coastal areas could present constraints to base planning and mission, no expansion of the mission is expected at this time.

2.4.2 Land Use

Keesler AFB covers 1,636 acres, most of which is improved and/or developed. Improved grounds require maintenance of lawns and landscaped areas. Semi-improved grounds, such as airfield areas and clear zones, require only periodic maintenance, and unimproved grounds require only minimal maintenance (Figure 2-4). Table 2-9 provides more information regarding the distribution of land uses on Keesler AFB.

Table 2-9. Land-use distribution at Keesler Air Force Base.

Land Use Type	Acreage
Community Services	37
Medical	58
Aircraft Operations	70
Administrative	102
Commercial Services	105
Industrial	120
Technical Training	130
Housing Unaccompanied	158
Airfield	233
Outdoor Recreation	343
Open Space	373
Housing Accompanied	388
Total	**2,117**

2.4.3 Current Major Impacts

Major sources of potential pollution or safety concerns associated with base operations include hazardous materials and hazardous waste, solid waste disposal and recycling, fuel storage, environmental restoration program (ERP) sites, air emissions, wastewater, Air Installation Compatible Use Zones (AICUZ), and noise.

Figure 2-3. Wetlands associated with Keesler Air Force Base

Legend

- Wetlands
- Keesler Air Force Base
- Major Highways
- Highways

N

0 0.5 1 Mile

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS
State database (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

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Colorado State University

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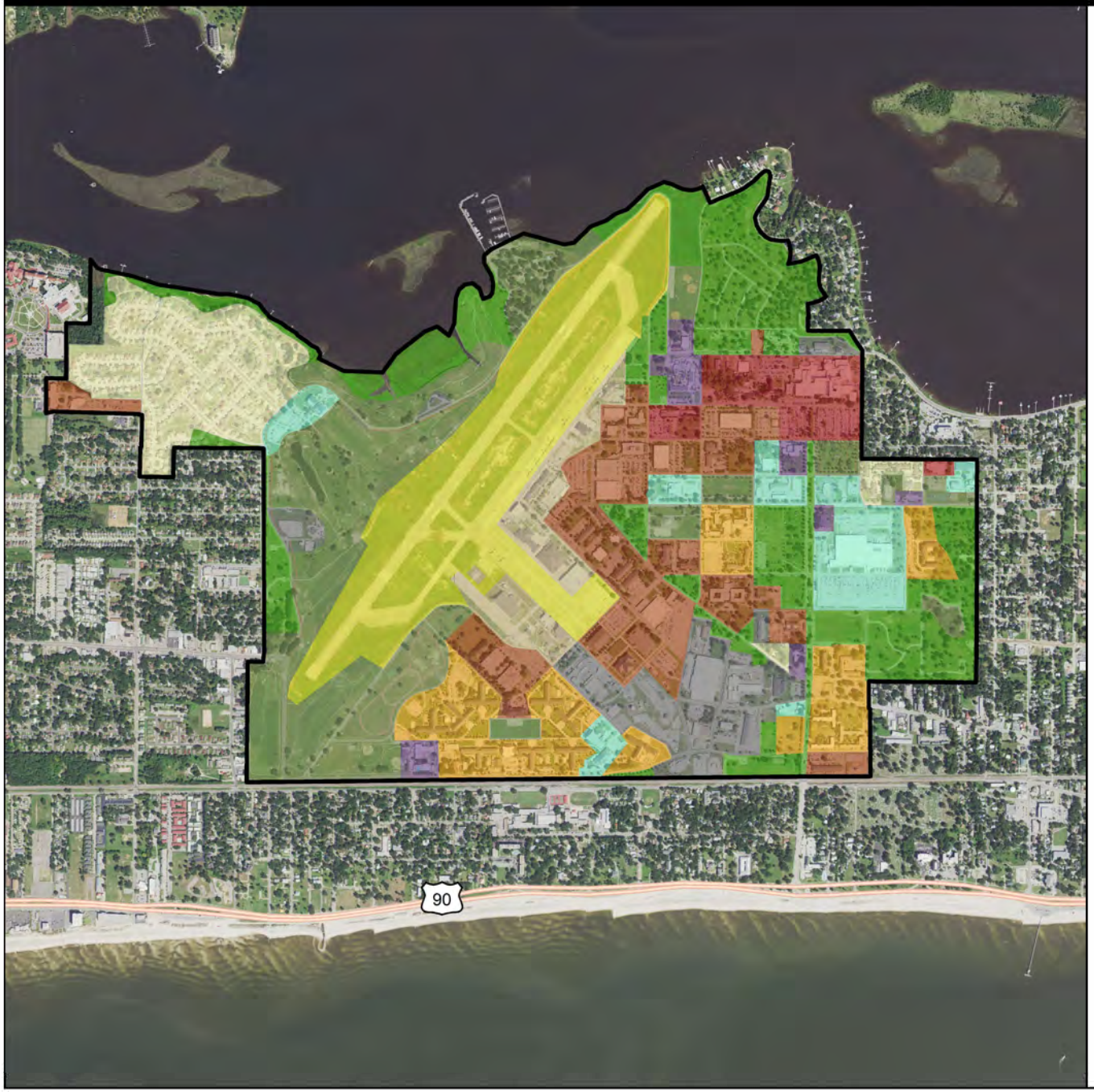
Figure 2-4. Existing land uses on Keesler Air Force Base



Legend

Major Highways

Highways

Land-Use Type

- An Industrial Use
- Administration
- Aircraft Operations and Maintenance
- Airfield Clearance
- Community Commercial
- Community Service
- Housing
- Housing Unaccompanied
- Medical/Dental
- Open Space/Buffer Zone
- Outdoor Recreation

N

0 0.25 0.5 Mile

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS State dataset (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

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2.4.3.1 Hazardous Materials and Hazardous Waste

Hazardous materials are identified and regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (the "Superfund" act), as amended (42 U.S.C. §9 601 et seq.), the Occupational Safety and Health Administration standards, and the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, as amended (42 U.S.C. Chapter 116). Hazardous materials have been defined in AFI 32-7086, *Hazardous Materials Management*, to include any substance with characteristics that could harm people, plants, or animals. Hazardous waste is defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended (U.S.C. 6901 et seq.), as any solid, liquid, contained gaseous or semisolid waste, or any combination of wastes, which could or do pose substantial hazards to human health or the environment. Waste may be classified as hazardous due to its toxicity, reactivity, ignitibility, or corrosiveness. Certain types of waste also are "listed" or identified as hazardous in 40 Code of Federal Regulations (CFR) 263, *Standards Applicable to Transporters of Hazardous Waste*.

Collecting hazardous waste.

Hazardous materials management at USAF installations is guided primarily by AFI 32-7086 and AFI 32-7042, which incorporate the requirements of all federal regulations, other AFIs, and DoD directives for reducing the use and purchase of hazardous materials. The hazardous materials addressed by the instruction include ozone-depleting substances and products containing any of the chemicals listed under EPCRA, also referred to as the Superfund Amendments and Reauthorization Act Title III. At Keesler AFB, no EPCRA Section 313 chemicals are currently used in amounts exceeding threshold levels set by the U.S. Environmental Protection Agency (EPA) and subsequently by the MDEQ.

All hazardous materials brought onto Keesler AFB must receive prior authorization. Contractors are allowed to use only contract-approved chemicals, which are specified in their scopes of work. The Safety Data Sheet and authorization request form are first submitted to the KBOS/CEV, Bioenvironmental, and Safety for review and authorization.

At Keesler AFB, hazardous materials are tracked through the EESOH-Management Information System. The storage, tracking, and labeling of hazardous materials is conducted per USAF guidelines. For petroleum, oil, and lubricant materials, spill prevention guidelines are detailed in the base's SPCC Plan (81st Training Wing 2018b). The base also maintains detailed best management practices (BMPs) in the SWPPP (Keesler Air Force Base 2011a), which the base implements to prevent the release of pollutants into waterways such as the Back Bay of Biloxi.

Unless otherwise exempted by CERCLA regulations, RCRA Subtitle C (40 CFR Parts 260 through 270) regulations are administered by the EPA and are applicable to the management of hazardous waste. In the State of Mississippi, regulatory authority for hazardous waste is delegated and enforced by the MDEQ. Hazardous waste on Keesler AFB must be handled, stored, transported, disposed of, or recycled in accordance with both federal and MDEQ regulations.

Keesler AFB is registered as a municipal, large-quantity generator of hazardous waste. The hazardous wastes generated on base include spent solvents, thinners, strippers, paint waste, laboratory chemicals, and unused materials considered to be waste or products containing hazardous materials that have exceeded their shelf life. Motor oil, turbine oil, hydraulic fluid, antifreeze, batteries, and fluorescent lights used/spent

on base are transported to an off-base facility for recycling. A total of 23 satellite accumulation points are located on the base. All hazardous wastes are transported to the 90-day waste accumulation site located in Building 4420 for transport. Details concerning hazardous waste storage, tracking, and disposal at the base are located in the Hazardous Waste Management Plan (81st Training Wing 2018b).

Since 1987, implementation of a waste minimization program has reduced hazardous waste generation at Keesler AFB by 76 percent from 56,893 pounds generated in 1992 to an average of approximately 12,000 pounds of hazardous waste per year under normal operations. In 2017, approximately 9,494 pounds of hazardous waste were transported off Keesler AFB for disposal (Mills 2018).

2.4.3.2 Solid Waste Disposal and Recycling

USAF regulatory requirements and management of solid waste are established by AFPD 32-70, which requires compliance with applicable federal, state, and local environmental laws and standards. For solid waste, AFPD 32-70 is implemented by AFI 32-7042. AFI 32-7042 requires that each installation have a solid waste management program that includes a solid waste management plan to address handling, storage, collection, disposal, and reporting of solid waste. State requirements are covered under Mississippi Regulation SW-2, *Nonhazardous Solid Waste Management Regulations and Criteria*.

Recycling at Keesler AFB.

Solid waste generated at Keesler AFB is collected by a service contractor and disposed of at the MacLand Landfill, located in Moss Point, MS. Recycling services are performed by the service contractor under the Qualified Recycling Program. Materials collected include mixed paper, steel and aluminum cans, glass, plastics, and cardboard. Construction and demolition waste from the base that requires disposal is transported to the Coastal Recyclers Landfill in Biloxi. Solid waste collection/disposal and recycling in the housing areas are handled by the privatized housing contractor. Therefore, the residential solid waste and recycling is not counted in the installation waste stream.

2.4.3.3 Fuel Storage

All regulated liquid fuel storage tanks, including underground and aboveground storage tanks that did not meet current environmental requirements, were upgraded, replaced, or removed by 1998.

2.4.3.4 Environmental Restoration Program Sites

The ERP is a USAF program that identifies, quantifies, and mitigates hazardous waste sites on DoD installations. The ERP is a subcomponent of the Defense Environmental Restoration Program, which became law under the Superfund Amendments and Reauthorization Act in 1986. The ERP requires each DoD installation to identify, investigate, and clean up hazardous waste disposal sites. These ERP sites can be designated either as “finished” or “open” (investigations are still ongoing). Any land development in the area of these ERP sites is discouraged until the area is given a closure, indicating that the site needs no further regulatory action. If no long-term monitoring is required, then the land may be developed.

2.4.3.5 Air Emissions

The Clean Air Act of 1970, as amended (42 U.S.C. § 7401), directed the EPA to develop, implement, and enforce effective environmental regulations that would ensure cleaner air for the environment. To protect the environment and public health and welfare, the EPA developed concentration-based standards—the National Ambient Air Quality Standards (NAAQS). The EPA classifies the air quality within an air quality control region according to whether or not the concentrations of pollutants in the atmosphere exceed primary or secondary NAAQS, which are currently established for six air pollutants known as criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ground-level ozone (O_3), sulfur oxides (SO_x measured as sulfur dioxide, SO_2), lead (Pb), and particulate matter (PM) (United States Environmental Protection Agency 2018). PM standards incorporate two classes: (1) particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), and (2) particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) (United States Environmental Protection Agency 2016a). The NAAQS are shown in Table 2-10.

Air quality testing at Keesler AFB.

Mississippi's statewide air quality monitoring network is operated by both state and local environmental programs. Ambient air quality data from monitors are used to assess the regions' air quality in comparison to the NAAQS. Currently, the state of Mississippi is in attainment for all of the NAAQS and remains in attainment status with the 8-hour ground-level ozone and fine particulate matter ($PM_{2.5}$) standards.

Keesler AFB is located within the Mobile-Pensacola-Panama City-Southern Mississippi Interstate Air Quality Control Region 5. The county meets the national ozone standard, but currently there are no data for CO, Pb, NO_2, SO_2, and PM_{10} (U.S. Environmental Protection Agency 2016c).

Based on the potential to emit, Keesler AFB is classified as a major source of air pollutants and is currently operating under a Synthetic-Minor Operating Permit (No. 1020-00006). The permit was issued for the operation of air emissions equipment at a synthetic minor source (i.e., a source with potential to emit regulated "New Source Review" pollutants at or above thresholds for major sources) and expires on 30 April 2023 (State of Mississippi Office of Pollution Control 2018). The largest sources of actual regulated pollutant emissions at Keesler AFB are external combustion (mostly boilers and heaters), followed by internal combustion (emergency generators). The 81 TRW partnered with MDEQ to develop a plan for reducing air contaminant emissions during an air-pollution alert, warning, or emergency. Actions include reduction or cessation of nonessential vehicle trips, engine operation, boiler operation, fire training, painting and corrosion-control activities, construction work, and other electrical and fuel consumption activities. Air emissions were calculated for all identified sources belonging to the source categories listed below.

