U. S. AIR FORCE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Holloman Air Force Base

(See INRMP signature pages for plan approval date)

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ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the U.S. Air Force's (AF) 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-U.S. territories will comply with applicable Final Governing Standards (FGS). Where applicable, external resources, including Air Force Instructions (AFIs); AF Playbooks; federal, state, local, FGS, biological opinion and permit requirements, are referenced.

Certain sections of this INRMP begin with standardized, AF-wide "common text" language that address AF 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 AF-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 AF environmental Installation Support Teams (ISTs) and/or installation personnel.

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

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DOCUMENT CONTROL

Record of Review – The INRMP is updated not less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. In accordance with (IAW) the Sikes Act and AFI 32-7064, *Natural Resources Management*, the INRMP is required to be reviewed for operation and effect not less than every five years. Annual reviews and updates are accomplished by the base Natural Resources Manager (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 NR 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), state fish and wildlife agency, and 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. Following update, the installation NRM obtains approval signatures on the updated document.

INRMP APPROVAL/SIGNATURE PAGES

49 WG/CC

CONCURRENCE WITH HOLLOMAN AIR FORCE BASE
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Pursuant to the Sikes Act (16 U.S.C. 670a-670o), as amended, Holloman Air Force Base, New Mexico, has completed its 5-year revision of the installation's Integrated Natural Resources Management Plan (INRMP). The 49 WG/CC has reviewed the INRMP and concurs with the findings and management recommendations therein.

Aug 27, 2018

JOSEPH L. CAMPO, Col, USAF
Commander

Date

HAFB Integrated Natural Resources Management Plan

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

CONCURRENCE WITH HOLLOMAN AIR FORCE BASE
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

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Regional Director Signature

Aug. 20, 2018
Date

NEW MEXICO DEPARTMENT OF GAME AND FISH

CONCURRENCE WITH HOLLOMAN AIR FORCE BASE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

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Alexandra Sandoval

Director Signature

7/23/18

Date

EXECUTIVE SUMMARY

The Department of Defense (DoD) is committed to the conservation and protection of biodiversity on military lands. Biodiversity conservation on United States Air Force (USAF) controlled lands and waters shall be promoted when consistent with the mission and practicable. Maintaining biodiversity is crucial to overall ecosystem integrity and sustainability. Failure to maintain ecosystem diversity may result in severe degradation of land and loss of public confidence in the USAF's stewardship of land and natural resources. If access to the land is subsequently denied to the USAF, this will negatively impact the USAF mission (AFI 32-7064). According to AFI 32-7064 (18 November 2014) and the Sikes Act, 16U.S.C § 670 et. seq., all DoD installations must prepare and implement an Integrated Natural Resources Management Plan (INRMP) as the chief tool for managing natural resources in a coordinated manner.

This INRMP was developed to provide interdisciplinary strategic guidance for natural resource management on Holloman Air Force Base (HAFB) through an ecosystem management approach. The ecosystem management approach strives for sustainable use, consistent with operational readiness and military mission. Based on an interdisciplinary approach to ecosystem management, this INRMP ensures the successful accomplishment of the military mission by integrating all aspects of natural resource management with each other and with activities associated with the installation's mission.

HAFB's INRMP was developed in an interdisciplinary manner, based on previous INRMPs along with additional studies and information and involved military and/or civilian representatives of all relevant HAFB groups including the United States Fish and Wildlife Service (USFWS) and New Mexico Department of Game and Fish (NMDGF). This INRMP was prepared according to DoD Policy Directives and Instructions designating procedures to develop comprehensive ecosystem management plans (DoDI 4715.03, DoDD 4700.4) and complies with USAF Directive and Instructions AFPD 32-70, AFI 32-7064 and AFI 32- 7065. The plan incorporates information and guidance from the Comprehensive Wildlife Conservation Strategy for New Mexico (CWCS) (NMDGF 2006) and the State Wildlife Action Plan for New Mexico (SWAP) (NMDGF 2016a).

This INRMP is focused on the achievement of 12 specific goals for the protection and improvement of the natural environment (See Section 8 Management Goals and Objectives for more detailed descriptions):

- **Goal 1:** Maintain a Fully Staffed Natural Resources Program
- **Goal 2:** Designate, Map, and Monitor Important Wildlife Habitats within the Chihauhuan Desert
- **Goal 3:** Document and Monitor HAFB Species Diversity and Population Trends
- **Goal 4:** Conserve and manage, if present, threatened, endangered, and candidate species listed for regulatory protection by federal and state agencies, as well as critical habitat and wetlands on HAFB main base, BWWSA, and geographically separated units (GSUs). Includes monitoring HAFB Species of Concern (SOC) for population trends and potential impacts.
- **Goal 5:** All activities on base under HAFB jurisdiction and control conserve use of potable water to maintain sustainable quantities of high quality surface water and groundwater resources
- **Goal 6:** Lake Holloman and the constructed wetlands are managed, consistent with the primary purpose of the constructed wetlands and BASH concerns, for shorebird and waterfowl habitat
- **Goal 7:** Optimize the Wildland Fire Management Program for HAFB main base, BWWSA, and (GSUs)
- **Goal 8:** Manage pests in a manner that reduces impacts to natural resources, watersheds, landscapes, and the base mission
- **Goal 9:** Manage noxious weeds and invasive plants on HAFB main base, BWWSA, and GSUs

- **Goal 10:** Reduce Wildlife Aircraft Strike Hazards for HAFB
- **Goal 11:** Increase awareness, appreciation and conservation of natural resources on HAFB
- **Goal 12:** Maintain Natural Resource data for HAFB and associated properties to efficiently plan ground-based mission activities and various projects as well as performing INRMP updates and revisions; meeting mission objectives while protecting biodiversity on base

This document directs natural resource management policy for the next five-year planning period of 2018-2022. This plan must be reviewed annually and updated every five years. The INRMP will be available in digital format on the HAFB website and the AF portal and is available through the 49th Civil Engineer Installation Management Flight (CES/CEI) on compact disk (CD). Making the plan available electronically will increase the user base and efficiency in implementing procedural guidelines. The plan follows a format that compiles analysis and information regarding specific and related resources in one section, within the context of USAF, USFWS, and NMDGF goals and policies.

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 assets of the United States Air Force. They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of Air Force adaptability in all environments. The Air Force has stewardship responsibility over the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the Air Force natural resources program is to sustain, restore and modernize natural infrastructure to ensure operational capability and no net loss in the capability of AF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation’s mission. The INRMP is intended for use by all base personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

This INRMP will guide the Holloman AFB (HAFB) Natural Resources Manager (NRM) and base personnel in their efforts to protect and enhance the natural resources of HAFB for multiple use, biological diversity, ecological integrity, and sustainability in coordination with land uses for military readiness. Many of the standards and recommendations presented here are derived from Federal regulations; DoD mandates, directives, and instructions; professional peer-reviewed natural resource publications, and studies and monitoring conducted on HAFB. The INRMP takes a whole-system approach to the conservation of biodiversity on HAFB (DoDI 4715.03, 2011; AFI 32-7064, 2014).

The INRMP identifies resource management goals, objectives and strategies, including priority management actions base wide for HAFB. The goals and strategies have also been developed in cooperation with the USFWS and NMDGF within the context of the CWCS (2006) and SWAP (NMDGF 2016a), prepared by the NMDGF, in compliance with the State and Tribal Wildlife Grants Act of 2001. We identified and prioritized HAFB goals with pertinent strategies for managing the base and its specific resources addressed in a framework of standards for the various resources and appropriate management actions.

HAFB has characteristic ecological and natural resource values within the unique, diverse, and large-scale Tularosa Basin ecosystem. On the broadest scale, natural resources management focuses on these values within the context of military readiness. Human activities that conflict with these values create resource management issues, and management goals are broad strategies for addressing them. Management standards define a framework of criteria within which proposed activities can be evaluated for consistency with the stated goals and for which appropriate management actions can be developed. They are documented as desired future conditions – the desired management landscape and resulting conditions as foreseen within the stated goals. Conservation actions address specific management issues that arise from past, current, or proposed activities; they are designed to resolve, mitigate, and/or ameliorate management issues. Each management action should contribute to meeting one or more management goals in accordance with relevant management standards.

We developed all goals and standards/desired future conditions with the aim of meeting or exceeding DoD and United States Air Force (USAF) mission and environmental stewardship goals and HAFB mission goals and objectives. Specific conservation actions are proposed for each management goal as defined by the standards/desired future conditions. This INRMP also identifies how these conservation actions will impact HAFB mission.

The conservation actions represent the heart of the INRMP. This INRMP provides the basis for requesting and obtaining funding for implementation of the identified conservation actions for meeting HAFB management goals. When implemented, these actions should satisfy DoD and USAF directives for ecosystem management. These actions also are driven by and in full compliance with the laws, regulations, and Executive Orders identified in Summary of Key Legislation Related to Design and Implementation of the INRMP. Most importantly, they make real the integrated management of the abundant natural resources present on HAFB. Each management action is designated with a priority for implementation, an analysis on effect on mission, and federal and state laws and regulations, DoD and USAF guidance, and memoranda of agreements identified in Summary of Key Legislation Related to Design and Implementation of the INRMP. These goals and management actions are shown in Section 8, Management Goals and Objectives.

A proposed action inconsistent with the management standards described here will move the ecological condition of the resource away from, rather than toward, the desired condition as defined by the management goals. These actions must either be modified or not be implemented, or the management goal and standards themselves modified. Proposed actions consistent with the standards will be formalized during the annual review of the INRMP or at its five-year revision.