- Abrasive blasting
- External combustion
- Fuel cell maintenance
- Fuel dispensing
- Fuel fill stands
- Fuel storage
- Miscellaneous chemical use
- Ozone-depleting substances
- Pesticide usage
- Small arms firing—indoor
- Solvent degreasing
- Stationary internal combustion equipment
- Surface coating
- Woodworking

Table 2-10. National Ambient Air Quality Standards (United States Environmental Protection Agency 2016b).

Pollutant	Primary / Secondary		Averaging Time	Level[1]	Form
Carbon Monoxide (CO)	Primary		8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead (Pb)	Primary		Rolling 3-month average	0.15 µg/m3	Not to be exceeded
Nitrogen Dioxide (NO_2)	Primary		1 hour	100 ppb	98th percentile of 1-hour daily maximum concentration, averaged over 3 years
	Primary and secondary		1 year	53 ppb	Annual mean
Ozone (O_3)	Primary and secondary		8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Sulfur Dioxide (SO_2)	Primary		1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary		3 hours	0.5 ppm	Not to be exceeded more than once per year
Particulate Pollution	PM 2.5	Primary	1 year	12.0 µg/m3	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m3	Annual mean, averaged over 3 years
		Primary and secondary	24 hours	35 µg/m3	98th percentile, averaged over 3 years
	PM 10	Primary and secondary	24 hours	150 µg/m3	Not to be exceeded more than once per year on average over 3 years

[1] ppm = parts per million; ppb = parts per billion; µg/m^3 = micrograms per cubic meter of air.

2.4.3.6 Wastewater

Harrison County Wastewater District provides wastewater treatment and disposal for Keesler AFB. The 50-mile wastewater collection system owned and maintained by Keesler AFB can accommodate an estimated wastewater flow of approximately 3.1 million gallons per day. Wastewater is pumped to the West Biloxi Sewage Treatment Plant, which provides secondary treatment of the effluent. The facility treats an average flow of nine million gallons per day. Effluent from the treatment plant is discharged to the Back Bay of Biloxi and has consistently maintained a concentration of 5 milligrams per liter (mg/L) or less for total suspended solids and biochemical oxygen demand and 1 mg/L or less for ammonia (Neel-Schaffer, Inc. 2017). No septic tanks are used or have been abandoned at Keesler AFB.

Storm water surface drainage within the base is divided into 10 drainage areas, the majority of which encompass small residential or commercial areas not associated with industrial activities. These drainage areas discharge to the Back Bay of Biloxi though 10 outfalls located on the base, as does the majority of the storm water drainage from Keesler AFB. However, a portion of the base storm water flows south through the city of Biloxi's storm drainage system of the Mississippi Sound (Keesler Air Force Base 2011a).

The majority of storm water drainage flows to the Back Bay.

Keesler AFB developed a SWPPP that documents existing storm water management practices at the base and is a guide for base personnel who are responsible for ensuring that the potential for storm water contamination is minimized (Keesler Air Force Base 2011a).

Groundwater treatment consists of chlorination (disinfection) and fluoridation. Chlorination occurs through the automated injection of chlorine gas into the source well pump discharge pipe. Fluoridation is accomplished by feeding sodium fluoride from solution tanks into the well pump discharge pipe. Chlorine residuals typically range from 0.60 to 1.10 mg/L. Fluoride levels typically range from 0.40 to 1.2 mg/L. Each well can pump 500–1,000 gallons per minute. Keesler AFB supports six elevated, 400,000-gallon water tanks. During an average year, the base's water use is more than 605.33 million gallons. Water lines are owned and maintained by Keesler AFB (Keesler Air Force Base 2013a).

The area surrounding the base is highly urbanized, as is most of the peninsula between Biloxi and Gulfport. City water is available to all residents in the area, except near the marina. Shallow groundwater is not used on Keesler AFB because it contains hydrogen sulfides and naturally occurring dissolved organic matter from peat deposits. Septic systems and storm water also infiltrate the shallow groundwater aquifer. Near wetlands and coastal areas, the shallow groundwater also may be affected by saltwater intrusion.

A Water Contingency Response Plan (WCRP) (Air Force Institute for Operational Health 2004) was developed for Keesler AFB. This emergency response plan for the potable water system incorporates existing base and water system-specific emergency response protocols, as well as additional data elements required by the EPA under Public Law 107-1888 (Title IV), the *Public Health Security and Bioterrorism Preparedness and Response Act* of 2002. The goal of the information and protocols developed in the WCRP is ". . . to be sufficient for base personnel to effectively respond to credible threats and hazards, maintain service, restore water system components, and lessen the impact of intentional and non-intentional water contamination and/or supply (service) disruption events" (Air Force Institute for Operational Health 2004).

2.4.3.7 Air Installation Compatible Use Zones

The AICUZ program is an ongoing DoD plan designed to promote compatible land uses in the areas around military airfields. The purpose of the AICUZ program is to minimize the effects of flying operations on land uses adjacent to installations, to prevent incompatible development in high noise-exposure areas and accident potential areas, and to maintain operational capability through compatible land use planning and control.

The objectives of the AICUZ program are achieved primarily through encouraging local government officials to implement compatible land uses. Such land-use restrictions protect natural resources and the public while helping to maintain operational capabilities of the base's flying mission. Keesler AFB released

its first AICUZ study in 1995, and the current approved AICUZ study was released in 2010. Clear, safety, and accident potential zones have been designated to minimize aircraft-related accidents (Figure 2-5). Within clear and safety zones, construction is either prohibited (clear zones) or limited in terms of placement and height (safety zones). The designated clear zones at Keesler AFB are 3,000 feet wide by 3,000 feet long (Keesler Air Force Base 2010).

Accident potential zones (APZs) are geographic areas around airfields where most aircraft accidents occur. At Keesler AFB, APZ I meets the DoD-required length (3,000 feet wide by 5,000 feet long). Land uses in this zone are usually limited to light industrial, manufacturing, transportation, communications, utilities, wholesale trade, open space, and agricultural uses. APZ II (3,000 feet wide by 7,000 feet long) extends beyond APZ I. Land uses within APZ II include all of those considered compatible with APZ I, as well as low-density residential, service, and retail trade. Land uses considered compatible within various APZs and areas characterized by various noise levels at Keesler AFB are described in the *Air Installation Compatible Use Zone Study* conducted at Keesler AFB (Keesler Air Force Base 2010).

Noise is considered an unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. It may be intermittent, continuous, steady, or impulsive. Noise also may be stationary or transient. Stationary noise is normally related to specific land uses (e.g., housing tracts or industrial plants), whereas the transient noise moves through the environment either along relatively established paths (e.g., highways, railroads, and aircraft flight tracks around airports) or randomly. There is a wide diversity of response to noise that not only varies according to the type of noise and the characteristics of the sound source, but also according to the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source (e.g., an aircraft) and the receptor (e.g., a person or animal).

Ambient background noise in urbanized areas typically varies from 60 to 70 decibels (dBA), but it can be louder; suburban neighborhoods experience ambient noise levels of approximately 45 to 50 dBA. The Federal Aviation Administration (2015) describes land uses that are compatible for various noise levels. Harris (1979) provides dBA-equivalents among sounds of common indoor and outdoor activities and settings and identifies subjective human judgement of noise levels, which can help ascertain impacts of noise.

Noise at Keesler AFB (Figure 2-5) is characteristic of the noise associated with flying operations at most USAF installations and civilian airports. When aircraft ground or flight activity occurs, the noise environment changes and noise levels increase. During periods of minimal aircraft activity, noise at Keesler AFB includes activities related to shop operations, ground traffic movement, construction, and similar sources. This noise is restricted almost entirely to the base itself and is comparable to sounds that occur in adjacent communities. Because the primary natural area is along the Back Bay of Biloxi near the northern edge of the base, potential impacts of noise there are minimal. Noise levels in the wetlands are in the 65 to 70 dBA range (Keesler Air Force Base 2010).

2.4.4 Potential Future Impacts

No major changes in base missions are anticipated for the period of this INRMP update (2019–2023). Keesler AFB will continue to operate as a training facility and home for the medical center. Without a mission change, the number of personnel on the base is not expected to change significantly; however, if a mission change were to occur, NEPA documentation would be required to assess whether a change to land use or a change in personnel would be considered significant. Future demolition activities include a full or partial demolition of the Locker House (Facility 3101).

Figure 2-5. Accident Potential Zones and Noise Contour Levels at Keesler Air Force Base

Legend

- Keesler Air Force Base
- Major Highways
- Highways

Noise Contour Levels

- 65 db
- 70 db
- 75 db
- 80 db

Accident Potential Zones

- APZ I
- APZ II
- CLEAR ZONE
- CLEAR ZONE GRADED AREA

N

0 0.5 1 Mile

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS State dataset (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

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Future construction activities include those listed below.

- Division Street Gate (currently under Construction)
- Transportation Complex
- Student Center, Warrior Fitness Center
- Training Facility Phase 4 (Replacement of Allee Hall)
- Cyber Processing Center
- Construct Taxiway Shoulders

2.4.5 Natural Resources Needed to Support the Military Mission

Open areas used by Keesler AFB for its flight line and flight safety zones are monitored and controlled to prevent and control occurrences of invasive species. Control and prevention of invasive species occurrence on the base are largely handled through BMPs outlined in the BASH program.

Although not necessary for supporting the military mission, per se, the live oaks at Keesler AFB do benefit the military mission. These trees have become a symbol of Keesler AFB, and the military and surrounding communities have developed a strong connection to the trees. Maintaining and caring for the live oaks demonstrates to the community that Keesler AFB is a good steward of these character-defining resources, thereby fulfilling some of its commitment to conduct public outreach within the local community.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The USAF environmental program adheres to the Environmental Management System (EMS) framework and its "Plan, Do, Check, Act" cycle for ensuring mission success. Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and international standards provided by the International Organization for Standardization 14001:2004 provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

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

4.0 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities necessary for implementing and supporting the natural resources program at Keesler AFB are listed in Table 4-1. Specific roles and responsibilities for managing natural resources are described in appropriate sections of this plan.

Table 4-1. Roles and responsibilities at Keesler Air Force Base.

Office/Organization/Job Title	Installation Role/Responsibility Description
Installation Commander	• Approves the INRMP by signature and certifies all INRMP updates • Ensures that the INRMP is consistent with the use of the base to ensure the preparedness of the Armed Forces • Controls access to and use of Keesler AFB's natural resources • Commits to seeking funding and executing all "must fund" projects and activities within identified timeframe • Provides appropriate staffing to execute INRMP implementation
Air Force Civil Engineer Center Natural Resources Media Manager/Subject Matter Expert/Subject Matter Specialist	• Advocates for resources and funding to implement approved INRMPs
Installation Natural Resources Manager/POC	• Supports military training by managing the natural resources of the base in accordance with applicable laws, EOs, and directives • Coordinates INRMP updates, revisions, and implementation requirements with applicable federal, state, and tribal government agencies, as well as nongovernmental organizations and parties
Installation Security Forces	• Ensures that the natural resources on Keesler AFB are supported and maintained in accordance with legal requirements
Installation Unit Environmental Coordinators; see AFI 32-7001 for role description	• Act as conduits between their unit and the NRM • Advise work area supervisors on any EMS and environmental policies • Manage and monitor EMS requirements for the unit
Installation Wildland Fire Program Manager	• n/a

Table 4-1. Roles and responsibilities at Keesler Air Force Base.

Office/Organization/Job Title	Installation Role/Responsibility Description
Pest Manager	• Primary point of contact for all range pesticide use • Assists natural resources staff with the safe, effective, economical, and environmentally acceptable management of pests
Range Operating Agency	• n/a
Conservation Law Enforcement Officer	• n/a
NEPA/Environmental Impact Analysis Process Manager	• Conducts NEPA/Environmental Impact Analysis Process for all installation projects in coordination with the Natural Resources and Environmental Managers
U.S. Department of Agriculture, Forest Service	• n/a
USFWS	• Signatory to the INRMP • Ensures compliance with the Endangered Species Act (ESA) on Keesler AFB
MDMR	• Maintains jurisdiction at 200 feet mean tide of wetlands boundary
MDWFP	• Primary jurisdiction over wildlife management, except where pre-empted by federal law • Manages wildlife predators and recovery of protected species in accordance with the ESA, shared responsibility with the USFWS • Signatory to the INRMP

5.0 TRAINING

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

Trainings for Keesler AFB natural resources support personnel are listed below.

- Natural resource management personnel shall be encouraged to attain professional registration and certification or licensing for their related fields, and they may be allowed to attend appropriate national, regional, and state conferences and training courses.
- Individuals participating in the capture and handling of sick, injured or nuisance wildlife should receive appropriate training.
- Personnel supporting the BASH program should receive training for submitting animal remains to the Smithsonian for identification and flight-line driver training.
- The DoD-supported publications and webinars provide guidance, case studies and other information.

Individuals conducting pest management at Keesler AFB are not under the responsibility of the NRM. Rather, they are under the Installation Arborist/Pest Management Coordinator, which ensures that pest management contractors are fully vetted and certified to conduct work at Keesler AFB.

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records in accordance with Air Force Manual 33-363, *Management of Records*, and disposes of records in accordance with the Air Force Records Management System's records disposition schedule. Numerous record types must be maintained to support implementation of the natural resources program. Specific records are identified in applicable sections of this plan, in the Natural Resources Playbook, and in referenced documents. All natural resources-related documentation for Keesler AFB is stored and maintained at the Civil Engineering Building (Building 4705). Natural resources personnel also store and maintain the data on a shared drive.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM, Air Force Civil Engineer Center Media Manager, and Subject Matter Specialists should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance and report development.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

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

Installation Supplement—Natural Resources Program Management

The Keesler AFB INRMP will be implemented by KBOS/CEV personnel. As per AFPD 32-70, the USAF manages natural resources in accordance with applicable federal, state, and local laws and regulations. A primary objective of the USAF natural resources programs is to sustain, restore and/or modernize natural, statutory, and/or workforce infrastructure to ensure operational capability. Natural resources will be managed to support and be consistent with the military mission while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity. Land-use practices and decisions shall be based on scientifically sound conservation procedures and techniques and an ecosystem-based approach.

7.1 Fish and Wildlife Management

Applicability Statement

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

Program Overview/Current Management Practices

A natural habitat inventory was conducted for Keesler AFB in 2001.There are three main fish and wildlife management areas at Keesler AFB: the airstrip, the marina, and the wetlands. Fish and wildlife resources at the airstrip are managed via the Keesler AFB BASH program. The marina is managed at Keesler AFB for boating, fishing, and recreational purposes. Wetlands along the Back Bay of Biloxi are considered to be a multiple-use resource, but they are protected under the Clean Water Act (CWA) of 1972.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

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

Program Overview/Current Management Practices

Outdoor recreation areas on Keesler AFB are managed by the 81st Force Support Squadron. These areas represent constraints on base planning and mission. The primary focus of the outdoor recreation program is to promote the well-being and improve the quality of life for USAF personnel and their families by offering a variety of opportunities for outdoor recreation and leisure.

Keesler AFB Outdoor Recreation Marina Park.

7.2.1 Outdoor Recreation Facilities and Activities

Keesler AFB has three major outdoor recreation areas: the marina and its associated recreation and picnic area

(Naval Oaks Reserve), a FamCamp (for recreational vehicles), and an 18-hole golf course. These areas are accessible to base personnel and family members but not to the general public. Planning is currently underway for the development of a FamCamp in Harrison Court.

The majority of the land at Keesler AFB designated for outdoor recreation is zoned Class I for general outdoor recreation areas suitable for intensive activities, according to USAF criteria. Because the marina supports activities like fishing, it is a Class II natural environmental area. Wetlands located west of the marina are zoned Class III because they contain valuable ecological features that require protection. The marina, bordered by the Back Bay of Biloxi and the runway, is used for recreational boating and fishing.

Keesler AFB 81st Security Forces Squadron and Mississippi Department of Marine Resources install buoys in the Back Bay.

In 2018, Keesler AFB partnered with MDMR to install 15 restricted-area buoys in the Back Bay of Biloxi to provide additional base security. This project was conducted in coordination with the 81st Security Forces Squadron Anti-terrorism Office, the 81 TRW Legal Office, the state, and the USACE in Washington D.C (Groue 2018).

7.2.2 Marina and Fisheries Management

Keesler AFB personnel and associated visitors and guests must obtain a fishing license to fish at the marina. The fishing license program is run by marina staff and follows the MDFWP's fee structure. One dollar out of every fishing license represents "non-appropriated funds" and is called an "agent fee." The agent fee goes to the operation of the marina, and the rest of the license fee goes to the state. These fees are to be used for the protection, conservation, and management of fish and wildlife, including habitat improvement and related activities, in accordance with AFI 32-7064. Other marina fees include boat rentals, boat equipment, sporting equipment, storage fees, and activity fees.

The Marina Park consists of the Naval Oaks Reserve, a 17-acre recreation and picnic area. Marina Park includes indoor and open-air pavilions for rent, picnic areas, playground, volleyball courts, splash pad, and an accessible park. The marina sells live bait and boat fuel to its patrons. Fuel storage and use are managed under the base's SPCC Plan (81st Training Wing 2018a).

In recent years, the outdoor recreation program has sponsored several events and programs, as listed below.

- Back Bay Guided Fishing Trips
- Campout in the Park
- Cardboard Boat Regatta and Pool Party
- Children's Appreciation Picnic
- Christmas on the Water
- Cruisin' Keesler
- Disc Golf Tournament
- Easter in the Park
- Fishing Rodeos
- Fishing Trips to the Islands and the Oil Rigs
- Ghouls in the Park
- Holiday Card Contest
- July 4th Dolphin Fireworks Trip
- Kids Fishing Rodeo
- Personal Watercraft Race
- Polar Bear Regatta

Keesler AFB personnel also have the opportunity to participate in activities such as deep-sea fishing trips on the Keesler Dolphin II, sailing lessons, kayak lessons, boating safety classes, and swimming lessons at the base pool.

The FamCamp, located in Thrower Park, offers 52 full-service sites for recreational vehicles. The sites are rented for camping by active duty or retired military personnel on a daily basis. Several athletic fields, running paths, and an 18-hole golf course also are located on Keesler AFB. Due to security measures, these and all outdoor recreation facilities at Keesler AFB are not open to the public.

7.2.3 Special Interest Areas

The wetlands located along the northern border of the base west of the marina comprise a special natural area that warrants special conservation efforts. Also, there is a small track near Bayridge that provides opportunities for wildlife viewing.

7.2.4 Off-Road Vehicle Use

The use of off-road vehicles is not permitted at Keesler AFB.

7.2.5 National Park Service Involvement

Keesler AFB has a Cooperative Agreement with the National Park Service and MDWFP for operating, developing, managing, and protecting outdoor recreation resources on the base.

7.3 Conservation Law Enforcement

Applicability Statement

No conservation law enforcement program is in place at Keesler AFB. All security issues are handled by installation Security Forces.

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

Applicability Statement

This section applies to USAF installations that have TES on USAF property. This section is not applicable to Keesler AFB.

Program Overview/Current Management Practices

Because Keesler AFB is almost completely developed or urbanized, no species listed by the MSNHP, USFWS, or NOAA Fisheries are known to occur on the base. During TES surveys completed in 2006 and 2012, no TES were found on Keesler AFB; however, areas near the base, such as the Back Bay of Biloxi, may provide habitat for TES. A list of protected species found in the local area is provided in Section 2, Table 2-7. Whereas TES and/or critical habitats do not represent constraints on Keesler AFB's planning or mission unless wetland areas are impacted, it is recommended that natural resource personnel at Keesler AFB be familiar with TES and critical habitats that occur in the area so that they may be identified and recorded if observed.

7.5 Water Resources Protection

Applicability Statement

This section applies to USAF installations that have water resources. This section is applicable to this installation.

Program Overview/Current Management Practices

Water resources management requires a multifaceted approach to eliminate pollution and reduce human impacts. The main goal of effective water resources management is to preserve biodiversity and maintain water quality for the health of people and natural resources. Additionally, Keesler AFB seeks to manage pollution and prevent any from reaching the Back Bay's water supply.

Keesler AFB and the Back Bay of Biloxi are located within the Coastal Streams Basin, located adjacent to south Mississippi's coastline. The basin drains approximately 1,545 square miles of land and empties into the Gulf of Mexico. The metropolitan areas of Biloxi, Gulfport, Ocean Springs, and D'Iberville also occur within this basin. In the Mississippi 2016 Section 303(d) List of Impaired Water Bodies, the MDEQ classified sixteen water bodies within the Coastal Streams Basin as impaired (Mississippi Department of Environmental Quality 2016). Those areas that did exceed water-quality standards were located in the upper reaches of the basin. Waters near and adjacent to Keesler AFB in the Back Bay of Biloxi met National Ambient Water Quality criteria.

7.5.1 Wastewater Management

Harrison County Wastewater District provides wastewater treatment and disposal for Keesler AFB. The 264,685 linear feet of the wastewater collection system owned and maintained by Keesler AFB can accommodate an estimated wastewater flow of 3.1 million gallons per day. Wastewater is pumped to the West Biloxi Sewage Treatment Plant, which provides secondary treatment of the effluent. The facility treats an average flow of nine million gallons per day. Effluent from the treatment plant is discharged to the Back Bay of Biloxi with concentrations of total suspended solids and biochemical oxygen demand at no more than 5 mg/L and ammonia at no more than 1 mg/L (Neel-Schaffer, Inc. 2017).

The city of Gautier provides wastewater treatment and disposal for Sandhill Landing. The wastewater collection system of Sandhill Landing is owned and operated by Keesler AFB and is a gravity feed system that empties into the city of Gautier's main sewer line.

Currently, the base is not involved with any watershed assessments required to obtain a total maximum daily load. MDEQ wastewater regulations require all users within 300 feet of a sanitary sewer to have a tie-in. Abandoned septic tanks are required to be filled with sand before closure; however, there are no known septic tanks in use or abandoned at Keesler AFB, including the FamCamp at Thrower Park and Sandhill Landing.

7.5.2 Storm Water Management

Storm water runoff is part of a natural hydrological process; however, human activities, particularly urbanization, can alter natural drainage patterns and add pollutants to rainwater runoff that enters rivers, lakes, streams, and coastal waters. The base's natural resources program is tasked with ensuring that storm water runoff from the base is safe for the environment, thereby protecting associated natural resources at the base and in surrounding natural habitats.

In 2011, Keesler AFB updated its SWPPP to document existing storm water management practices at the base (Keesler Air Force Base 2011a). The SWPPP is a guide for base personnel who are responsible for ensuring that the potential for storm water contamination is minimized. The SWPPP complies with the special conditions and pollution prevention plan requirements of Mississippi's Baseline Storm Water General National Pollution Discharge Elimination System (NPDES) Permit. The NPDES permit program began in 1990 when new federal storm water discharge requirements were promulgated as part of the CWA (55 Federal Register 48062-48901).

Historically, Keesler AFB was exempt from the NPDES requirement because of its federal facility status. The base was drawn into the NPDES permit process because of EPA 201 CWA initiatives, which changed the Standard Industrial Classification designation for the facility. An NPDES permit (no. MSR001362) was issued to the base from the MDEQ on 4 June 1999 to operate its storm water collection, treatment, and disposal system.

7.5.3 Mississippi Department of Environmental Quality—General Permit for a Small Municipal Separate Storm Sewer System

The MDEQ governs storm water quality at Keesler AFB. The base currently operates under a small municipal separate storm sewer system (MS4) General Permit (number MSRMS 4023), issued under the provisions of the Office of Pollution Control. This General Permit requires the development of a storm water management program for Keesler AFB that is updated every five years. The most recent plan was updated in 2016 (81st Training Wing 2016b).

7.5.4 Recordkeeping and Internal Reporting Procedures

The success of pollution-prevention efforts is effectively tracked through recordkeeping and internal reporting. Records of all spills, leaks, inspections, and maintenance activities associated with storm water pollution prevention are retained for a period of at least three years. These records include, but are not limited to

- information on significant spills and leaks of toxic or hazardous pollutants,
- storm water outfall monitoring or sampling data, and
- records of inspections to evaluate SWPPP adequacy to minimize pollution.

Additionally, Keesler AFB will report to the EESOHC semi-annually. The minimum reporting criteria will include

- status of the SWPPP,
- storm water system deficiencies and status of corrective actions, and
- storm water outfall monitoring data.

7.5.5 Best Management Practices

Keesler AFB employs the use of BMPs to protect the natural habitats around the base. A summary of each BMP identified for the base is provided below.

- **Good Housekeeping Program**—Numerous USAF policies and procedures dictate good housekeeping practices and are rigorously enforced at all levels of management. These generally include procedures to minimize the use of chemicals that are susceptible to environmental exposure and runoff, procedures to keep exposure areas clean, and procedures to minimize runoff contamination.
- **Preventive Maintenance**—Preventive maintenance procedures include weekly inspections and maintenance of storm water management devices, satellite accumulation points for hazardous waste, etc.; monthly inspections of storm water outfalls by KBOS/CEV; tracking hazardous material usage by contractors and USAF-purchased materials present at Keesler AFB; and the use of absorbent oil booms at various drainage locations to prevent possible contamination. A hard boom has been installed at storm water outfall 008 as an extra preventative measure.

- **Personnel Training**—Keesler AFB provides training programs in pollution prevention. The program focuses on good housekeeping and material management practices and spill prevention and response procedures.
- **Spill Prevention and Response**—The Keesler AFB SPCC Plan establishes procedures and tasks for spill response of petroleum products and hazardous materials and/or waste. Additionally, the Keesler AFB Hazardous Waste Management Plan fulfills the requirements of the RCRA and establishes guidelines to be followed in the identification and management of hazardous waste. It serves as a training guide for hazardous waste generators and handlers.
- **Recordkeeping and Internal Reporting Procedures**—Success of pollution prevention efforts is effectively tracked through recordkeeping and internal reporting. Records of all spills, leaks, inspections, and maintenance activities associated with storm water pollution prevention are retained for a period of at least three years.
- **Sedimentation and Erosion Control**—Sedimentation and erosion problems are most likely associated with construction activities. Keesler AFB requires contractors to establish storm water BMPs prior to initiating construction activities. Keesler AFB also requires construction contractors that disturb one to five acres to submit an MDEQ Small Construction Notice of Intent to KBOS/CEV and keep it on site until final stabilization is accomplished. Similarly, when construction contractors anticipate land-disturbing activities of five or more acres, they will submit an MDEQ Large Construction Notice of Intent to the State along with all required supporting documents.
- **Facility Security**—Keesler AFB is a secured facility; the perimeter is fenced and guards are posted at entrances and exits. These measures effectively limit access of unauthorized personnel to the facility. Additionally, access to materials located in accumulation points is limited to authorized personnel through locked gates.