Per the Sikes Act and AFI 32-7064, this INRMP will be evaluated using procedures pursuant to the National Environmental Policy Act (NEPA). Many proposed conservation actions are administrative in nature. Although they facilitate resource management, they do not directly impact the environment of HAFB. Examples of administrative management actions are educating Team Holloman, residents, and the public about natural resource values and soliciting input from the NMDGF or the USFWS about wildlife management or continuing coordination with Federal and state agencies under Memoranda of

Agreement. Pursuant to NEPA, only management actions that directly impact the environment are required to be evaluated in the NEPA document prepared for the INRMP; administrative actions are categorically excluded under Appendix B to 32 CFR Part 989. In addition to the programmatic NEPA document for this INRMP as a whole, programmatic NEPA documents for management of all ground based training and for management of the High Speed Test Track (HSTT) have been prepared and the results are incorporated by reference into this INRMP. The INRMP:

- Ensures the management of natural and cultural resources is consistent with the mission at HAFB and is within the larger context of DoD and USAF policies, guidance, requirements, and goals including DoD goals as documented in DoDI 4715.03 (2011) and USAF goals as documented in AFI 32-7064
- Is developed in cooperation with the USFWS and NMDGF to ensure it is consistent with inventory, survey and monitoring needs, desired future conditions, and conservation actions as documented in the CWCS (NMDGF 2006) and SWAP (NMDGF 2016a)

Not all natural and cultural resources have all levels of the legal and guidance hierarchy; therefore, only those levels that exist are included. The HAFB INRMP has five stated purposes that apply to this update:

1. To create an easily accessible, well-used, integrated reference for use by Command, action proponents, base planners, and natural resources manager that would:

    - Identify locations and critical timing of natural resources and management actions
    - Identify locations and circumstances of potential conflicts and conflict resolution opportunities
    - Identify unique and sensitive areas
    - Provide resources for proactive planning by action proponents
    - Provide a basis for requesting and obtaining funding
    - Develop a “one-stop” planning document that incorporates and integrates goals, purposes, management direction, and management activities for each natural resource, fully consistent with each resource component plan and complementary with other component plans

2. To foster understanding of the jobs, roles, responsibilities, and needs of the various flights and functional operations as they relate to the protection, rehabilitation, maintenance, and enhancement of and interaction with natural resources on HAFB to:

    - Identify, coordinate, and clarify the cross-functional roles of the organizational representatives and action proponents within the base organization
    - Open lines of communication for more effective and timely planning, more efficient mission operations, and more pleasant, proactive, and cooperative relationships
    - Identify various Federal, state, and local agencies and Indian tribes, and public and private stakeholders and other interested parties, and provide appropriate means for participation in HAFB planning and management of natural resources

3. To develop realistic management goals, management activities and programs, and funding levels for HAFB natural resources that both support mission and increase the quality of work and recreation on the base.

4. To direct natural resources management policy on base for the planning period, through cross-functional consensus and Command approval, so that all functional activities on HAFB can move forward together to:

    - Identify areas dedicated to natural resource management
    - Determine primacy of goals and management activities when activities and natural resources conflict and provide rationale for changing existing natural resource management actions when necessary

5. To ensure consistency of HAFB programs and functions with environmental laws, regulations, Executive Orders, DoD Instructions and guidance, and USAF instructions. The process for the INRMP included collecting baseline information, GIS data, resulting in a baseline document incorporating the following information:

    - Ground-based training; Management of landscaped grounds, noxious and invasive plants, and pest management
    - Management of wildlife and plants and their habitats
    - Management of wetlands and the Lake Holloman area and constructed wetlands
    - Management of the Boles Wells Water System Annex (BWWSA)
    - Management of outdoor recreation involving natural resources
    - Management of the HSTT

    Using this information and HAFB subject matter experts, we conducted and incorporated the following analyses into the INRMP:

    - Development of desired future conditions (management goals and objectives) for identified resources
    - Identification of existing problems and conflicts under current management strategies
    - Identification of proposed future activities and associated problems and conflicts
    - Identification of natural resources management opportunities
    - Identification of responsibilities for monitoring effectiveness and impacts associated with implementation of actions identified in the INRMP
    - The program for all military ground-based training and exercises was evaluated in a separate environmental assessment and incorporated into the INRMP upon approval of the Finding of No Significant Impact (FONSI) dated 10 July 1998. Detailed analysis of tests conducted at the HSTT was also conducted, with best management practices applied to HSTT actions per the INRMP.

    The current process for the HAFB INRMP revision involved 49th Civil Engineer Squadron, Asset Management Flight (49 CES/CEI) and other base subject matter experts reviewing the information and the management goals, standards, and management actions in the 2015 INRMP and identifying:

    - Those actions that have been completed
    - Those action that are no longer appropriate
    - Necessary revisions to such actions
    - New Management actions

1.2 Management Philosophy

The INRMP is the chief tool for managing natural resources in a coordinated manner within the context of operational mission on DoD installations. Based on an interdisciplinary approach to ecosystem management, the INRMP ensures the successful accomplishment of the military mission by integrating all aspects of natural resource management with each other and with activities associated with the installation's mission. Under this plan, the diverse environments under the jurisdiction of the DoD are maintained for present and future human use, and their natural systems are allowed to function normally.

49 CES/CEI partners with many agencies and organizations to fulfill various program areas critical to the ongoing success of environmental programs on HAFB. These efforts have been instrumental in building excellent working relationships with regulatory agencies, opening lines of communication and reducing potential for fines affiliated with Notices of Violation. Collaborative management efforts for environmental resources crossing administrative boundaries are achieved more efficiently, with less money, via partnering and outreach activities. HAFB works closely with the USFWS and NMDGF as well as other neighboring federal, state and local agencies and organizations to achieve management goals outlined in this INRMP.

USFWS & NMDGF

The USFWS and NMDGF provide guidance regarding their involvement with preparation of INRMPs by DoD installations. HAFB shall notify the appropriate USFWS and NMDGF directors at least 60 days prior to delivering a draft INRMP for review.

According to the Sikes Act Improvement Act (SAIA) (1997, 16 U.S.C. 670), USFWS, NMDGF and USAF policies, if adequate special management or protection is provided by a legally operative plan such as an INRMP that addresses the maintenance and improvement of the primary constituent elements important to a species that would otherwise be listed (such as the White Sands pupfish on HAFB), and the agreement manages for the long-term conservation of the species, habitat identified as essential to the protection and recovery of a species may be omitted from federal critical habitat designation. The USFWS, NMDGF and the USAF use the following criteria to determine if an INRMP provides adequate special management or protection. The plan provides:

- A conservation benefit to the species, including maintaining or providing for an increase in a species' population, or the enhancement or restoration of its habitat within the area covered by the INRMP
- Certainty that the management plan will be implemented, including appropriate staffing, funding, and authority, with an implementation schedule
- Confidence that the conservation effort will be effective, through:
    - Measurable goals and objectives
    - Identifying quantifiable, scientifically valid parameters to monitor and demonstrate achievement of the objectives
    - Monitoring and where appropriate adaptive management
    - Reporting progress on implementation and effectiveness
    - Sufficient duration to implement the plan and achieve the benefits of its goals and objectives

- Although the SAIA requires "no net loss in the capability of military installation lands to support the military mission of the installation" to the extent appropriate and applicable, a "net loss" may be unavoidable to fulfill regulatory requirements other than the Sikes Act, such as complying with an Endangered Species Act Biological Opinion or protection of wetlands under the Clean Water Act. The INRMP will identify these circumstances and discuss measures being taken to recapture that net loss.

<u>Comprehensive Wildlife Conservation Strategy (CWCS) and State Wildlife Action Plan (SWAP)</u>

The USFWS and NMDGF provide an invaluable service for guidance on listed threatened and endangered species, as well as information on sensitive mammals, reptiles and amphibians, fish, birds, and some invertebrates. HAFB's INRMP incorporates pertinent guidance and recommendations from the NMDGF CWCS (NMDGF 2006) and SWAP (NMDGF 2016a) prepared in compliance with the State and Tribal Wildlife Grants Act of 2001. The SWAP is based on a review and revision of the 2006 CWCS and incorporates significant changes. This INRMP makes reference to the most updated information in the SWAP unless otherwise noted. The CWCS and SWAP:

- Are non-regulatory planning documents that rely on the best available science, including the expert opinion of Department biologists, to provide a high level view of the needs for and opportunities to conserve New Mexico's wildlife and their habitats
- Focus on species that warrant heightened attention (Species of Greatest Conservation Need - SGCN), key wildlife habitats, challenges affecting conservation, and outlining approaches to overcome these challenges. The desired outcome is for key habitats to persist in the condition, connectivity, and quantity necessary to sustain viable and resilient populations of resident SGCN while allowing for a variety of land uses with reduced resource use conflicts.
- Identify problems or "threats" which may adversely affect SGCN or their habitats:
  - Significant habitat alteration is attributed to off-road vehicle and other recreational uses as well as military activities. Although access restrictions on military lands provide substantial benefit to wildlife, military land uses may also destroy or fragment existing habitats.
  - Emphasize the need to control invasive and nonnative species, which, once established, have the ability to displace native plant and animal species, disrupt nutrient and fire cycles, and alter the character of the community by enhancing additional invasions. Noxious weed infestation is the second leading cause of native species being listed as threatened or endangered.
- Highlight the need for management and conservation of riparian and aquatic environments which contain key habitats, have a high diversity of SGCN, are subjected to a moderate to high magnitude of multiple habitat-altering factors, and may lack legal constraints or long-term management plans protecting them from habitat conversion
- Call for monitoring the impacts of actions that modify natural processes and ecological drivers, such as drought, fire management, and ecological sustainability (maintenance or restoration of the composition, structure, and processes over space and time), and ecological integrity (the function and resilience of an ecosystem, including maintaining viable populations, preserving ecosystem representation, maintaining ecological processes, protecting evolutionary potential, and accommodating human use), and loss of ecological keystone species

- State that one of the highest priority conservation actions for both terrestrial and aquatic key habitats statewide is to partner with federal, state, and private organizations, research institutions, and universities to design and implement research, survey, and monitoring projects to enhance our understanding of SGCN and their key habitats, particularly SGCN abundance and distribution and the connectivity and condition of key habitats

NM SGCN (NMDGF 2016a) that are documented on HAFB, including the BWWSA, include 26 bird species, two bat species, one reptile species, and one fish species. The following list highlights species HAFB defines as Species of Concern (SOC) based on federal or state listing status, frequency of sightings on base, and/or documented breeding on base. Vagrant bird species are not included in this list but are discussed further in Sections 2.3.4 & 7.4. For a comprehensive list of NM SGCN detected on base as well as more detailed descriptions for the species listed below see Sections 2.3.4 & 7.4.