7.5.6 Non-Point Source Pollution

Unlike pollution from industrial and sewage treatment plants, non-point source (NPS) pollution comes from many diffuse sources. NPS pollution accumulates in rainfall as it moves over and through the ground. As the runoff travels, it picks up and carries away natural and manmade pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and underground sources of drinking water (groundwater). NPS pollutants at Keesler may include

- excess fertilizers, herbicides, and insecticides from developed areas of the base;
- oil, grease, and toxic chemicals from urban runoff and energy production; and
- sediment from improperly managed construction sites and eroding stream banks.

A variety of Keesler AFB activities may contribute to NPS pollution. These practices include industrial and municipal activities, which may provide avenues for pollution to reach the natural ecosystems associated with the base. Proactive management of storm water and wastewater activities, as well as integrating spill prevention programs, is ongoing at the base. The SWPPP, SPCC Plan, and the Pest Management Plan have procedures and practices in place that are enforced to help manage potential NPS problems.

To reduce NPS pollution, Keesler AFB no longer applies fertilizers and pesticides on a predetermined schedule; rather, they are now applied on an as-needed basis. At the base golf course, insecticides are applied close to the ground by slit-seed method to preclude the need to spray insecticide into the air.

Irrigation runoff at the golf course is collected in an irrigation pond through a series of drainage ditches for reuse. Other irrigation systems on the facility are operated to prevent runoff into the streets or drainage ditches.

7.5.7 Floodplain Protection

Flooding is a concern at Keesler AFB. Tropical storms and hurricanes are common along the Gulf of Mexico Coast and produce not only torrential rainfall but also tidal surges that cause flooding. A more recent example of this flooding occurred when Hurricane Katrina swept across the entire Gulf Coast and onto the base. Figure 7-1 indicates the Keesler AFB floodplain boundaries.

Floodplain management is the implementation of an overall program of corrective and preventive measures for reducing flood damage. This includes, but is not limited to, emergency-preparedness plans, flood control works, and floodplain management regulations. Examples of floodplain management include mapping communities to identify flood-prone areas, elevating buildings above the base's floodplain, and relocating structures out of the floodplain. Keesler AFB is involved in floodplain management through EO 11988, *Floodplains Management*. This regulation requires federal agencies to provide leadership and action to reduce flood loss and impacts to human safety, health, and welfare; and to restore and preserve the natural and beneficial values of floodplains when managing federal lands.

Given that all of Keesler AFB lies within a 100- or 500-year floodplain, any future construction projects could potentially impact floodplains at Keesler AFB. For any future construction projects that might affect the floodplains, the natural resource management office will prepare an EA in accordance with NEPA to identify and quantify potential environmental impacts, including impacts to floodplains. As part of the NEPA process, the EA would examine alternatives to a proposed project that could impact a wetland. Ultimately, the EA could lead to a Finding of No Practicable Alternative (FONPA), a demonstration that a variety of alternatives were studied and there is no practicable alternative. The FONPA also must address potential impacts on floodplain values, including flood storage potential, wetlands, and wildlife. After Hurricane Katrina, the base developed new construction requirements, which include a 20-foot elevation AMSL for all finished first floors of new permanent facilities. Additionally, all structures must be built on land at least 16 feet AMSL (United States Air Force Air Education and Training Command 2006).

7.5.8 Regional and Cooperative Programs

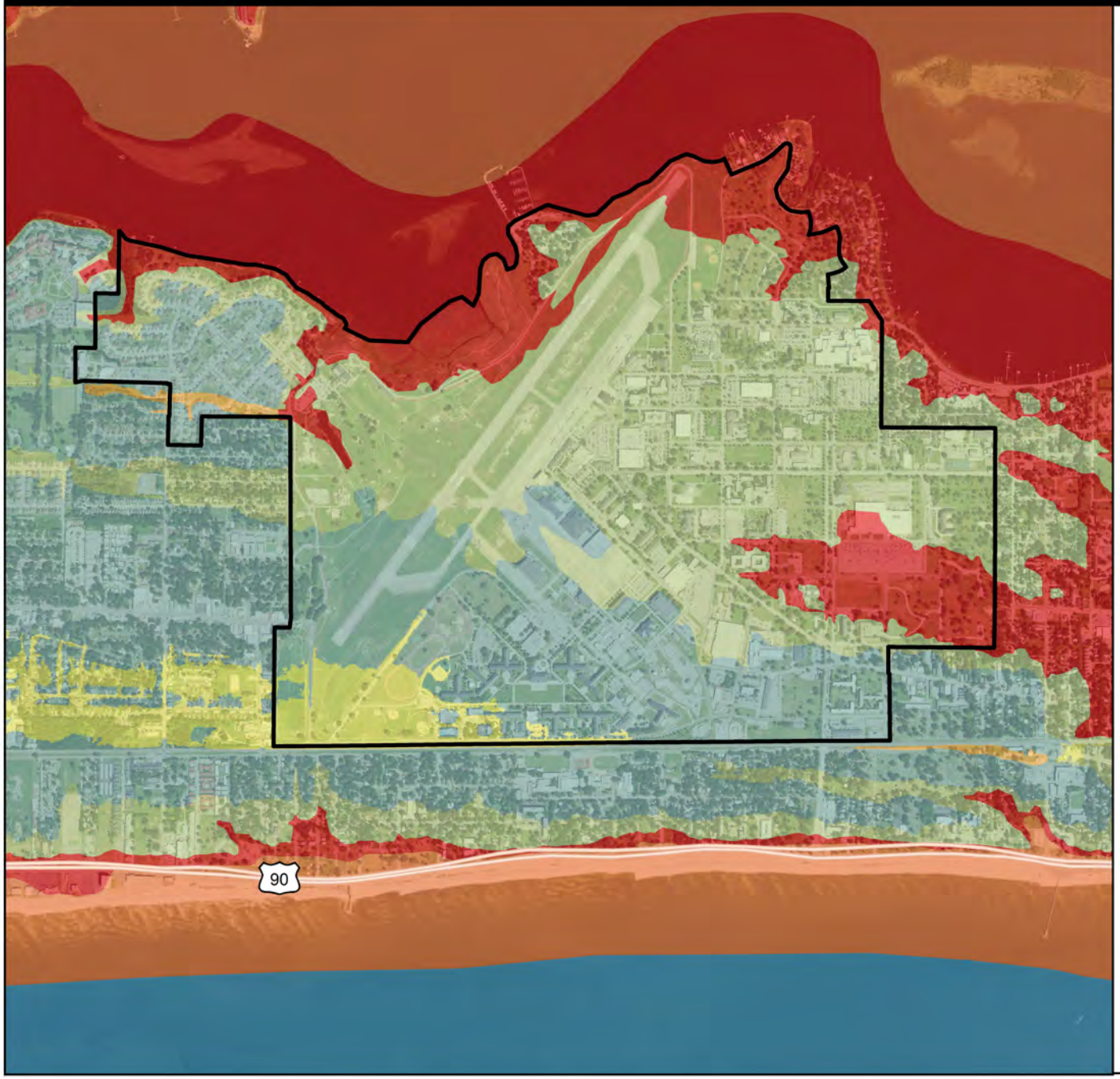
Keesler AFB is involved with the Gulf of Mexico Program, which is administered by the EPA. The goal of the Gulf of Mexico Program is to protect, restore and enhance the coastal and marine waters of the Gulf of Mexico and its natural coastal habitats; to sustain living resources; to protect human health and the food supply; and to ensure the recreational use of Gulf shores, beaches, and waters in ways that are consistent with the economic well-being of the region.

For floodplain protection, Keesler AFB has established agreements with the agencies and groups listed below.

- USFWS and MDWFP
- Tree City USA
- National Park Service
- Mississippi Department of Wildlife, Fisheries, and Parks
- BASH Program Agreements and Cooperatives
- Mississippi Emergency Management

Keesler AFB is a participant in the Gulf of Mexico Program through a cooperative effort with various organizations. The program's objective is to protect natural resources in the Gulf of Mexico Region.

Figure 7-1. Floodplain boundaries on Keesler Air Force Base



Legend

- Keesler Air Force Base
- Major Highways
- Highways

Flood Zones

- Open Water
- Zone X - Minimal flood hazard, above the 500-year flood level
- 0.2% Annual Chance Flood Hazard
- Zone AH - 1% Annual Chance of Shallow Flooding
- Zone A - 1% Annual Chance of Flooding
- Zone VE - Coastal areas with a 1% chance of flooding and an additional hazard associated with storm waves
- Zone AE - The Base Floodplain

N

0 0.25 0.5 Mile

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS State dataset (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

Prepared by:
Center for Environmental Management
MILITARY LANDS
Colorado State University

81st TRAINING GROUP

Created: November 20, 2018

7.6 Wetland Protection

Applicability Statement

This section applies to USAF installations that have existing wetlands on USAF property. This section is applicable to this installation.

Program Overview/Current Management Practices

Wetlands on Keesler AFB are under the jurisdiction of the USACE and the State of Mississippi, and they are managed under the natural resources program in accordance with appropriate USAF guidelines.

The northern shore of Keesler AFB along the Back Bay of Biloxi is bordered by coastal salt marsh wetlands, and the base takes into account the location of these wetlands when developing plans for future mission construction. The new wetland lines were verified by base personnel and the MDMR in 2012 but, because more than five years have passed since the last delineation was conducted, an update may be required.

The CWA of 1977 regulates pollutant discharges that could affect aquatic life forms or human health and safety, and Section 404 of the CWA and EO 11990, *Protection of Wetlands*, regulates development activities in or near streams or wetlands. Section 404 also regulates development in streams and wetlands and requires a permit from the USACE for dredging and filling in wetlands. As such, wetlands cannot be impacted without prior approval from the USACE and the State of Mississippi through the Section 404 permitting program.

7.6.1 Health of Existing Wetlands

The health of wetlands on or adjacent to the base has been affected by the three factors, as summarized below.

1. **Hurricanes Georges and Katrina:** Hurricane Katrina struck land in August 2005, leaving a path of destruction; however, wetlands around Keesler AFB were not as affected as they were during Hurricane Georges in 1998. The high-water flooding caused by Hurricane Katrina prevented the wind and wave action from upheaving vegetation, minimizing damage to the wetlands, whereas Hurricane Georges resulted in the conversion of a forested wetland to an emergent wetland. Subsequently, the wetland areas along the border of the Back Bay of Biloxi are now estuarine intertidal emergent wetlands dominated by needlegrass rush and smooth cordgrass.
2. **Original landfill construction:** Between 1950 and 1974, much of the original marsh area was impacted by the construction of Landfills 2 and 3. The marsh eventually grew back in around the landfills.
3. **Contamination from historical pest control practices and landfills:** The health of the salt marsh wetlands adjacent to the base along the Back Bay of Biloxi was affected by contamination from historical pest control practices and landfills. This contamination has been thoroughly investigated by Keesler AFB as part of the ERP. Both an RCRA Facility Investigation and a baseline risk assessment were initiated to determine the ecological and human health concerns associated with Landfill 3.

An interim remedial measure was implemented to stabilize Landfill 3. The stabilization was achieved through the construction of a steel sheet pile wall extending from the southwest corner, around the northern tip of Landfill 3, and across the bay side outlet of the eastern storm water channel. EPA Region 4 and MDEQ, under the RCRA corrective action program, approved the interim/stabilization measure. The objective of this measure was to physically contain the wastes in Landfill 3 and to minimize the potential effect of the tidal influence on the spread of waste and contamination in the Back Bay of Biloxi.

As a result of the sheet pile system's construction, 1.97 acres of the U.S. waters were filled. Of this total, approximately 0.52 acres of tidal saltwater marsh and freshwater marsh vegetation were filled. Implementation of this action, however, contained solid wastes within Landfill 3 and prevented further contamination of the bay from the landfill. Additionally, contaminated sediments were contained within the eastern storm water channel, preventing redistribution of these materials into the bay by storm waves, storm water discharges, and/or tidal action. Implementation of the project has had beneficial impacts on water quality.

Emergent wetland vegetation bordering the Back Bay of Biloxi adjacent to Landfill 2.

The impacts from the sheet pile system on wetlands were mitigated by restoring the wetland habitat at a former Keesler AFB archery range located to the west of Landfill 3 within the same embayment. Also, the wetlands along the edge of Landfill 2 were enhanced by the removal of exotic Chinese tallow trees (*Sapium sebiferum*). Facility design further mitigated impacts by not filling one acre of coastal marsh located in the eastern storm water channel.

The final corrective actions for Landfills 2 and 3 were implemented in 2002. They included a low-permeability soil cover, long-term groundwater and sediment monitoring, a vertical plank wall, dredging of existing storm water drainage canals, geo-textile tube fill and placement, and land-use controls. The low-permeability cover included a geo-synthetic clay layer with 1.5 feet of soil and top soil. A methane vent system was installed over the clay layer, and groundwater-monitoring wells were installed around the perimeter of the landfills.

A vertical plank wall along with a 200-foot, filled, geo-textile tube jetty was installed perpendicular to the storm drain near hole 10 at the golf course. The purpose of the jetty and plank wall is to reduce the wave energy from nearby waterway traffic. To determine the influence of the jetty and plank wall on sedimentation rates, sediment accumulation monitoring is conducted at seven locations. Wetlands also were restored along the shoreline, and untreated pilings were placed there to enhance the growth of the coastal marsh.

7.6.2 Ecological Health of the Back Bay of Biloxi

Salt marsh wetlands border the northern edge of Keesler Air Force Base along the Back Bay of Biloxi, a natural estuary.

The Back Bay of Biloxi is considered a tidal estuary, which is formed by mixing freshwater and tidal ocean waters. The combination of shallow water, adequate light, nutrient inputs from adjoining salt marshes, and extensive horizontal and vertical mixing make estuarine environments among the most productive ecosystems on earth.

A 2002 MDEQ study showed that the Back Bay of Biloxi was receiving large volumes of pollution from a variety of point and non-point sources and that the overall estuarine system was being subjected to considerable environmental stress. The volume of wastewater generated by industry and surrounding municipalities, especially Biloxi and Gulfport, was expected to increase in direct proportion to regional development. This expectation was due to the fact that nearly every municipality and industry along the Back Bay of Biloxi uses the natural water

system for wastewater effluent disposal. The waters of the Back Bay of Biloxi are classified as restricted and prohibited for shellfish harvesting; however, with future improvements in water quality within the Back Bay of Biloxi, there is the potential for upward re-classification where appropriate (Mississippi Department of Environmental Quality 2002).

7.7 Grounds Maintenance

Applicability Statement

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

Program Overview/Management Practices

The grounds maintenance program addresses the maintained areas of the installation. The primary focus of the program is to minimize the use of energy, water, fertilizer, pesticides, and herbicides for grounds-maintenance activities. Grounds maintenance emphasizes the use of regionally native plants, advanced technologies for pest control, and design techniques in landscape development that minimize adverse effects on the natural habitat.

Keesler AFB is involved with the management and control of invasive plant species and considers legislation such as EO 13112, *Invasive Species*, when making management decisions. EO 13112 requires federal facilities to prevent the introduction of invasive species on federal lands, to control invasive populations, and to restore native vegetation in areas where infestation has occurred. Invasive plant problems on Keesler AFB include managing cogongrass (*Imperata cylindrica*), Chinese tallow trees, and black elderberry (*Sambucus nigra)* in the wetlands.

7.7.1 Maintenance of Turf and Ornamental Planting Areas

All turf and ornamental planting areas on Keesler AFB, with the exception of the golf course and military family housing, are maintained by a contractor. For maintenance purposes, the varying degrees of maintenance required have led to classifying these areas as either improved grounds, semi-improved grounds, unimproved grounds, or airfield grounds.

7.7.1.1 Improved Grounds

Improved grounds are areas on the installation that require intensive maintenance. They are typically located within developed sections of the installation and include lawns, landscaping, rock beds, plant beds, flower beds, parade grounds, a golf course, and athletic fields. There are 337 acres of improved grounds on Keesler AFB.

Grass varieties include centipede and St. Augustine grass, Bermudagrass, and bahiagrass. Bed/planted areas contain trees, shrubs, flowers, vines, ground covers, rocks, and mulch. Landscape designs for Keesler AFB are developed by contractors and submitted to the base for selection. Keesler AFB selects the design that would best complement the surrounding area. The use of native plants and trees is encouraged in all landscape plans and designs.

The golf course is maintained up to the wetland boundaries and is maintained and mowed according to needs of the rough and greens. Signage is posted to demarcate the wetland boundaries. Irrigation of the golf course occurs at night, as needed. Typically, watering takes place between 0130 and 0300 hours. During periods of extremely high temperatures, water is applied for approximately two minutes during the day to cool the grass.

The amounts of fertilizer and pesticide used on the course have been reduced over recent years, as required by USAF regulations and policy. Fertilizers are applied in the fall and pesticides are applied as needed. The insecticides Suspend SC and Talstar P can be used to eliminate northern mole crickets (*Neocurtilla hexadactyla*) if they prove problematic. To preclude spraying insecticide into the air, application is conducted using the slit-seed method. Fungicides are applied in the winter months.

7.7.1.2 Semi-Improved Grounds

Semi-improved grounds cover 804 acres on Keesler AFB. These grounds generally require less maintenance than improved grounds. The predominant grass varieties in these areas are Bermudagrass and bahiagrass. Beds and planted areas have not been established on semi-improved grounds. Of the 396 acres that make up the semi-improved grounds on Keesler AFB, 233 acres are located in the airfield. The Naval Oaks Reserve covers approximately 25 acres and is managed under the urban forestry program. This category also includes 150 acres is the Harrison Court, Oak Park, and Pine Haven areas, which remain undeveloped.

Mowing requirements for semi-improved grounds are in accordance with the Keesler AFB Grounds Maintenance Performance Work Statement. Waste generated from tree and shrubbery pruning is taken to the base Recycle Center, which is then transported to the VA Medical Center Compost Facility. Grass clippings are mulched and left to provide nutrients to the soil (Keesler Air Force Base 2017).

7.7.1.3 Unimproved Grounds

Unimproved grounds cover 28 acres on Keesler AFB and generally include the wetlands on the north side of the base. Unimproved grounds generally require less maintenance or management activity than semi-improved and improved grounds require. On Keesler AFB, the edges of the wetlands bordering the Back Bay of Biloxi are mowed periodically for personnel safety (i.e., venomous snake control).

7.7.1.4 Military Family Housing

In the military family housing, occupants are responsible for routine ground maintenance activities. Families wishing to place additional landscaping around their homes must obtain approval from Hunt Housing. The primary restriction pertains to the types of plants occupants may use in their landscape designs.

7.7.1.5 Airfield Grounds

Listed below are grounds maintenance practices implemented in the airfield area to reduce the occurrence of BASH incidents at Keesler AFB.

- Maintain a grass height of 7 to 14 inches within 1,000 feet of the runway centerline; however, grass height may be varied seasonally, depending on the nature and species of bird activity.
- Apply herbicides for broadleaf control to eliminate food sources for birds.
- Eliminate potential resting sites by planting bare areas with grass.
- Selectively fertilize areas to promote uniform grass cover.
- Level airfield to eliminate high and low spots to reduce attractiveness to birds and to eliminate standing water.
- Keep airfield area free of all dead vegetation.
- Apply insecticides and herbicides for pest control to eliminate potential food sources for birds.
- Keep drainage ditches obstacle-free to maintain flow.
- Maintain drainage ditch sides with a minimum slope of five to one.

- Select erosion-control vegetation that supports BASH-incident reduction.
- Maintain the airfield as uniformly as possible to reduce the transition zone between differing habitats.
- Prune trees and shrubs to eliminate roosting locations.

7.7.2 Urban Forestry Program

An active urban forestry program is a part of the natural resources program at Keesler AFB. More than 12,000 trees currently exist on the installation. The most predominant trees are live oak, water oak, northern red oak, turkey oak, crepe myrtle, river birch, green ash, sweet gum, Callery pear, and slash pine.

Live oak trees are located throughout the base. This tree was dedicated as the "Airman's Oak" in 2013.

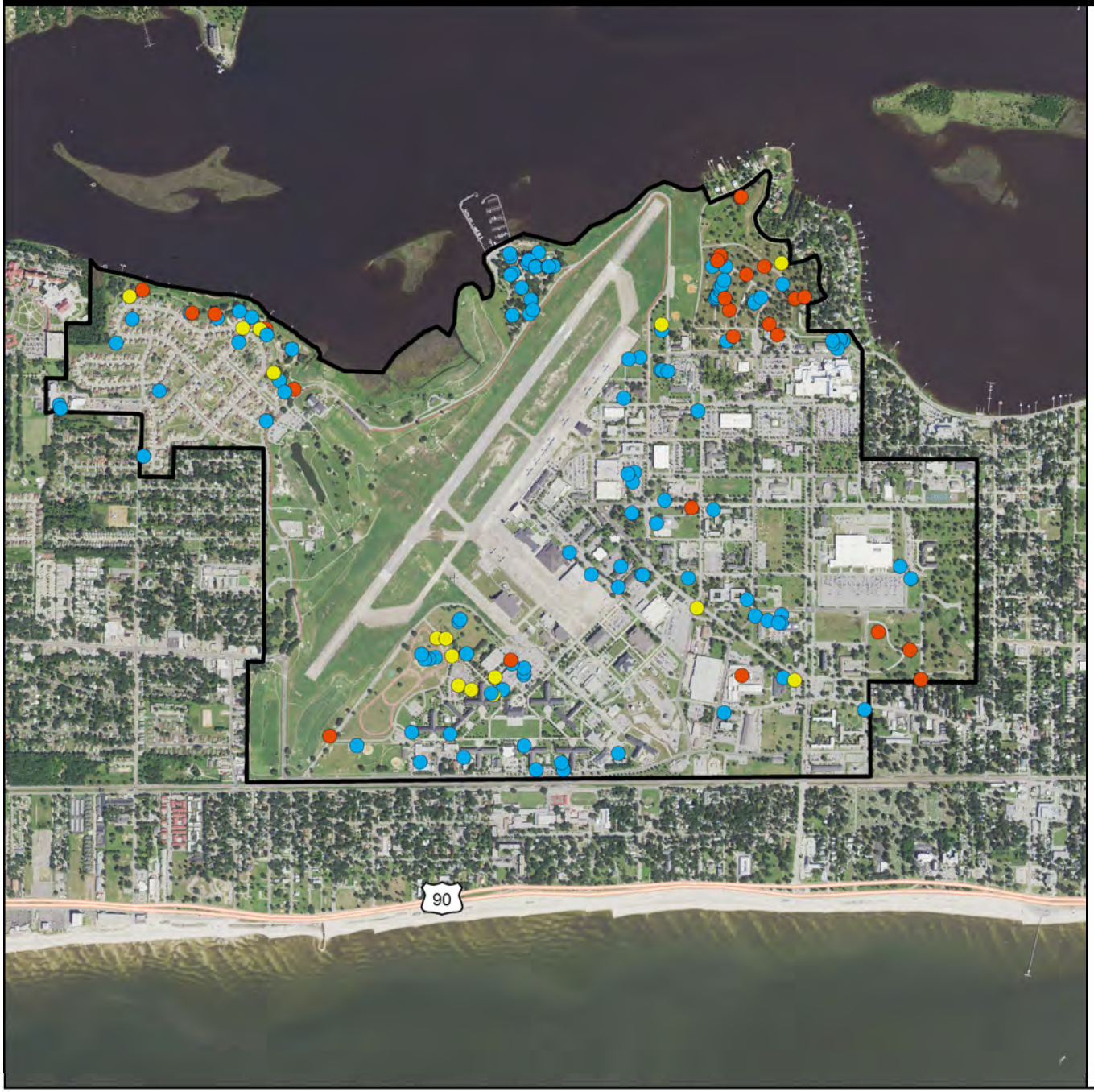
The base supports a large number of live oaks, many of which are more than 150 years old. These older trees have been designated by the city of Biloxi as "Heritage Trees" via Ordinance No. 1569, the *Ordinance Amending Article III of Chapter 15 of the Code of Ordinances, City of Biloxi, and Relating to the Planting, Protection and Removal of Trees*. These live oaks are scattered throughout the base and include a large stand immediately behind the Keesler Marina in the Naval Oaks Reserve. The base's natural resources program personnel manage the Heritage Trees, but the Marina Park is managed by the outdoor recreation program.

These large live oaks represent the largest plant species on the base and serve as significant character-defining features of Keesler AFB. Under Ordinance No. 1569, the trees are protected from development, destruction, and other impacts, and they may not be removed without formal approval from the base Commander. Unfortunately, a significant number of these trees exhibit signs of stress due to hurricane damage, drought, soil impaction, and erosion; however, they are removed only when they have been damaged permanently by lightning, disease, or wind, or if they pose a safety hazard to aircraft.

Hurricane Katrina was responsible for the loss of more than 5,000 trees, and, when new family housing units were constructed on the base to repair or replace those damaged or destroyed by the hurricane, many of the live oaks in these areas were damaged and required removal. In carefully keeping with its *Urban Management Plan*, Keesler AFB has replaced more than 8,000 live oaks since the hurricane to help restore the base's tree canopy and character-defining features (Keesler Air Force Base 2011b). Tree treatment and removal is an ongoing task of the urban forestry management program. Figure 7-2 depicts the location of trees that will receive treatment within the next three years and trees that require immediate removal.

Since the early 1990s, Keesler AFB has been a member of Tree City USA. To qualify as a Tree City USA community, the National Arbor Day Foundation and the National Association of State Foresters has set forth four standards that a municipality must provide: (1) a tree board or department; (2) a tree-care ordinance; (3) a community forestry program with an annual budget of at least $2 per capita; and (4) Arbor Day observance and proclamation (Arbor Day Foundation 2018).

Figure 7-2. Tree treatment and removal plan for Keesler Air Force Base (as of July 2018)



Legend

- Keesler Air Force Base
- Major Highways
- Highways

Treatment and Removal Plan

- 2 Year Treatment Plan
- 3 Year Treatment Plan
- Remove ASAP

N

0 0.25 0.5 Mile

Base data from ESRI StreetMap
Imagery from Mississippi NAIPS State dataset (2016)

World Geodetic System 1984 (WGS84) Projection
Zone 16 N
GCS_WGS_1984

81st TRAINING GROUP

Prepared by:
Center for Environmental Management
MILITARY LANDS
Colorado State University

Created: November 20, 2018

7.7.3 Solid Waste Program

Solid waste generated at Keesler AFB is collected by a service contractor and disposed of at a local landfill. Recycling services are performed by the service contractor under the Qualified Recycling Program. Materials collected include mixed paper, steel and aluminum cans, glass, plastics, and cardboard. Construction and demolition debris is taken to a site located in north Harrison County. Non-construction and demolition debris and municipal solid waste generated at Keesler AFB are collected by a service contractor and disposed of at the MacLand Landfill.