Birds

- Bank Swallow (*Riparia riparia*)
- Cassin's Sparrow (*Peucaea cassinii*)
- Chestnut-collared Longspur (*Calcarius ornatus*)
- Common Nighthawk (*Chordeiles minor*)
- Eared Grebe (*Podiceps nigricollis*)
- Golden Eagle (*Aquila chrysaetos*)
- Loggerhead shrike (*Lanius luduviaianus*)
- Long-billed Curlew (*Numenius americanus*)
- McCown's Longspur (*Rhynchophanes mccownii*)
- Peregrine Falcon (*Falco peregrinus*)
- Sagebrush Sparrow (*Artemisiospiza nevadensis*)
- Scaled Quail (*Callipepla squamata*)
- Snowy plover (*Charadrius alexandrius*)
- Vesper Sparrow (*Pooecetes gramineus*)
- Virginia's Warbler (*Oreothlypis virginiae*)
- Western Bluebird (*Sialia Mexicana*)
- Western Burrowing Owl (*Athene cunicularia hypugea*)
- White-faced Ibis (*Plegadis chihi)*

Mammals

- Pale Townsend's Big-eared Bat (*Corynorhinus townsendii*)
- Spotted Bat (*Euderma maculatum*)

Reptiles & Fish

- Desert Massasauga (*Sistrurus catenatus*)
- White Sands pupfish (*Cyprinodon Tularosa*)

Other

- Arthropods, mollusks, and crustaceans are not presently actively managed on HAFB as part of the natural resources program conducted by the 49 CES/CEIE

Other Neighboring Federal, State and Local Agencies and Organizations

In addition to the USFWS and the NMDGF under the Sikes Act, working partnerships include other military installations located within the Tularosa Basin, such as White Sands Missile Range (WSMR), Ft. Bliss, and other federal, state and local agencies and organizations. These partnerships provide unique opportunities to approach common land use issues particular to military activities. White Sands National Monument (WSNM) and the San Andres National Wildlife Refuge (SANWR) are also valuable partners that help support conservation efforts of plants and animals endemic to the basin, as well as providing seasonal migratory habitat for birds.

The Bureau of Land Management (BLM) shares responsibilities with HAFB in a portion of the BWWSA. This partnership helps define activities within this area that meet the needs of both the mission of the base and BLM. Lincoln National Forest manages lands east of the BWWSA and provides information on resource issues germane to the Sacramento Mountain foothills. Other agencies such as U.S. Environmental Protection Agency, U.S. Department of Agriculture - Jornada Experimental Range and the Natural Resource Conservation Service (NRCS) provide data on environmental processes specific to resources within the Tularosa Basin. Non-profit groups such as the New Mexico Audubon Council, Mesilla Valley Audubon Society and New Mexico Native Plant Society are partners in conservation issues and provide volunteers for project-oriented tasks to improve wildlife habitat within HAFB. University groups such as Texas A&M University (TAMU), Natural Heritage New Mexico (NHNM) of the University of New Mexico (UNM) provide database information on many of the endemics occurring on HAFB and have conducted numerous field studies on the base and within the Tularosa Basin.

The Department of Defense (DoD), Secretary of the Air Force, and/or HAFB have entered into Memoranda of Understanding (MOU) and Cooperative Agreements with various agencies (see Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP & Appendix D. Memoranda of Agreement and Cooperative Agreements).

1.3 Authority

According to AFI 32-7064 (18 November 2014) and the Sikes Act, 16U.S.C § 670 et. seq., all military installations must prepare and implement an INRMP. The plan must be reviewed annually and updated every five years. The original HAFB INRMP was approved in 2002.

Each plan must be prepared in cooperation with the USFWS and the NMDGF. The purpose is to provide for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of natural resources, including hunting, fishing, and nonconsumptive uses; and, subject to safety requirements and military security, public access to military installations to facilitate such use. Each INRMP shall establish specific natural resource management goals and objectives and timeframes for proposed actions.

The HAFB 49th Wing Commander (49 WG/CC) is authorized by the SAIA to enforce any special hunting permits and to collect, spend, administer, and account for permit fees, acting as an agent for USFWS and the NMDGF if the INRMP provides for this designation. All such funds collected shall be returned to HAFB for fish and wildlife management.

The USAF implements the Sikes Act through the INRMP as the "principal tool for managing military installation natural resources. The INRMP:

- Is prepared to assist the 49 WG/CC with the conservation and rehabilitation of natural resources consistent with the use of the installation to ensure the readiness of the Armed Forces
- Defines natural resources management goals and objectives that are consistent with the military mission and ensure no net loss in the capability of the installation to support the military mission" (AFI 32-7064, 2014)

The DoD, the USFWS, and the State departments of fish and wildlife management, as represented by the International Association of Fish and Wildlife Agencies, entered into a MOU on 31 January 2006 (updated in 2013) for "A Cooperative Integrated Natural Resource Management Program on Military Installations." MOU summary (see Appendix D for complete MOU):

- <u>Purpose</u>: to further a cooperative relationship between DoD, US Department of the Interior (DOI), USFWS, and the state fish and wildlife agency in preparing, reviewing, revising, updating and implementing INRMPs for military installations

- <u>Recognizes</u>: INRMPs to the maximum extent practicable, "incorporate ecosystem management principles, and describe procedures and projects that manage and maintain the landscapes necessary to sustain military-controlled lands for mission purposes. INRMPs also allow for multipurpose uses of resources, including public access appropriate for those uses, provided such access does not conflict with military land use, security requirements, safety, or ecosystem needs, including the needs of fish and wildlife resources."

    - Sustainable multiple use of natural resources on military installations shall include, as appropriate, both consumptive and non-consumptive uses with due regard for military readiness, and the welfare of the public, native fish and wildlife, threatened and endangered species, and the environment

- <u>Requires</u>: cooperating parties to conduct collaborative annual reviews and five year revisions of INRMPs; encouraging streamlining and expediting the preparation, review, revision or implementation of INRMPs; ensuring that the INRMPs are comprehensive and implemented as mutually agreed; meeting annually to discuss and develop projects and to assist in the preparation and implementation of the INRMPs

- Priority will be given to projects identified in INRMPS that:

    - Support both military mission and conservation of natural resources

    - Provide adequate staffing with the appropriate expertise for updating, revising, and implementing the INRMP within the scope of DoD responsibilities and mission.

1.4 Integration with Other Plans

Implementation of an INRMP constitutes a federal action and therefore requires consideration of potential environmental effects as described in AFI 32-7061, Environmental Impact Analysis Process (EIAP) per the National Environmental Policy Act (NEPA). An EIAP is prepared concurrently with the development of the plan to support the proposed recommendations. Information and direction incorporated in the INRMP will be integrated into and used in conjunction with the HAFB General Plan (2004) and appropriate component plans for base planning activities. Natural resource constraints are to be considered for all future installation development, including land use planning. Information in the General Plan is not duplicated in the INRMP; however, this information is cross-referenced for ease of referral.

Base component plans, such as the HAFB Bird/Wildlife Aircraft Strike Hazard (BASH) Plan (Sections 7.12 & 15.0 Tab 2), the HAFB Integrated Pest Management Plan (IPMP) (Sections 7.11 & 15.0 Tab 5), the Wildfire Fire Management Plan (Sections 7.9 & 15.0 Tab 1), the Integrated Cultural Resources Management Plan (ICRMP) (Sections 7.14 & 15.0 Tab 4), as well as other relevant planning documents such as the White Sands Pupfish Conservation Plan (2015), are supported by and integrated /incorporated by reference into this INRMP. Future revisions of these plans will be based on the direction in this and future INRMPs. In addition, the Programmatic Environmental Assessment/Finding of No Significant Impact for Ground-Based Training (1998) was revised (2008) and the resulting Supplemental Programmatic Environmental Assessment incorporated by reference into this INRMP, Appendix B. The Programmatic Environmental Assessment/Finding of No Significant Impact for Management of the HSTT was also completed and incorporated by reference into this INRMP, Appendix C.