In 2013, the Keesler AFB ground maintenance contractor delivered all ground maintenance-generated waste, with the exception of grass clippings, to the Recycle Center, which then transported the waste to the VA Medical Center Compost Facility (Keesler Air Force Base 2017).

7.7.4 Irrigation and Water Management

There are currently 28 irrigation systems in use on Keesler AFB. Irrigation of improved grounds and athletic fields takes place April through October. Sufficient water is applied to ensure uniform grass color and to prevent brown or barren areas from developing due to a lack of water. For areas located outside the range of an irrigation system, trees, shrubs, and hedges are hand watered to prevent the discoloring or defoliation of leaves. During times of extreme drought or low moisture conditions, irrigation is used outside of the normal growing season (April through October) to ensure plant and tree survival.

The golf course irrigation system is a variable-flow-rate sprinkler system that has the capacity to deliver 1,000 gallons per minute. Water is supplied from a concrete-lined irrigation pond located on the golf course. During periods of limited rainfall or drought, the pond's water level is maintained by adding water from the city of Biloxi's water system. The placement of irrigation systems on the airfield would create a hazard to flight operations on Keesler AFB. When rainfall is insufficient for maintaining ground cover to meet BASH program requirements, the airfield is irrigated with watering trucks.

7.7.5 Fire Management Program

Because the average rainfall (61 inches) that Keesler AFB receives each year is high, fire hazard is typically not considered a threat to the area. Grasses are the only form of vegetation requiring fire management through ground maintenance activities, including frequent mowing and application of herbicides (as needed).

7.8 Forest Management

Applicability Statement

Currently, commercial forestry is not practiced at Keesler AFB, although the installation does maintain an urban forestry program. This INRMP section is not applicable to Keesler AFB.

7.9 Wildland Fire Management

Applicability Statement

Wildfires are not an issue at Keesler AFB; therefore, this INRMP section is not applicable to Keesler AFB.

7.10 Agricultural Outleasing

Applicability Statement

Agricultural outleasing of Keesler AFB land is not practiced; therefore, this INRMP section is not applicable to Keesler AFB.

7.11 Integrated Pest Management Program

Applicability Statement

This section applies to USAF installations that perform pest management activities in support of natural resource management (e.g., invasive species, forest pests, etc.). This section is applicable to this installation.

Program Overview/Current Management Practices

The pest management program entails a regular inspection and maintenance program to control wildlife and other pests. The 2016 Pest Management Plan (81st Training Wing 2017) at Keesler AFB meets the requirements established by DoD Directive 4150.07, *Pest Management Program*, and AFI 32-1053, *Pest Management Program*.

Emergency control measures of nuisance wildlife species are authorized only when wild animals endanger the base's operations or public health. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service, USFWS, and MDWFP are notified as soon as possible after emergency control measures are implemented.

Routine treatment of nuisance wildlife species at the base is conducted on an as-needed basis and includes the use of pesticides as a last-resort option. When appropriate, the 2016 Pest Management Plan (81st Training Wing 2017) is consulted for procedures and policies. Other than the airfield, which is covered under the BASH Plan, the pest management program is responsible for managing and controlling disease vectors and other health-related pests, general household and nuisance pests, structural pests, weeds, pests of stored products, pests of ornamentals and turf, pests of natural resources, miscellaneous pests, and vertebrate pests. The methods of managing these pests at Keesler AFB are described below.

- **Mosquitos**—To control larvae, Altosid Residual Briquettes are applied to areas of standing water and to areas on the airfield that hold open water. To control adult mosquitos, fogging can be conducted with Master Line Kontrol, Prentox Pyronyl Oil, or Riptide.
- **Rodents**—Proper sanitation both inside and outside are the best non-chemical controls. When necessary, glue traps and wooden snap traps area used in any building; appropriate care must be taken to ensure that building occupants do not disturb the traps. Pest Management uses Contrac All-Weather Blox bait blocks in secure boxes outdoors.
- **Cockroaches**—Sticky traps are placed in food handling and storage establishments for inspection purposes and when evidence of roaches are found, egg capsules are removed and destroyed. All buildings can be treated with pesticides by base personnel except the hospital, in which case Critter Gitter Pest Control is contacted.
- **Fleas**—Veterinarians on the base often encounter fleas on animals brought to the clinic. Fleas are managed and controlled using pesticides such as Precor IGR Concentrate, Precor 2000 Premise Spray, Suspend SC, and Talstar P.
- **Venomous spiders (Southern Black Widow [*Latrodectus mactans*]/Brown Recluse [*Loxosceles reclusa]*)**—The Pest Management personnel conduct aggressive inspections when building occupants observe these spiders. If observed, spiders and egg masses are destroyed and pesticides are used. These include Suspend SC, Talstar P, PT-565 XLO, and CY-KICK.
- **Fire ants (*Solenopsis* spp.)**—Visual inspection is the most useful method for monitoring fire ants, and Pest Management treats ant mounds with pesticides, such as Maxforce FC, Amdro Pro Fire Ant Bait, Suspend SC, and Talstar P.
- **Wasps/bees/yellow jackets**—The most productive and least environmentally destructive methods for controlling wasps and yellow jackets are to modify their habitat and their occurrence in human-

activity areas and to control them through trapping and nest removal. Pesticides include Wasp Freeze, Suspend SC, and Talstar P.

- **Cottonmouth (*Agkistrodon piscivorus*) and Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*)**—If a snake is sighted and determined to be a venomous species, such as a cottonmouth or eastern diamond rattlesnake, Pest Management will use snake tongs to capture it. Most sightings are near the wetlands.
- **Flying insects (fruit flies/drain flies, house flies)**—Fly swatters and sticky ribbons are used as non-chemical means to control flies. If necessary, pesticides such as PT-565 XLC are used.
- **Bed bugs (*Cimex* spp.)**—Bed bug infestations are treated with Suspend SC, PT-565 XLO, Temprid SC, and Bedlam Plus.
- **Ants (Pharaoh [*Monomorium pharaonis*], Little Black Ant [*Monomorium minimum*], Tawny Crazy Ant [*Nylanderia fulva*])**—If ants are discovered, sanitation of the area is the first step. Pesticides may be applied if necessary, such as Suspend SC, Talstar P, Phantom, Niban Granular Bait, and Terro-PCO Liquid Ant Station.
- **Subterranean Termites**—Termites left untreated can cause great damage to wooden elements of buildings at the base. Sanitation is the only non-chemical treatment but, if necessary, Termidor SC pesticides can be applied.
- **Carpenter ants (*Camponotus* spp.)**—Carpenter ants left untreated can cause great damage to wooden elements of buildings at the base. Removal of damaged wood can help diminish the threat of carpenter ants and, if necessary, pesticides such as Talstar P, Suspend SC, Niban Granular Bait, or CY-KICK can be used.
- **Weed Control**—Any undesired weeds are monitored and treated with Ranger Pro, Round Up Pro, Crossbow, Rodeo, Image 70 DG Herbicide, or Fusilade II.
- **Drugstore Beetle (*Stegobium paniceum*), Sawtoothed Grain Beetle (*Oryzaephilus surinamensis*), Warehouse Beetles (*Trogoderma* spp.), and "pantry" beetles**—If these beetles are seen, sticky traps and sanitation are the first non-chemical methods employed. Since these pests have the potential to damage great stores of food, any impacted food should be destroyed and the infestation quickly resolved. Applicable pesticides include PT-565 PLUS XLO, CY-KICK, and ULD BP-300.
- **Aphids**—Aphids and wax scale can cause temporary aesthetic damage to plants and can be removed with water and soap if necessary.
- **Mole Crickets**—Mole crickets can damage lawns and can be controlled using Suspend SC or Talstar P.
- **Chinese Tallow Tree**—Lanier Environmental personnel are responsible for monitoring these trees and, if any are found, they must be removed and disposed of, particularly when found in the wetlands area.
- **Southern Pine Beetle (*Dendroctonus frontalis*)**—Infested trees must be removed and disposed of with the ultimate goal of completely removing diseased trees and pine beetles from the base.
- **Bats**—Exclusion is the only method for controlling bats, but this should not be attempted from April through August. After the bats are removed from the building, entrance point(s) and voids (crevices or other places bats use for roosting) are sealed. If bat guano is present, a contractor with proper personal protective equipment should be contacted.
- **Birds**—If birds present a risk to aircraft activity, they are dispersed. See the Keesler AFB BASH Plan (81st Training Wing 2017).

- **Virginia Opossum (*Didelphis virginiana*) and Raccoon (*Procyon lotor*)**—Trapping is the only method for removing opossums and raccoons and, once captured, they are taken to a wildlife management area and released.
- **Eastern Gray Squirrel (*Sciurus carolinensis*)**—Exclusion and trapping are the only methods used to control gray squirrels. Once they are removed from the site, they are taken to a wildlife management area and released.

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to USAF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. This section is applicable to this installation.

Program Overview/Current Management Practices

Keesler AFB implements a BASH program because there is movement of resident and migratory birds that creates hazardous conditions for aircraft. The purpose of the BASH program is to minimize the potential for bird strikes to aircraft and any associated adverse impacts to the Keesler AFB mission. Base Operations maintains records of daily bird counts and bird shoots. Responsibilities and recordkeeping requirements for the BASH program are detailed in the Keesler AFB BASH Plan (81st Training Wing 2016a).

Keesler AFB developed a BASH Plan in accordance with AFI 91-202, *USAF Mishap Prevention Program*, and AFPAM 91-212, *BASH Management Techniques*, for the implementation of the BASH program. The BASH Plan was reviewed and updated in June 2011.

There is no single solution to the BASH problem, and a variety of techniques and organizations are involved in this complex program. Reducing the bird-strike hazard for Keesler AFB flight operations requires a cooperative effort between several base organizations. The Chief of Airfield Safety is responsible for developing this plan.

Specific portions of the plan are implemented continuously and other portions are implemented as required by observed bird activity. Objectives of the BASH Plan are listed below.

- Establish a bird hazard working group (BHWG) and designate responsibilities to its members.
- Establish procedures for reporting hazardous bird activity and altering or discontinuing flying operations, as required.
- Establish aircraft and airfield operating procedures to avoid high-hazard situations.
- Provide for disseminating information to assigned and transient aircrews on bird hazards and procedures for bird avoidance.
- Establish guidelines to decrease airfield attractiveness to birds.
- Provide guidelines for dispersing birds in airfield locations (81st Training Wing 2016a).

The BHWG collects, compiles, and reviews data on bird strikes and identifies and recommends actions to reduce hazards. The BHWG recommends changes in operational procedures and prepares informational programs for aircrews. Proposed BASH Plan changes are approved by the Wing Commander and implemented through the normal chain of command. The Vice Wing Commander serves as the BHWG chair. The BHWG group consists of representatives from the Wing Flight Safety Office (SEF), Airfield Management, Pavement and Equipment, Civil Engineering (pest management, natural resources, and grounds maintenance), tenant units, and other tasked organizations, as required. The BHWG complies with

applicable tasks, responsibilities, and recommendations for countering bird-strike hazards as outlined in the BASH Plan. SEF is responsible for monitoring base-wide compliance with the BASH Plan.

Additionally, SEF disseminates BASH data to the BHWG and flying units and maintains a current bird activity map for the base. SEF also coordinates with agencies such as the USFWS, National Audubon Society, Smithsonian Institute, and local ornithologists for information sharing that pertains to migratory, local, and seasonal bird activities and bird identification. SEF is responsible for coordinating with aircrews and maintenance personnel for collecting non-fleshy remains of bird strikes and providing a bird-strike hazard awareness program. Records of reported bird strikes have been maintained by SEF in accordance with USAF Safety Center requirements since 1995.

7.12.1 Role of Fish and Wildlife Personnel

The base's Civil Engineer is responsible for providing a natural resources representative to the BHWG to monitor and advise the group of environmental modifications. The Civil Engineer is also responsible for

- developing procedures for the removal or control of bird attractants,
- conducting BASH surveys,
- correcting environmental conditions that increase BASH potential,
- using land-management practices that reduce BASH potential,
- maintaining bird habitat and base environmental maps, and
- incorporating BASH Plan practices into the Keesler General Plan.

These activities may require natural resources personnel involvement. BASH program practices that affect natural resources at Keesler AFB are listed below.

- Grass height management and mowing criteria
- Controlling broadleaf weeds
- Planting bare areas
- Fertilizing
- Reducing edge effect
- Leveling the airfield
- Removing dead vegetation
- Removing dead birds and other animals
- Controlling pests
- Maintaining drainage ditches
- Eliminating standing water
- Using erosion-control vegetation
- Controlling waste disposal (proper landfill techniques)
- Eliminating roosting sites
- Bird-proofing buildings and hangars
- Preventing other animal hazards to aircraft (81st Training Wing 2016a)

7.12.2 BASH Plan Wildlife Issues and Concerns

Several BASH program practices are used to avoid bird-strike hazards. Details concerning flight patterns, schedules, and other operational activities not related to natural resources are detailed in the BASH Plan. Fish and wildlife management issues and practices regarding the BASH program are noted below.

- **Remove Dead Animals**—Dead birds or other animals are removed from the field to avoid attracting vultures or other scavengers. Remains that may be the result of collisions with aircraft are forwarded to SEF for identification. SEF forwards the non-fleshy remains of bird-strike incidents to the Smithsonian Institute. Based on incident information and bird identifications, records of flyway patterns are maintained for effective management of bird-strike hazards.

- **Controlling Pests**—Pest Management conducts pest-control activities at the airfield. Insect and earthworm control is crucial to reduce area attractiveness and food sources for birds.
- **Eliminate Roosting Sites**—Pest Management and Entomology conduct roost site-elimination activities. Vegetation management of roost sites controls blackbirds (Icteridae) and European starlings (*Sturnus vulgaris*), where possible. Trees are pruned to reduce the number of perches available and entire trees or stands are removed, if necessary.
- **Bird-Proof Buildings and Hangars**—Currently, specific work orders must be submitted for conducting bird-proofing activities at the base. Rock pigeons (*Columba livia*), house sparrows (*Passer domesticus*), and European starlings frequently nest in buildings and hangars. Access-exclusion practices, such as screening windows, closing doors, and blocking entry holes, are most effective. When necessary, other measures may be used, such as toxic perches, pellet guns, netting, Avitrol, trapping and removal, design features, door coverings, sharp projections, and night harassment.
- **Prevent Other Animal Hazards to Aircraft**—Live trapping is used to remove animals (other than birds) near the airfield. Animals are released elsewhere following removal from the airfield. Additional management techniques are currently implemented that are not included in the BASH Plan (81st Training Wing 2016a).

Pest Management also maintains bird boxes along the airfield. These boxes are baited with Avitrol on an as-needed basis to control nuisance birds such as European starlings. Other closely monitored techniques used by pest-management specialists include propane cannon pyrotechnics, sirens, bioacoustics, fogging with ReJeX-It (a biodegradable, food particle-based repellent), and firearms. Rock pigeons, starlings, and house sparrows may be taken without a depredation permit. Airfield Management coordinates with appropriate state and federal agencies regarding depredation permits and responsibilities for other bird species, as appropriate.

Keesler AFB has established the Bird Hazard Warning System, which is used for the immediate communication between ground agencies and aircrews concerning potential strike hazards. Bird Watch Conditions and Phase I and II Bird Activity guidelines are employed under this system. Additionally, a designated Bird Dispersal team that has immediate access to necessary equipment for immediate bird-strike hazards has been established.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USAF installations located along coasts and/or within coastal management zones. This section is applicable to this installation.

Program Overview/Current Management Practices

Keesler AFB is located on a barrier island within the coastal zone of Mississippi (all land located south of I-10). There are several protected areas within this zone and in proximity to the base, including the Mississippi Sandhill Crane National Wildlife Refuge in Gautier and the Gulf Islands National Seashore. Coastal areas are highly dynamic zones where tidal currents, wind, waves, storm events, and natural habitats all interact to form the resulting features. Common problems in coastal zones are related to these dynamic processes and typically include erosion of inlets, beaches, and dunes; sedimentation; and similar processes. Protection strategies associated with the base's coastal zones include minimizing impacts to habitats and conserving wetlands and natural shorelines. Keesler AFB reduces environmental impacts and provides protection to the surrounding area through its NPDES and the spill prevention program.

7.13.1 Mississippi Coastal Management Program

Keesler AFB preserves coastal resources as part of the overall natural resources management program. To the maximum extent practicable, all activities conducted within the Mississippi coastal zone are consistent with the goals of the Mississippi Coastal Management Program (CMP). Most of Keesler AFB is located within the CMP, and any areas that are outside its bounds are covered by the nationwide permitting.

Key issues for the Mississippi CMP are wetland preservation and restoration. For proposed actions within a coastal zone that could have significant impacts, consistency determinations must be prepared and submitted to the state clearinghouse for intergovernmental coordination on federal projects and programs. These determinations are made as part of the Section 404 permitting process for construction projects. All proposed actions receive a response from the state that indicates concurrence or non-concurrence with the determination.

7.13.2 Coastal Zone Management Act

In recognition of the increasing pressures that over-development places on the nation's coastal resources, Congress enacted the Coastal Zone Management Act (CZMA) in 1972. The CZMA encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources, such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. A unique feature of the CZMA is that participation by states is voluntary. To encourage states to participate, the CZMA makes federal financial assistance available to any coastal state that is willing to develop and implement a comprehensive coastal management program.

7.13.2.1 Coastal Zone Consistency Determinations

The CZMA requires federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone to be consistent with the enforceable policies of a coastal state's federally approved coastal management program. These federal actions may include

- direct federal actions, which are activities and development projects performed by a federal agency or a contractor for the benefit of a federal agency; and/or
- indirect federal actions, which are activities not performed by a federal agency but require federal permits or licenses or other forms of federal approval and federal financial assistance to states and territories and local governments.

The objective is to ensure that federal agencies and applicants for federal approvals and funding adequately consider and comply with the state's CMP. Federal consistency is a method of ensuring greater protection of coastal uses and resources through the coastal management policies of states and territories by assisting states in managing coastal uses and resources.

After working with state CMPs and making any appropriate changes to the proposed action, federal agencies and applicants provide a consistency statement to the CMP, along with supporting information. A state CMP reviews the federal action to determine whether the proposed action will be consistent with the CMP. Federal consistency reviews are the responsibility of the lead state CMP agency (National Oceanic and Atmospheric Administration 2018).

The State Coastal Zone Management Office reviews Section 404 permits as part of the review process. A given project must comply with the coastal zone consistency guidelines for a permit to be approved. These requirements include preparation of a document, in accordance with NEPA, that addresses alternatives to the proposed activity (justification for placement of project in waters under USACE and state jurisdiction), baseline conditions assessment, impacts assessment, and mitigation plan. Keesler AFB has met these

requirements on two Section 404 permits, one each for the marina and the Landfill 3 restoration projects. Floodplain issues were fully assessed as part of the NEPA documentation required for the Section 404 permits. If an EA is prepared, a FONPA is required for projects that impact floodplains, and it is submitted concurrently with the EA. This includes an analysis of potential impacts of the proposed project on floodplain functions and values, an analysis of the reasons why no other practicable alternatives exist for placing the project in the floodplain, an assessment of flood safety issues, and a floodplain mitigation plan, if needed.

7.13.3 Coastal America Program Involvement

Coastal America forms a partnership between federal agencies (including the USAF), state and local governments, and private organizations to address the environmental problems along the nation's coastlines by providing a forum for interagency collaborative action and a mechanism to facilitate regional action plans to protect, preserve, and restore the nation's coastal living resources. This interagency effort operates within existing authorities and serves to link many federal statutes that affect coastal living resources, including but not limited to the CWA, CZMA, Fish and Wildlife Coordination Act, Intermodal Surface Transportation Act, Water Resources Development Act, and NEPA.

7.13.4 Marine Animal Protection

Marine animals occur in the Back Bay of Biloxi, the Mississippi Sound, and the Gulf of Mexico. The base helps to protect marine animals through effective management of the marina fishing license program. In addition, boating and personal water craft activities may impact marine animals and their environment. At Keesler AFB, these activities are limited to the dock areas and discouraged in open water farther from the base.

The wetland areas along the Back Bay of Biloxi provide nursery and foraging habitats for a wide variety of marine animals, including fish, reptiles, amphibians, invertebrates, and birds. These wetland habitats are protected under the CZMA, Section 404 of the CWA, and Section 10 of the Rivers and Harbors Act. Measures to ensure conservation are incorporated into the natural resources program described in Section 7.6 of this INRMP. The base also provides protection of marine animals by staying in compliance with the requirements of the NPDES Phase 1 Storm Water Permit, the NPDES Construction Storm Water Permit, and the requirements established in the SPCC Plan.

7.14 Cultural Resources Protection

Applicability Statement

This section applies to USAF installations that have cultural resources that may be impacted by natural resource management activities. This section is applicable to this installation.

Program Overview/Management Practices

Many of the cultural resources that existed on the base were damaged due to natural disasters over the last century. In 2003, a survey of Cold War-era buildings was conducted at Keesler AFB and, of the 1,424 Cold War-era buildings inventoried, only 144 were evaluated further on the basis of their association with Cold War missions of Keesler AFB. Seven of these buildings are recommended as eligible for listing in the National Register of Historic Places (NRHP) as Cold War-era resources. Buildings 1002, 6901, 6902, 6903, and 6918 are recommended as eligible under Criterion C for listing in the NRHP for their associations with radar and electronics training during the Cold War. Buildings 4116 and 4331, both over 50 years old, are currently recommended as eligible under Criterion A for listing in the NRHP for their associations with electronics training for the Korean War effort, and they are recommended as eligible examples of state-of-

the-art electronics training facilities from the early Cold War/Korean War period (United States Air Force Air Education and Training Command 2003). Through subsequent meetings and evaluations with the Mississippi State Historic Preservation Office, Buildings 6902, 6903, and 6918 were approved for demolition (Keesler Air Force Base 2013b).

An assessment of the remaining early Cold War-era resources at the base that are already 50 years old found that none are eligible for listing in the NRHP due to their lack of architectural integrity or historical association with the Cold War (United States Air Force Air Education and Training Command 2003).

There are no known archeological resources on Keesler AFB; however, if ground-disturbing activities reveal previously unknown cultural resources, the activity must stop immediately. Also, the base Environmental Manager and base Civil Engineer must be contacted and the resource evaluated for NRHP eligibility. If the resource is determined to be eligible for listing in the NRHP, Keesler AFB will comply with Section 106 of the National Historic Preservation Act, including consultation with the Mississippi State Historic Preservation Office and possible development of impact mitigations (Keesler Air Force Base 2013b).

The large number of live oaks on Keesler AFB designated as Heritage Trees are set aside for conservation. Despite their grand presence as natural resources, they are also valuable cultural assets to Keesler AFB. Not only have these trees stood for centuries, they have become character-defining features of the base itself and iconic to the military and civilian communities. The NRM is responsible for ensuring that these trees are monitored and protected as both natural and cultural resources.

7.15 Public Outreach

Applicability Statement

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

Program Overview/Management Practices

Access to Keesler AFB is restricted for security reasons; however, the base supports a variety of natural resource-based research projects and sponsored programs and events involving the public. An annual event of note is Keesler's participation in Arbor Day, which brings awareness to military and civilian people about the grandeur of the base's trees, particularly the live oaks. The base also participates in annual coastal cleanups and provides and distributes pamphlets to encourage volunteers and bring awareness to coastal health. Additional public outreach programs are discussed in Section 7.2, *Outdoor Recreation and Public Access to Natural Resources*.

7.16 Geographic Information Systems

Applicability Statement

This section applies to all USAF installations that maintain an INRMP because all geospatial information must be maintained within the USAF GeoBase system. The installation is required to implement this element.

Program Overview/Management Practices

GeoBase information management is an important part of natural resource planning. The current geographic information system (GIS) at Keesler AFB allows personnel to organize, evaluate, present, and update

natural resource information for the effective and efficient management of natural resources through the natural resources program.

Currently, the base uses ArcGIS software. The GIS program is integrated with all base operations, including emergency response, work and build permits, utilities mapping, transportation projects, and airfield operations. The GIS program is available to a large group of base members, and it has a web-based map viewer interface available to all Common Access Card users. Keesler AFB has entered all civil engineering operations into the GIS program.

The Keesler AFB GIS program is compatible with federal, state, and local agency databases and it can be upgraded and expanded. The GIS data are designed to be in compliance with the spatial data standards for facilities, infrastructure, and environment (Spatial Data Standards for Facilities, Infrastructure, and Environment, ver. 3.1) (Center for Environmental Management of Military Lands 2017). The base has sufficient equipment and personnel for supporting the current GIS program in place. ArcGIS desktop software is available on multiple machines with trained personnel using GIS.

Currently, all spatial data for base resources are mapped in GIS. The Keesler Common Installation Picture, as it is known, is made up of data layers served on the GeoBase web server, providing continuous access to vital information.

The GIS program mission is to provide geospatial information and deploy GeoBase web services across the 81 TWG. The program intends to

1. maintain the Keesler Common Installation Picture and associated databases,
2. support units in the development of mission data sets for their GeoBase applications, and
3. train end users of the GeoBase system.

The Keesler GeoBase program is a wing-wide, decision-making tool used by all levels of command. It is used in base planning and formed the baseline data for the Keesler AFB General Plan (Black & Veatch 2004).

8.0 MANAGEMENT GOALS AND OBJECTIVES

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

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

Goals and objectives for the Keesler AFB INRMP are formed on the basis of the background information presented in previous chapters of this INRMP. Goals are the primary focal points for implementing the INRMP and should reflect the values of Keesler AFB by expressing a vision of desired conditions for the base's natural resources in the foreseeable future. Objectives support the goals and indicate a management initiative or strategy anticipated to achieve the stated goal. An objective specifically states what will be done and how it will be done, it is bound by time, and it is measurable. Projects are the individual component actions anticipated to achieve objectives and they include specific methods and procedures. Projects must be achievable within the period covered by the INRMP.

Installation Supplement—Management Goals and Objectives

GOAL 1: Assess, Manage, Conserve, and Protect Wetlands on Keesler AFB

- Objective 1.1: Assess the quality of base wetlands.
    - Project 1.1.1: Conduct a base wetlands delineation study.
- Objective 1.2: Manage and conserve base wetlands.
    - Project 1.2.1: Remove any invasive species, especially cogongrass and Chinese tallow trees, from base wetlands areas. Document any migration of invasive species from currently known locations.
- Objective 1.3: Protect base wetlands.
    - Project 1.3.1: Use mapping, GIS, and field surveys to determine the quantity and quality of base wetlands. Additionally, address any migration or spread of invasive species if funds are available.
    - Project 1.3.2: Assess factors and actions that threaten the quantity and quality of base wetlands, such as erosion, development, and recreation activities.