HAFB component plans will be consistent with the INRMP upon completion of all necessary planning requirements and administrative approvals. As appropriate, HAFB component plans will be reviewed and updated as needed based on the results of this integrated planning effort. The INRMP baseline information and its associated GIS layers will be reviewed annually, where necessary, using an interdisciplinary process, and modified as necessary to ensure a quality foundation for integrated planning efforts and natural resource management at HAFB. The INRMP itself must be reviewed annually with the USFWS and NMDGF and updated every five years per the SAIA.

Activities that may affect natural resources require one or more of the following forms submitted:

- AF Form/IMT 332 (Base Civil Engineer Work Request) through TRIRIGA NextGen IT site
- AF Form/IMT 813 (Request for Environmental Analysis)
- AF Form/IMT 103 (Base Civil Engineering Work Clearance Request)
- DD Form 1391 (Military Construction Project Data)

2.0 INSTALLATION PROFILE

Office of Primary Responsibility	The 49th Civil Engineer Squadron Installation Management Flight, 49 CES/CEIE has overall responsibility for implementing the Natural Resources Management program and is the lead organization for monitoring compliance with applicable federal, state and local regulations
Natural Resources Manager/POC	Ramón Acevedo-Cruz 575-572-3931/6670 ramon.acevedocruz.3@us.af.mil
State and/or local regulatory POCs (For US-bases, include agency name for Sikes Act cooperating agencies)	US Fish and Wildlife Service – Region 2 Director New Mexico Department of Game and Fish - Director
Total acreage managed by installation	58,949
Total acreage of wetlands	33.03; 20.53 provisional
Total acreage of forested land	0
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
NR Program Applicability (Place a checkmark next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	☑ Fish and Wildlife Management Program ☑Threatened and endangered species ☑ Invasive species ☑ Wetlands Protection Program ☑ Grounds Maintenance Contract/SOW ☐ Forest Management Program ☑ Wildland Fire Management Program ☐ Agricultural Out leasing Program ☑ Integrated Pest Management Program ☑ Bird/Wildlife Aircraft Strike Hazard (BASH) Program ☐ Coastal Zones/Marine Resources Management Program ☑ Cultural Resources Management Program

2.1 Installation Overview

Air Combat Command (ACC) is the primary force provider of combat airpower to America's warfighting commands. To support the global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management, and electronic-combat aircraft. It also provides command, control, communications and intelligence systems, and conducts global information operations.

As a force provider, ACC organizes, trains, equips and maintains combat-ready forces for rapid deployment and employment while ensuring strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime air defense. ACC numbered air forces provide the air component to U.S. Central, Southern and Northern Commands, with Headquarters ACC serving as the air component to Joint Forces Command. ACC also augments forces to U.S. European, Pacific and Strategic Command.

The 49th Wing - host wing at HAFB – ACC supports national security objective by deploying worldwide to support peacetime and wartime contingencies. The wing provides combat-ready Airmen, trains MQ-9 Reaper pilots and sensor operators, and hosts the 54th Fighter Group's F-16 Fighting Falcon pilot training mission, and the 704th Test Group's High Speed Test Track (HSTT) mission. Additionally, the wing delivers Air Transportable Clinics and Base Expeditionary Airfield Resources (BEAR) under the Air Force Material Command while providing support to more than 17,000 military and civilian personnel. The wing has a proud history of service in World War II, Korea, Southeast Asia, Southwest Asia and NATO-led Operation ALLIED FORCE. The 49th Wing is organized in four groups: 49th Operations Group, 49th Maintenance Group, 49th Mission Support Group, and 49th Medical Group. A diverse group of tenants provide important research and testing integral to maintaining military excellence.

- Formerly supported national security objectives as directed by the Joint Chiefs of Staff with F-117 Nighthawks, F-22A Raptors, and Remotely Piloted Aircraft (RPA) MQ-1 Predators
- The mission has changed to support RPA MQ-9 Reaper for training
- Can rapidly mobilize and deploy worldwide to meet peacetime and wartime contingencies
- Provides morale, welfare, and administrative support for over 4,500 assigned personnel

2.1.1 Location and Area

HAFB is located in Otero County, in southeastern New Mexico, approximately six miles west of Alamogordo (Figure 2.1.1-1. Location of Holloman AFB and GSUs). HAFB is uniquely situated in the center of the Tularosa Basin within easy reach of several ecologically distinct areas with a rich diversity of desert flora and fauna broadly classified as the northern reaches of the Chihuahuan Desert. Nearby managed areas include volcanic peaks and mesas covered in high mountain grasslands and conifer forests, dropping to desert shrublands mantled with cactus and yucca. Surrounding mountain fronts vary in vegetation cover from xerophytic shrublands, to juniper-pinyon savannas, and high mountain meadows.

Views from HAFB are spectacular. To the east rise the Sacramento Mountains, an impressive range that attains an elevation of 12,003 feet, nearly 4,000 feet above the surrounding basin floor and extends north and south as far as the eye can see. Parallel to the Sacramento Mountains to the west are the San Andres Mountains, equally extensive to the north and south. The Tularosa Basin which lies between these two ranges is dominated by diverse, broad expanses of lowland desert environments, including gypsum dunelands punctuated by playas and ephemeral drainages.

Within its contiguous boundaries, HAFB's main base covers approximately 51,813 acres. HAFB has water rights on an additional 7,136 acres of noncontiguous lands in the BWWSA and Bonito Lake. HAFB is bounded to the north and west by the US Army administered WSMR, which extends roughly 100 miles to the north and south and 40 miles west. WSNM borders HAFB on the southwest corner of the base. The eastern boundaries are with private land and lands administered by the BLM. HAFB's main base area consists of approximately 12.2% developed lands and 87.8% undeveloped lands. Developed areas were calculated using satellite imagery. The greatest development occurs within the cantonment area and activities associated with the HSTT. Acreage counts differ between HAFB GIS layers and existing Real Estate records. For the purposes of this report, values are calculated from GIS layers.

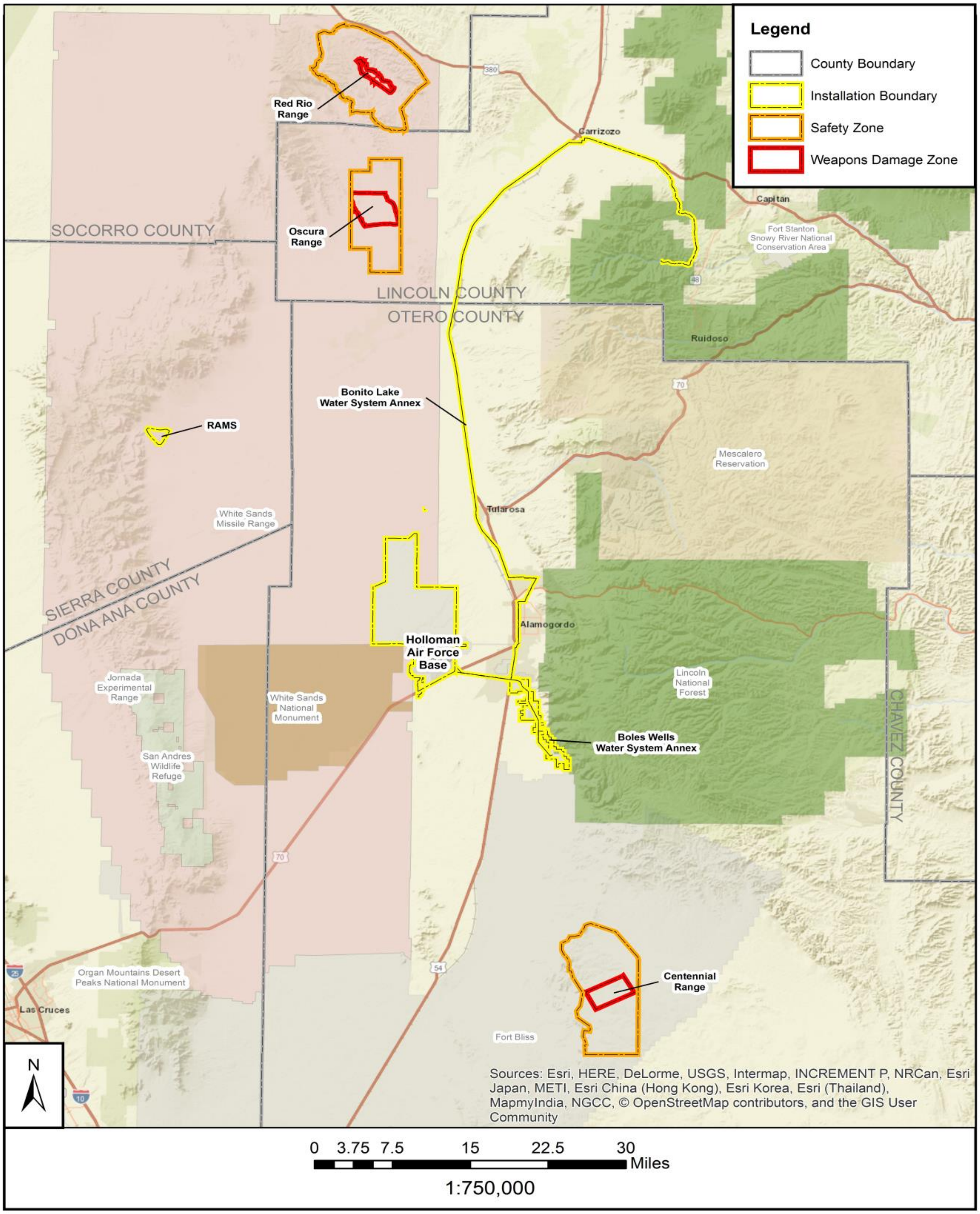


Figure 2.1.1-1. Location of Holloman AFB and GSUs

Installation/GSU Location and Area Descriptions

Base/GSU Name	Main Use/Mission	Acreage	Addressed in INRMP?	Describe NR Implications
Holloman AFB Boles Well Field Bonito Pipeline	Host Base	51,813 6,983 153	Yes Yes Yes	Direct Support
Red Rio Bombing Range	Training Area	45,365	Yes	Direct Support
Oscura Bombing Range	Training Area	31,956	Yes	Direct Support
Centennial Bombing Range	Training Area	47,579	Yes	Direct Support
RATSCAT Advanced Measurement Site (RAMS)	N/A	N/A	Yes	WSMR – Army

Roads and Access

The cantonment has the highest density of roads on base, with the main commercial, military and residential development. Primary access to the base is through the Main Gate from US Highway 70. The West Gate, also accessing US Highway 70, is for access to military/civilian personnel and commercial vehicles. The La Luz Gate accesses the northeast area of the base for limited entrance and exit. Gate 10 is guarded during daylight only, and the Tula Peak Gate is closed, with access available for authorized personnel only. The Base has approximately 191 miles of paved roads and 189 miles of unpaved roads. The primary paved roads outside of the cantonment area are:

- Douglas Road, which runs east-west north of the Cantonment/airfield area
- Range Road 9, also known as Tula Peak or Kelly Road, which connects Douglas Road to the northern border of the base parallel to the HSTT
- Range Road 10, which connects Range Road 9 to the eastern border of WSMR south of the HSTT
- Vandergrift Road, also known as La Luz Gate Road connecting Douglas Road to the La Luz Gate on the east side of the base

Outside of the cantonment, the HSTT to Camera Pad Road and the open grassland area north of Douglas Road have relatively high densities of unpaved gravel roads in relatively good condition. The road network becomes denser closer to the HSTT and Douglas Road. However, this secondary road network has relatively low use compared to the secondary roads in the cantonment. The Lake Holloman area south of the cantonment has secondary roadways that provide access to the wastewater treatment plant and to public access areas. Except near the HSTT and in the borrow area used for recreational and military off-road vehicle use, all current authorized vehicle use is located on the road network. Off-road travel is restricted on HAFB, based on authority provided to Federal agencies by the amendment to E.O. 11644. Unauthorized off-road vehicle use for military or recreational use appears to have been substantially reduced in the last five years due to better enforcement and education. This has reduced damage to soils, biological crusts, and wetlands and playas, particularly in Malone, Ritas, and Dillard Draws. Appendix C: Programmatic Environmental Assessment/Finding of No Significant Impact for Management of the HSTT on Holloman AFB, incorporated into this INRMP, has requirements for minimizing damage from test-related off-road vehicle use. All ground-based training shall be confined to approved and established ground-based training areas and conducted according to the ground-based training Programmatic Environmental Assessment (see Appendix Programmatic Environmental Assessment/Finding of No Significant Impact for Ground Based Training on Holloman USAF Base).

2.1.2 Installation History

HAFB has management responsibility for diverse cultural resources spanning more than 10,000 years, ranging from prehistoric Paleoindian archaeological sites to historic Cold War architecture. In the Tularosa Basin, documented prehistoric cultural history begins with nomadic Paleoindians, followed by archaic hunter-gatherers, then later pithouse to puebloan subsistence agriculturists and finally Apache migration. Contact between aboriginals and Europeans did not occur until the late 1700s. Apache control of the area thwarted permanent European settlement until the early to mid-1800s. Once settlements were established, homestead ranching, mining and eventually military activity became the primary activities within the basin. All of these societies left their indelible mark on the landscape. Detailed information is available in the HAFB ICRMP available from 49 CES/CEIE and included in Section 15.0, Tab 4.

Prehistoric Cultural Resources in the Tularosa Basin

Paleoindian sites are relatively rare in the basin however a few Paleoindian sites have been documented on HAFBs main base area, BWWSA, and GSUs. Following the Paleoindian period, water sources within the basin were seasonal and scarce which may indicate why a majority of archaeological sites during Archaic and Formative periods represent short-term use and/or small campsites (Carmichael 1986; Whalen 1978). However, there is evidence, based on archeological surveys conducted on HAFB and WSMR, that some basin sites were utilized for longer periods, perhaps for residential use (Doleman 1988).

Many of the basin’s prehistoric sites are distinguished by gypsum “fossil hearths”. Fossil hearths are unique to the gypsum dunes due to the chemical properties of gypsum. When campfires are made in gypsum sediment a phase change occurs which creates a substance similar to Plaster of Paris. When this substance is rehydrated and subsequently dehydrated it fuses like a statue; creating a more resistant surfaces that persist while surrounding sands are eroded by prevailing winds. These “hearth mound” sites typically contain one or more fossil hearth features and are surrounded by various artifact types such as fire cracked rock, lithics, and ceramics. Documented hearth mound sites range in age from the Archaic period through the Formative period. On HAFB, these sites are found at the periphery of the dune field within the blowouts of parabolic dunes and some nearby eolian flats.

Other sites on HAFB identified with the Formative period are predominantly along the periphery of the dunes and within the uplands near drainages. The BWWSA also has numerous sites associated with the alluvial fan environment. The human population within the Tularosa Basin increased substantially during the Doña Ana phase of this period. Large sites inhabited for long periods were located on alluvial fans, while smaller campsites existed for seasonal occupation and short-term use within the basin (Carmichael 1986, Anschuetz et al. 1990). Agriculture was widely adopted, yet dependence on hunting and gathering persisted. The El Paso phase is the best documented phase of prehistoric occupation in south-central New Mexico (Anschuetz et al. 1990). This phase shows transition from pithouses to the above-ground structures of the pueblo village, with an increasing dependence on agriculture. Cultivars such as beans, corn, and squash, along with subsistence gathering of mesquite, yucca, acorns, and cacti, make up the plant diets of these populations. Large middens of rabbit bone are also found at these sites (Whalen 1978). Ninety-five percent of the documented villages were found at the base of alluvial fans and along the basin edge. Scattered throughout the basin environment are small, temporary sites that may have been used for special activities such as hunting and plant gathering (O’Laughlin 1980).

Late prehistoric and historic populations of Mescalero Apache (from approximately 1500 AD to 1870) inhabited large portions of the region between the Pecos and Rio Grande Rivers (Doleman 1988, Hawthorne 1994a). Surveys conducted on HAFB (CES/CEV Archaeological Database) detected some evidence for the use of the area by Mescalero Apache, such as teepee poles near Malone Draw.

Historic Cultural Resources in the Tularosa Basin

The earliest nonnative settlers to the Tularosa Basin (1845) were Hispanics that moved from the flooded Rio Grande regions to the foothills of the Sacramento Mountains (Hawthorne-Tagg 1997). Some of the first settlements were at the mouth of the Rio Tularosa and La Luz Creek. These settlers were either associated with the water-powered sawmill constructed along Tularosa Creek for the church in El Paso or were predominantly sheep or cattle ranchers who homesteaded acreage within the basin, pursuant to the Homestead Act of 1862. By 1916, due to droughts, limited water resources, and poor crop returns, 90% of the homesteads were abandoned. The only HAFB property to remain in continual use for farming and livestock grazing purposes until condemnation by the government was the BWWSA area.

From 1934, when livestock grazing was regulated on Federal lands, to 1942 when the government took over lands now known as HAFB, five grazing allotments overlapped these lands. The permittees had ranches on private lands, grazing allotments on federal lands, and leases on state lands. In comparison to other ranches throughout the Tularosa Basin, Holloman ranches were much smaller, but their proportion of federal range was much higher. Interestingly from a natural resources perspective, salt cedar was first planted as windbreaks at ranches above Carter Draw and has since moved aggressively into the drainage bottoms and lowland depressions on the southern end of the base.

HAFB main base lands were taken out of agricultural production in 1942 in preparation for the establishment of the base. The BWWSA was obtained by the USAF via condemnation for national defense purposes in the mid-1950s for water well development. Approximately 43 single component historic homestead sites, including the remains of ranches, farms, irrigation systems, and refuse scatter, have been inventoried and documented on HAFB and BWWSA (Hawthorne-Tagg 1997). These sites represent an important cultural and historic link to past lifestyles and occupants, particularly characteristic of the Tularosa Basin, and some are considered eligible for the National Register of Historic Places (Hawthorne-Tagg 1997).

Military History of HAFB

Broad, relatively flat and open spaces, clear skies, and sparsely populated areas within the Tularosa Basin suited the purposes of military missions for developmental testing of early space technology. Perhaps for some of these same reasons, long before this area was acquired for defense purposes, early man created solar observation points in the nearby Sacramento Mountains. One of these, Walley's Dome, has several upright rock formations supporting a horizontal rock slab that appears to be astronomically aligned to record annual solstice events (Eidenbach 1981). The father of modern rocketry, Robert Goddard, also found the physical landscape of New Mexico favorable for his research near Roswell, New Mexico, throughout the 1930s. Today, a national center for ground-based observations of the sun, the National Solar Observatory, is located at Sunspot, New Mexico in the Sacramento Mountains.