GOAL 2: Assess, Manage, Conserve, and Protect Heritage Trees and Native Vegetative Resources on Keesler AFB

- Objective 2.1: Continue to develop and implement an effective and proactive Urban Forestry Management Program.
    - Project 2.1.1: Assess tree resources through monitoring the health of trees and native vegetation on Keesler AFB; if funds are available, conduct the assessment at least annually. A 2012 Tree Habitat Conservation Plan report included a tree inventory and identified treatment procedures. Establish an updated inventory on the health of the trees, and proceed with recommendations.
    - Project 2.1.2: Manage and conserve tree resources by treating and/or removing diseased trees and native vegetation as necessary to save heritage trees and other native vegetation, as necessary.
    - Project 2.1.3: Manage tree resources by removing dead trees, as necessary, to ensure public safety and prevent damage to base facilities.
    - Project 2.1.4: Conserve trees by establishing a new tree conservation policy in coordination with wing leadership.
    - Project 2.1.5: Protect tree resources by removing all invasive trees and vegetation from terrestrial areas.

GOAL 3: Enhance and Monitor Wetlands and Assess Other Areas to Protect and Encourage Populations of Native Species and Approved Nongame Wildlife on Keesler AFB

- Objective 3.1: Assess areas to identify their potential for establishing butterfly gardens, meditative areas, and wildflowers.
    - Project 3.1.1: Amend Keesler AFB Landscaping Plan to include these additions.
- Objective 3.2: Protect and improve the habitats of and growing conditions for native species on Keesler AFB.
    - Project 3.2.1: Work with architects and engineers in planning and designing phases of projects to ensure that native species are considered in project management.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

The INRMP is reviewed annually by the environmental staff to ensure that implementation of natural resources management is compatible with other base management plans and that the INRMP reflects current Keesler AFB practices. The EMS, CFT, and EESOHC are briefed on changes to the INRMP. The Installation Commander signed the 2013 plan and will sign any major revisions to the INRMP.

Table 9-1 identifies the projects to be implemented for this INRMP, when those projects will be completed, and the approximate cost of each project. No additional staff are required for Keesler AFB to implement the INRMP. The KBOS/CEV will provide natural resources management training to Keesler AFB personnel. This training will allow Keesler AFB personnel to implement the INRMP.

9.2 Monitoring INRMP Implementation

The KBOS/CEV will work with Keesler AFB personnel to monitor the implementation of this INRMP. During annual reviews of the INRMP, EMS and the CFT will identify which projects have been completed and any issues associated with implementing the projects. Keesler AFB personnel also will identify the results of the projects and any adaptive management strategies that may be used.

9.3 Annual INRMP Review and Update Requirements

The Keesler AFB INRMP will be implemented by AFB personnel and reviewed annually by the KBOS/CEV and EESOHC. The annual review will be certified by the KBOS/CEV, who will verify that

- all "must fund" projects and activities have been budgeted for, implementation is on schedule, and all required natural resources positions are filled or are in the process of being filled and those personnel are trained;
- projects and activities for the upcoming years have been identified and included in the INRMP (an updated project list does not necessitate revising the INRMP if the goals and objectives remain unchanged);
- all required coordination with the USFWS and MDWFP has occurred; and
- any significant changes to the installation's mission requirements or its natural resources have been identified.

In accordance with AFI 32-7064, the Keesler AFB INRMP must be reviewed and updated at least once every five years in cooperation with the USFWS and MDWFP. If changes in the military mission, environmental compliance requirements, or other new information that significantly affects the installation's ability to implement the Keesler AFB INRMP occur, interim updates to the INRMP would be required at an interval of less than five years. Significant changes in the installation mission or its natural resource management issues would also require an INRMP revision, including coordination with the appropriate agencies. The KBOS/CEV will make the determination if the Keesler AFB INRMP requires a revision during the annual review and coordination process.

Table 9-1. Proposed projects at Keesler Air Force Base.

Project	Year to be Completed	Approximate Cost[1]
Maintain health of trees on Keesler AFB.	Ongoing	$21,000/year
Conduct a base wetlands delineation survey.	2024	TBD
Remove any invasive species, especially cogongrass and Chinese tallow trees, from base wetlands areas. Document any expansion of invasive species from currently known locations.	Ongoing	$63,000
Use mapping, GIS, and field surveys to determine the quantity and quality of base wetlands. Additionally, address any expansion of invasive species, if funds are available.	Ongoing	
Assess factors and actions that threaten the quantity and quality of base wetlands, such as erosion, development, and recreation activities.	Ongoing	
Assess tree resources through monitoring the health of trees and native vegetation on Keesler AFB. At a minimum conduct the assessment annually if funds are available.	2021	$60,000
Manage and conserve tree resources by treating and/or removing diseased trees and native vegetation, as necessary, to save heritage trees and other native vegetation.	Ongoing	
Manage tree resources by removing dead trees, as necessary, to ensure public safety and prevent damage to base facilities.	Ongoing	
Conserve trees by establishing a new tree conservation policy in coordination with 81 TRW leadership.		
Protect tree resources by removing all invasive trees and vegetation from terrestrial areas.	Ongoing	
Amend Keesler AFB Landscaping Plan to include alterations to the natural resources on base.	Ongoing	
Work with architects and engineers in planning and design phases of projects to ensure consideration of native species in project management.	Ongoing	

[1] Initial estimates roughly in order of magnitude.

10.0 ANNUAL WORK PLANS

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

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

Table 10-1. Annual Work Plans for Keesler Air Force Base, 2019–2023.

Annual Work Plans (include year)	**Office of Primary Responsibility**	**Funding Source**	**Priority Level**
Annual invasive species work	Keesler AFB NRM	AFCEC	High
Annual/semi-annual tree treatment	Keesler AFB NRM	AFCEC	High

11.0 REFERENCES

11.1 Standard References (Applicable to all USAF installations)

- AFI 32-7064, Integrated Natural Resources Management
- DoDI 4715.03, Natural Resources Conservation Program
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook—an Internal AF reference available at https://cs1.eis.af.mil/sites/ceportal/CEPlaybooks/NRM2/Pages/

11.2 Installation References

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12.0 Standard Acronyms (Applicable to all USAF installations)

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

12.1 Installation Acronyms

ADP	Area development plan
AETC	Air Education and Training Command
AF	Air Force
AFB	Air Force Base
AFPD	Air Force Policy Directive
AFI	Air Force Instruction
AICUZ	Air Installation Compatible Use Zones
AMSL	Above mean sea level
APZ	Accident Potential Zones
BASH	Bird/Wildlife Aircraft Strike Hazard
BMP	Best management practice
BHWG	Bird Hazard Working Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFT	Cross-Functional Team
CMP	Coastal Management Program
CO	Carbon monoxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	Decibels
DoD	Department of Defense
DoDI	Department of Defense Instruction
EA	Environmental Assessment
EESOHC	Energy Environmental Safety and Occupational Health Council
EIS	Engineering Installation Squadron
EMS	Environmental Management System
EPA	Environmental Protection Agency
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	Environmental Restoration Program
ESA	Endangered Species Act
FGS	Final Governing Standards
FamCamp	Family Camp
FONPA	Finding of No Practical Alternative
GIS	Geographic Information Systems
GSU	Geographically Separated Units
IDP	Installation Development Plan
INRMP	Integrated Natural Resources Management Plan

KBOS/CEV	Keesler Base Operating Services Base Environmental
MDEQ	Mississippi Department of Environmental Quality
MDG	Medical Group
MDMR	Mississippi Department of Marine Resources
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
Mg/L	Milligrams per liter
MIS	Management Information System
mph	Miles per hour
MS	Mississippi
MS4	Municipality Separate Storm Sewer System
MSG	Mission Support Group
MSNHP	Mississippi Natural Heritage Program
NAAQS	National Ambient Air Quality Standards
n/a	Not applicable
n.d.	No date
NEPA	National Environmental Policy Act
NO_2	Nitrogen dioxide
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	Non-point source
NRHP	National Register of Historic Places
NRM	Natural Resources Manager
NWI	National Wetlands Inventory
O_3	Ground-level ozone
OSD	Office of the Secretary of Defense
Pb	Lead
P.L.	Public Law
PM	Particulate matter
POC	Point of contact
ppb	Parts per billion
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
SEF	Wing Flight Safety Office
SO_X	Sulfur oxides (SO_x measured as sulfur dioxide, SO_2)
SPCC	Spill Prevention, Control, and Countermeasure
SWPPP	Storm Water Pollution Prevention Plan
TES	Threatened and endangered species
TRG	Training Group
TRW	Training Wing
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
U.S.	United States
U.S.C.	United States Code

VA	Veteran's Affairs
WCRP	Water Contingency Response Plan
WG	Wing
WRS	Weather Reconnaissance Squadron
WWII	World War II

13.0 STANDARD DEFINITIONS

(Applicable to all USAF installations)

- Natural Resources Playbook—Definitions Section

14.0 APPENDIX

Appendix 1: Annotated summary of key legislation related to design and implementation of the INRMP.

Federal Public Laws and Executive Orders	Explanation
National Defense Authorization Act of 1989, Public Law (P.L.) 101–189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101–511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasizes inventory and stewardship responsibilities of biological, geophysical, cultural, and historical resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, Protection and Enhancement of Environmental Quality	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, Protection and Enhancement of the Cultural Environment	All federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters that they administer.
EO 11988, Floodplain Management	Provides direction regarding actions of federal agencies in floodplains and requires permits from state, territory, and federal review agencies for any construction within a 100-year floodplain to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of federal lands and facilities.
EO 11989, Off-Road Vehicles on Public Lands	Directs installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, Protection of Wetlands	Requires federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have already been implemented; and requires Federal agencies to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, Federal Compliance With Pollution Control Standards	Delegates responsibility to the head of each executive agency for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the EPA authority to conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.
EO 12898, Environmental Justice	Requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, Exotic and Invasive Species	Prevents the introduction of invasive species and provides for their control and minimizing their economic, ecological, and human health impacts.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	**Explanation**
Animal Damage Control Act (7 U.S.C. § 426–426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigating and controlling mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668–668c), as amended	Provides for protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of these birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act (42 U.S.C. § 7401–7671q, 14 July 1955), as amended	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish federal standards for air pollutants. It is designed to improve air quality in areas of the country that do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682; P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage from and respond to releases of hazardous substances, fund and establish standards for clean-up, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.

Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 et seq.; P.L. 93-205), as amended	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and NOAA Fisheries (formally, the National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure that pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act (43 U.S.C. § 1701–1782)	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values, and to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974 (7 U.S.C. § 2801–2814)	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. §1251–1387)	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322; PL 96-366)	Encourages installations to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS or state or territorial agencies to ascertain means of protecting fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. §§ 3371–3378)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-Excess Property of Military Departments (10 U.S.C. § 2667), as amended	Authorizes DoD to lease to commercial enterprises federal lands not currently needed for public use; covers agricultural outleasing program.
Migratory Bird Treaty Act (16 U.S.C. § 703–712)	Implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4321 et seq.; P.L. 91-190), as amended	Requires federal agencies to use a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality created Regulations for Implementing the National Environmental Policy Act (40 CFR Parts 1500–1508, as amended), which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act (16 U.S.C. § 470 et seq.)	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the NRHP. Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Improvement Act (U.S.C. 16 § 668dd; P.L. 105–57)	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Establishes requirements for the treatment of American Indian human remains and sacred or cultural objects found on federal lands; includes requirements on inventory and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the U.S. without a federal permit. Installations should coordinate with the USACE to obtain permits for the discharge of refuse affecting navigable waters under the NPDES and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land (10 U.S.C. § 2665)	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for advancing the conservation, protection, and enhancement of these resources consistent with other federal and local programs.

Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of the DoD, USFWS, and state fish and wildlife agency in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources, and it allows collection of nominal hunting and fishing fees. NOTE: AFI 32-7064, sec. 3.9, Staffing—As outlined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act (16 U.S.C. § 670 et. seq.), the Office of Management and Budget Circular no. A-76, Performance of Commercial Activities (4 August 1983; revised 29 May 29 2003) does not apply to the development, implementation, and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to have DoD personnel perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	**Explanation**
DoDI 4150.07, DoD Pest Management Program, dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, Environmental Security	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures that environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoDI 4715.03, Natural Resources Conservation Program	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
Office of the Secretary of Defense (OSD) Policy Memorandum (17 May 2005) Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout the DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum (1 November 2004), Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on the scope of INRMP review and public comment on INRMP review.
OSD Policy Memorandum (10 October 2002) Implementation of Sikes Act Improvement Act: Updated Guidance	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout the DoD and replaces the 21 September 1998 guidance, Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	**Explanation**
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process	Provides guidance and responsibilities in the Environmental Impact Analysis Process for implementing INRMPs. Implementing an INRMP constitutes a major federal action and therefore is subject to evaluation through an EA or an Environmental Impact Statement.
AFI 32-7062, Air Force Comprehensive Planning	Provides guidance and responsibilities related to the USAF comprehensive planning process on all USAF-controlled lands.
AFI 32-7064, Integrated Natural Resources Management	Implements AFPD 32-70, Environmental Quality; DoDI 4715.03, Natural Resources Conservation Program; and DoDI 7310.5, Accounting for Sale of Forest Products. It explains how to manage natural resources on USAF property in compliance with federal, state, territorial, and local standards.
AFI 32-7065, Cultural Resources Management	Implements AFPD 32-70 and DoDI 4710.1, Archaeological and Historic Resources Management. It explains how to manage cultural resources on USAF property in compliance with federal, state, territorial, and local standards.
AFPD 32-70, Environmental Quality	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning USAF's future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust, and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo (29 January 1999) for Implementation of Sikes Act Improvement Amendments, Headquarters USAF Environmental Division	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.