Not until the Legacy Resource Management Program (LRMP; Public Law 101-511, 1991) were archives explored and field explorations made to uncover the primary role HAFB contributed to the beginnings of space exploration. Under the LRMP on HAFB for National Register Surveys, a Thematic Survey of Early Missile, Instrumentation and Test Objects was conducted (Mattson and Tagg 1995). Following guidelines set by the LRMP, the objective of this survey was to "inventory, protect and conserve the physical and literary property and relics of the DoD connected with the origins and development of the Cold War" (Mattson and Tagg 1995). This study reports that HAFB was conceived nine months after the United States declared war against Germany, Italy and Japan and was thereafter integral in the early stages of the United States space program throughout the Cold War.

On June 10, 1942, an event occurred that permanently changed the face of the Tularosa Basin -- Alamogordo Army Air Field was established at a site six miles west of Alamogordo, New Mexico. Facilities were designed after the Royal Air Force base, used in the British Training Program for World War II bomber crews. A Royal Air Force base is typically comprised of a cantonment area, west area and north area. From 1942-1945, Alamogordo Army Air Field served as the training grounds for over 20 different groups, flying primarily B-17s, B-24s, and B-29s. Typically, these groups trained their personnel for about six months before deploying to combat in either the Pacific or European theaters.

The first atomic bomb was detonated at the Trinity Site on 16 July 1945, in the northwest corner of the Alamogordo Bombing and Gunnery Range (now WSMR). In 1946, more lands became available within the Tularosa Basin and HAFB was reassigned to be a missile development facility. By 1947, the Air Force became a separate service and AAAF was transferred to the Air Materiel Command to conduct guided missile programs.

On 13 January 1948, the base was renamed Holloman AFB after Col. George V. Holloman, an early pioneer in guided missile development. The range was 64 miles long, running north and south, and 38 miles wide. At this time, the Army Ordnance Corps built White Sands Proving Ground (WSPG) with a range just south of these lands. The combined range of these facilities was 100 miles long and 40 miles wide (Mattson and Tagg 1995). Under army management, on 01 September 1952, the HAFB Bombing and Gunnery Range was combined with the Army Range to form the 'Integrated White Sands Range'.

From 1952 to 1970, missile development and testing included the Snark, Matador, Mace, Falcon, Aerobee, JB-2 Loom, and Firebee missiles. High speed sled tests, high altitude balloon projects, and Aeromedical Field Laboratory experiments were also conducted. During this time the Central Inertial Guidance Test Facility and the Radar Target Scatter Test Facility were developed. The Primate Research Facility trained the first chimpanzee named HAM, acronym for Holloman Aerospace Medical, to make a suborbital flight and the first chimpanzee (Enos) to orbit the earth. Two projects begun during the Cold War continue on the base, the HSTT and the Primate Research Lab (both are considered tenant organizations).

In 1972 the base was taken over by Tactical Air Command (TAC) and became primarily a fighter base although some developmental testing continued. On 15 November 1991 command responsibility passed from the 833rd Air Division to the 49th Wing.

Today, the 49th Wing provides leadership to the installation and HAFB continues to serve at the forefront of military operations, with its F-16 Falcon, MQ-9 Reaper RPA, and serving as the training center for the

German Air Force's Tactical Training Center, etc. Since its inception, HAFB has seen drastic changes to its mission at no expense to our natural resources. At this time, the big change to the mission of HAFB is the tentative addition of 54 each F-16 Falcons. This change does not represent an issue or negative impact to our natural resources.

German Air Force Flying Training Center

The following information is taken from a report from the Congressional Research Service - The Library of Congress, *CRS Report for Congress German Military Presence in the United States: The Case of Holloman Air Force Base* (Karen Donfried, Specialist in European Affairs Foreign Affairs and National Defense Division).

In the fall of 1990, the United States offered the German Air Force (GAF) the opportunity to expand training at HAFB, which led to the location of what is now the German Air Force Flying Training Center (FTC) at HAFB. In addition to the F-4 Phantom jets that had been transferred to Holloman from George AFB, the United States agreed that the Germans could station German Tornado jets there. In May 1994, an MOU was signed which covered construction of the German Air Force Tactical Training Element and the stationing of 12 Tornado air-to-ground and air defense fighters and roughly 300 military and civilian employees, along with their families. Known as Holloman I, these planes and personnel are part of a weapons instructor and flight training program; the Germans invested about 62 million German marks ($40 million) to construct the necessary infrastructure, including hangars and maintenance facilities. On 01 May 1996, U.S. Defense Secretary Perry and German Defense Minister Ruhe activated the German Tactical Training Center at HAFB.

2.1.3 Military Missions

49th Wing Mission

Graduate Combat Ready RPA Aircrew...Support Team Holloman...Feed the Fight.

49th Wing Vision

Tight community of Airmen - proud of their service, caring for their people while remaining mission focused.

49th Wing Priorities

- Provide unmatched RPA pilot & sensor operator training
- Enable tenant units & enhance regional partnerships
- Ensure Airmen readiness & development
- Strengthen our Air Force family & community
- Prepare for seamless AETC transition

The HAFB goals in support of national defense objectives include:

- Protect personnel and resources
- Ensure facilities and infrastructure support mission accomplishment

- Provide for physiological and psychological needs of military families
- Reduce fuel, water, and electricity use
- Maintain environmental quality
- Identify opportunities and physical constraints for the DoD's future use of HAFB
- Partner with local communities

The HAFB objectives in meeting these goals include:

- Enhance and expand indoor and outdoor recreation areas
- Utilize sustainable design by the systematic consideration of an activity, project, product, or facility's life cycle impacts on the sustainable use of environmental and energy resources
- Landscape with native plants
- Minimize impacts to environmental and cultural resources
- Reduce pollution
- Comply with environmental laws
- Maintain positive relationships with surrounding communities and keep them informed of HAFB's role in national defense

Military Activities

HAFB is one of the ACC resources under the 12th Air Force, headquartered at Davis-Monthan AFB, Arizona. The 12th Air Force controls ACC forces based in the western United States Command. Since 2004, the 12th Air Force has served as the Air Force model for the future of the combined Air and Space Operations Centers.

HAFB is home to the 49th Wing, and supports the maintenance and operations of the F-16 (tenant organization from Luke AFB), MQ-9 Reaper, F-16 drones that replaced QF-4 Phantoms from Tyndall AFB, Black Hawk helicopters from Army Air and T-38 Talon through the T-38 Companion Trainer Program contract, as well as continuing to support the German Air Force. The 49th Wing serves as the forefront of military operations, with capability to rapidly mobilize and deploy assets and personnel worldwide to meet peacetime and wartime contingencies.

The 49th Wing staff agencies include agencies that make up the wing commander's staff. The staff agencies are the Inspector General, Staff Judge Advocate, Public Affairs, Protocol, Command Post, Chapel, Wing Plans and Inspections, Safety, History, and the 49th Comptroller Squadron.

The 49 WG has four groups:

- The 49th Operations Group supports national security objectives, as directed by the Joint Chiefs of Staff, by utilizing HAFB assets for training and deployment
- The 49th Maintenance Group maintains aircraft, propulsion, avionics and accessory systems for air assets and directs all maintenance, qualification, on-the-job and ancillary training for over 1,000 personnel, manages over $4.3 billion in aircraft and equipment, and supports flying activities, exercises, and worldwide taskings as assigned by the Secretary of Defense and the war-fighting commanders

- The 49th Mission Support Group provides a wide spectrum of support services for wing and tenant organizations, including military and civilian personnel support, maintenance of facility and utility systems, security police duties, communication capabilities, and family leisure programs
- The 49th Medical Group is made up of healthcare professionals dedicated to providing the best health care possible to the 49th Wing and its units. It maintains an air transportable hospital and three clinics in combat-ready status. In addition, it provides comprehensive healthcare and physiological training while promoting wellness and fitness through a proactive health promotions program.

Tenant Organizations:

635th Materiel Maintenance Group (635 MMG)
The 635 MMG is the Air Force's only organic Basic Expeditionary Airfield Resources (BEAR) unit and is responsible for providing flexible and responsive resources and expertise to support the Nation's priorities. The Group is responsible for the storage, inspection, repair, deployment, and accountability of BEAR Base assets belonging to Air Force Material Command (AFMC) and ACC. The Group responds worldwide for the deployment, sustainment, setup, operation, maintenance, teardown, and reconstitution of equipment in support of contingencies, natural disaster response, humanitarian support, exercises, counterdrug operations, and other higher headquarters and POTUS directed requirements. Additionally, the Group provides mobile training teams that instruct other DoD personnel in deployed operations. The Group represents the Air Force's largest deployment mission, and manages the Air Force's largest container program.

704th Test Group (704 TG)
The 704 TG at HAFB is a unit of Arnold Engineering and Development Complex, headquartered at Arnold AFB (AFMC), TN, which is part of the Air Force Test Center, headquartered at Edward AFB, CA. The Test Group's mission is to operate world-class test facilities for high speed sled track testing, navigation and guidance system testing, radar signature measurements, weapon systems flight testing, and Air Force Liaison for all AF programs tested at WSMR. Additionally, the 704 TG has two GSUs: Operating Location (OL)-AA, located at Kirtland AFB, NM, is responsible for directed energy and high energy laser testing and OL-AC, located at Wright-Patterson AFB, OH, performs landing-gear and aircraft survivability tests. The Test Group includes the 586th Flight Test Squadron (586 FLTS), 746th Test Squadron (746 TS), and 846th Test Squadron (846 TS).

586th Flight Test Squadron (586 FLTS)
The 586 FLTS's mission is to conduct and enable agile weapons, avionics and survivability testing for the joint warfighter. Flight test services are provided for DoD and commercial customers across the full spectrum of program size and complexity. The squadron's low cost per flight test hour enables technology development programs to move beyond the laboratory environment, while working within a small test budget. On the other end of the spectrum, the squadron offers larger and more complex programs and specific flight test solutions required for a major acquisition program. Agility is maintained due to the small size of the organization, resident review and approval, authorities for safety, airworthiness and the rapid ability to accommodate evolving requirements.

746 Test Squadron (746 TS)

The 746 TS, also known as the Central Inertial and GPS Test Facility (CIGTF), has been the DoD's leader in guidance and navigation system testing for over 50 years. While the CIGTF's mission began with inertial guidance and navigation testing, the unit has since expanded its expertise to include GPS due to its success as a navigation aid. Today, the CIGTF is the established leader in inertial, GPS and blended GPS/inertial component and system testing.

846 Test Squadron (846 TS)

The 846 TS operates the HSTT, which is the world's premier rocket sled test track. At 50,971 feet, the HHSTT is the longest facility of its type in the world. The mission of the 846th TS is to plan and execute world-class rocket sled tests enabling critical weapon system development in support of the warfighter using world-class people, technical excellence, cost-effectiveness and agility. The HSTT serves as a critical link between laboratory-type investigations and full-scale flight tests by simulating selected portions of the flight environment under accurately programmed and instrumented conditions, often before flight-worthy hardware is available.

54th Fighter Group

The 54th Fighter Group is the United States Air Force premier F-16 training organization. This selectively manned unit conducts formal graduate level F-16 initial, re-qualification, senior officer, and instructor training for ACC, Pacific Air Forces, United States Air Forces in Europe, AFMC, Air Force Reserve Command, and the Air National Guard. The group's 1020 Airmen and contractors train 120 F-16 pilots, 200 F-16 crew chiefs, and 20 flight surgeons per year at Holloman Air Force Base, New Mexico.

Detachment 1, 82nd Aerial Targets Squadron

The Detachment 1, 82nd Aerial Targets Squadron provides full-scale aerial target support on WSMR for Department of Defense research, development and test projects. This includes supervising and monitoring the operations and maintenance on F-16 drones. This squadron is a detachment of the 475th Weapons Evaluation Group, Tyndall AFB, Fl. Project support includes the advanced medium-range air-to-air missile (AMRAAM), Patriot, Chaparral, Stinger missiles, and many more.

German Air Force (GAF) Flying Training Center

Forty-two Tornados and approximately 850 GAF staff members were stationed at the GAF Flying Training Center at HAFB. Many aspects of New Mexico, and HAFB in particular, are not available to German pilots at home. Given New Mexico's sparse population and the existing special use air space, German pilots had a greater opportunity to conduct flying training at low altitudes and high speeds. They used the full array of radar jamming equipment and conducted live bombing exercises. Second, the weather is much better in New Mexico than in Germany. Training continuity is ensured, because a pilot can fly more hours per month or year than he can in Germany. In New Mexico, pilots trained all year long. Finally, HAFB is relatively close to Fort Bliss, Texas, the headquarters for German Air Force operations in North America. Today, there are no German Tornados at HAFB and about 60 staff personnel ending the GAF mission. GAF operations at HAFB will terminate in 2019.

Listing of Tenants and NR Responsibility

Tenant Organization	NR Responsibility
704 TG	49 WG
54th Fighter Group	49 WG
Detachment 1, 82nd Aerial Targets Squadron	49 WG
German Air Force Flying Training Center	49 WG
635 MMG	49 WG

2.1.4 Surrounding Communities

The region surrounding Holloman AFB encompasses mainly rural areas. The city of Alamogordo, with a population of 30,403 people as of the last official census, lies east of the base. Other surrounding communities are considerably smaller. To the west of the base is WSNM, and surrounding the base on all other sides is the WSMR. Because of this Holloman AFB should not expect any encroachment issues in the near future.

2.1.5 Local and Regional Natural Areas

Non-Military Activities on HAFB and Adjacent Federal and State Managed Lands

Alamogordo Primate Facility
The basic mission of the Alamogordo Primate Facility, as a Center of Excellence for Chimpanzee Health Care, is to continue to improve the quality of life for captive chimpanzee by advancing the standards of health care. To that end the facility will maintain its National Institute of Health (NIH) owned chimpanzees in the best possible conditions. The primary research programs include animal care, veterinary services and maintenance of the primates under its care. It also provides externships and postgraduate primate residencies. It currently has 43 personnel and approximately 55 chimpanzees.

U.S. Army - White Sands Missile Range (WSMR)
WSMR, administered by the U.S. Army, is a 2.2 million acre expanse of nearly pristine desert plains, riparian areas, and montane ecosystems. WSMR is west of HAFB and stretches both north and south with some contiguous boundaries. Only approximately 3% of the missile range is actually used for military research and testing activities and associated disturbances (Figure 2.1.1-1. Location of Holloman AFB and GSUs). The basin within WSMR has not been grazed by livestock for over 45 years, with the exception of feral horses, Oryx, and trespass cattle, primarily along the eastern boundary. WSMR has no public access except for limited escorted hunting of oryx, mule deer, and pronghorn. Holloman and WSMR cooperate on management strategies and research for the White Sands pupfish. All vegetation communities within HAFB are represented in WSMR, including wetland plant communities.

U.S. Army Fort Bliss
Fort Bliss, administered by the U.S. Army, comprises approximately 1.1 million acres south of HAFB, extending into Texas. The base functions as a training area for the army, with ground maneuver activities occurring in the basin and adjacent mesas. One of the largest extents of black grama-blue grama (*Bouteloua eriopoda-B. gracilis*) grasslands in the state occurs on Otero Mesa, a large east-dipping tableland located south of the southern foothills of the Sacramento Mountains. Many sensitive and

endemic species reside within this diverse landscape, which includes basin dunelands and montane forests. McGregor Range is jointly managed for multiple-use (mostly grazing and hunting) by the BLM. HAFB also uses a portion of McGregor Range for military training and overflights (Centennial Bombing Range).

White Sands National Monument (WSNM)

WSNM, administered by the National Park Service, is located to the southwest of, and contiguous with, portions of the western border of HAFB (Figure 1. Location of Holloman AFB). Over 500,000 visitors each year use the park, including recreational driving of the loop road through the Monument, self-guided hiking trails, and picnicking. A primitive overnight camping site is available by permit. The Monument cooperates with HAFB on fencing for Oryx (*Oryx gazella*) management, and research and management for the White Sands pupfish. Due to the proximity of WSNM to HAFB, concerns over nonnative plant infestations such as African rue (*Peganum harmala*) and salt cedar (*Tamarix ramosissima*) are a natural resource concern. The monument has begun a program to control the spread of salt cedar, which quickly colonizes riparian areas, usually displacing native species. The monument has an aggressive program to eradicate African rue from the park's visitor center, housing units, and other disturbed sites.

Bureau of Land Management (BLM)

The BLM, Las Cruces Field Office manages areas within the Tularosa Basin and shares joint land management of the McGregor Range within Fort Bliss. McGregor Range has multiple-use areas open to hunting, grazing, and recreation (PL99-606, which withdrew McGregor, authorizes BLM to manage for multiple uses under the authority of FLPMA). Specific portions of McGregor Range within Fort Bliss are closed to the public. Varied military use over this extensive range includes bombing and ground maneuvers. HAFB is the principal unit operating missions in the Centennial Bombing Range on Otero Mesa within McGregor Range. The Valley of Fires Recreation Area, west of Carrizozo, is managed by the BLM's Roswell Field Office. Three Rivers Petroglyphs Site allows camping and has an interpretive trail leading to petroglyphs and partially excavated ruins of the Jornada Branch of the Mogollon culture. The BLM-administered lands are typically interspersed with state and private holdings and support some endangered and sensitive plants. The BLM and HAFB have cooperated within the BWWSA in surveying for state and federally listed plant species such as the Alamo Canyon beardtongue (*Penstemon alamosensis*), Villard's pincushion cactus *(Escobaria villardii*), button cactus (*Epithelantha micromeris*), and the Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*).

Lincoln National Forest

The Lincoln National Forest (LNF) is located immediately east of Alamogordo in the Sacramento Mountains. Camping, hunting, hiking, timber harvests, and livestock grazing occur in the forest. The Sacramento Mountains provide a critical source of potable water for HAFB and Alamogordo. The Mexican spotted owl (*Strix occidentalis lucida*), a Federally-listed threatened species, is protected and managed following federal guidelines (50 CFR Part 17) and the Mexican Spotted Owl Recovery Plan (USFWS 2012). The Sacramento Mountains thistle (*Cirsium vinaceum*), Kuenzler's hedgehog cactus (*Echinocereus fendleri* var. *kuenzler*), Todsen's pennyroyal (*Hedeoma todsenii*), Sacramento prickly-poppy, and peregrine falcon (*Falco peregrinus*) are other Federally-listed species also native to the Sacramento Mountains. The LNF and HAFB also coordinate on issues involving air space, endangered species, and noxious plant management.

Oliver Lee State Park

Oliver Lee State Park is located in Dog Canyon, 15 miles south of Alamogordo between the north and south of the BWWSA. The canyon has diverse plant and animal life that are attracted to the springs and seeps. Facilities include camping sites, picnicking, hiking trails, and a visitor center. The park preserves and illustrates some of the history of turn-of-the-century ranch life found in Otero Country, particularly between 1885 and 1941, when the Oliver and Winnie Lee family owned much of the county.

Mescalero Indian Reservation

The Mescalero Indian Reservation is located approximately 25 miles east of the City of Tularosa and is surrounded by the Lincoln National Forest. The Tribe conducts timber thinning, timber harvests, prescribed burns, and livestock grazing in its ponderosa pine and mixed-conifer forests.

2.2 Physical Environment

2.2.1 Climate

HAFB is located in the Tularosa Basin within the Mexican Highland section of the Basin and Range Province, in a semi-arid region within the northern portion of the Chihuahuan Desert (Schmidt 1986). Its climate resembles other semi-arid regions with warm to hot summer days, cool nights, and mild winters. December through March are the coolest months with average temperatures ranging from 41-46°F. Freezing temperatures are common from late November through early March (Noyes and Schmader 1988). Snowfall averages 4.8 inches annually and occurs primarily between the months of December and February. July is typically the hottest month, with average temperatures of 81°F and mean maximum temperatures of 93°F. Daytime temperatures in summer commonly reach 100°F. In the Tularosa basin, evapotranspiration is usually high due to dry air, large daily solar radiation totals, seasonally high winds, and warm temperatures. The annual evaporation rate at HAFB is between 65 and 70 inches with 40 to 45 inches lost from May to October (Bennett 1986).

Seasonal fluctuation in precipitation rates is a result of prevailing wind directions, which can bring in frontal storms from the north or the Pacific or Caribbean cyclonic systems. Holloman averages 8.58 inches of rainfall annually. Nearly half this amount falls within the months of July through September, known as the summer monsoons. Monsoon thunderstorms are generally short in duration and high in intensity. Occurrences are highly variable from year to year and one or two short-term events may contain a large percentage of the net annual precipitation (Anschuetz et al. 1990). Low precipitation amounts and high rates of evapotranspiration deplete the soil of moisture, making summer rains critical to the survival of plants and animals. Winds are also seasonally variable, occurring at peak speeds in the spring. When the ground heats, intensifying convection, this diverts stronger winds aloft down to the ground, where they maintain horizontal momentum (Bennett 1986). The highest wind speeds occur from April through July, reaching median wind speeds of 25 mph. At 13-18 mph, velocities are great enough to pick up large amounts of dust, and winds from 32-46 mph will break twigs from trees. During the month of May, wind velocities are greater than 17 mph approximately 90% of the time. Prevailing winds are from the west from February to June. During the months of July through September, the prevailing winds are south to southeasterly and from October through January, the prevailing winds are from the north.

2.2.2 Landforms

HAFB landscapes were formed by Rocky Mountain orogenic processes during the late Pennsylvanian or early Permian period (Hawley 1986, Noyes and Schmader 1988). The Tularosa Basin is a broad, internally-drained basin situated between two north-south trending fault-block mountain ranges (Figure 2.2.2-1. Physical Setting of Holloman AFB). The watershed for the Tularosa basin covers 4,364,187 acres.

The principal range defining the western edge of the basin is the San Andres Mountains, a west-tilted fault block that rises in elevation to 8,968 feet at Salinas Peak (Muldavin and Mehlhop 1992). The corresponding east-tilted fault block is the Sacramento Mountains reaching 12,003 feet at Sierra Blanca Peak. During Pleistocene glacial eras, Sierra Blanca Peak was the southernmost glaciated peak in the continental United States (Hawley 1986). The Tularosa Basin ranges in elevation from 3,855 feet in the southern range to 5,000 feet in the northern section of the range. The topographic relief between Sierra Blanca Peak and the bottom of the Tularosa Basin constitutes the greatest local relief in New Mexico (Hawley 1986). The San Andres and Sacramento Mountains are Precambrian age granites overlain with Pennsylvanian and Permian lithologic units. These north-south trending mountains dip gradually to the west and east, respectively, with steep mountain fronts joining the piedmont and basin fill deposits of the Tularosa Basin.

The basin landscape is relatively flat occasionally interrupted by mountain ranges such as Phillips Hills and the Jarilla and Franklin Mountains that rise abruptly from broad, alluvium-filled basins. The major landforms include a small Permian Age rock outcrop, gypsum sand dunes, lava flows, flat to gently sloping alluvial plains, and alkali flats and playas. Tularosa (Tula) Peak is a solitary rock outcrop located in the far northeast corner of the base. Tularosa Peak is the highest point within the main base, rising 1,246 feet above the surrounding plains, reaching an elevation of 4,330 feet. The lowest point being the extreme southern tip of Stinky Playa at 4,015 feet. Average elevation is 4,086 feet. Gypsum dunes cover the western portion of the base and form the easternmost extent of the white sands. A line of sharp crests form the leeward side of the boundary of the active dunes, which abruptly grade into slightly undulating interdune grasslands and shrublands.

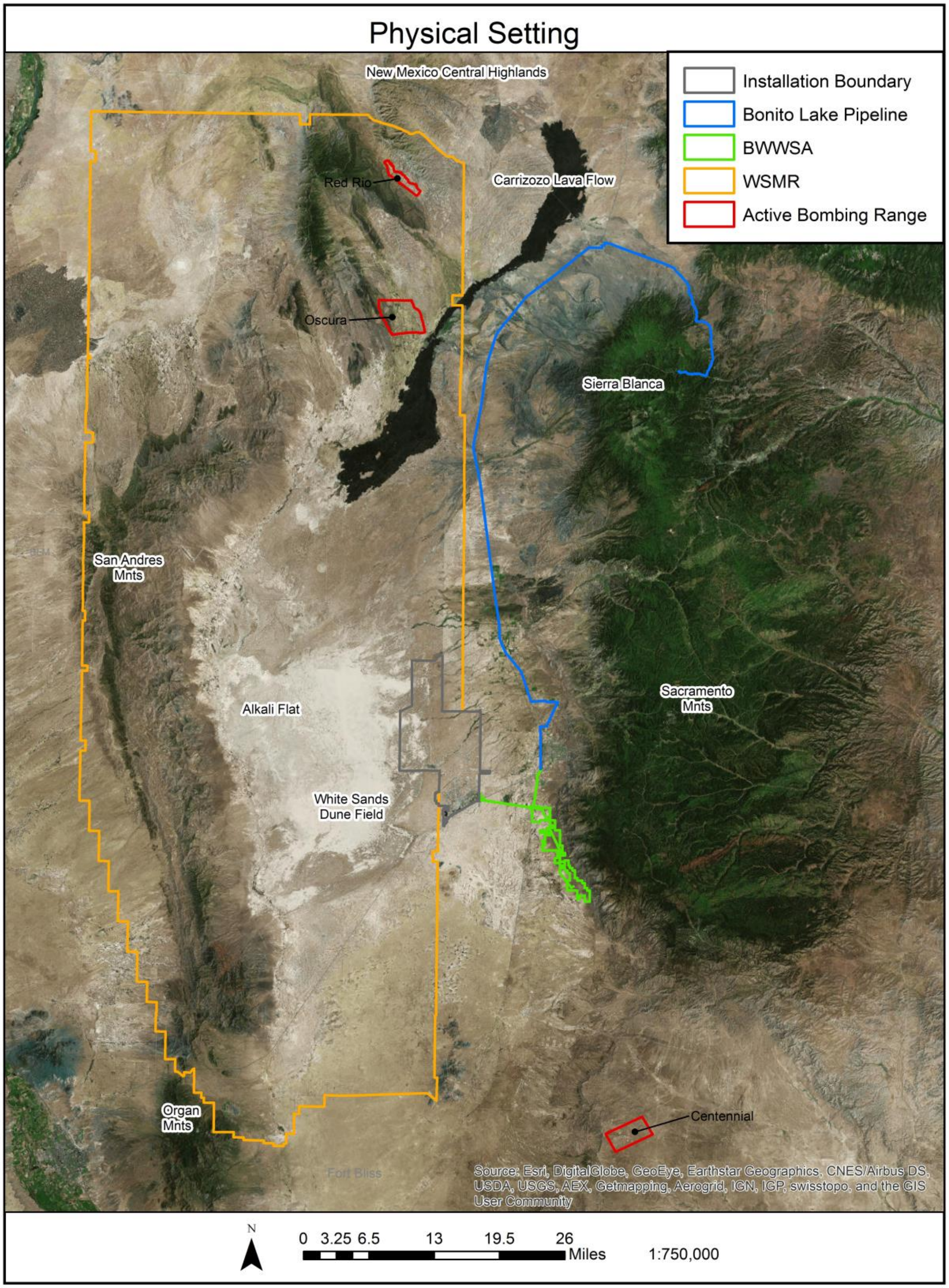


Figure 2.2.2-1. Holloman AFB Physical Setting

The alluvial plains are dissected from east to west by at least nine prominent intermittent ephemeral streams that typically terminate on the western portion of the base, creating broad drainage bottoms. Large alkali flats and playas have formed at the end of these arroyos, and small permanent and ephemeral lakes and ponds are scattered across the basin floor. The most prominent of these is Lake Holloman, formed from the northern end of Stinky Playa by a non-engineered dam, which contains water throughout the year. Since the dam was built, Stinky Playa now intermittently holds water. The waterbodies were originally the terminus for Dillard Draw and other arroyos but have subsequently been altered by dams and earthen canals that alter flows and holding capacity. The system of playas west of the golf course and east of Lake Holloman have also undergone extensive modification. The largest of these, Lagoon G, is surrounded by an earthen dam and is part of the constructed wetlands wastewater treatment facility.

The BWWSA lies on the Sacramento Mountains bajada. Elevations range from 4,087 feet in the northern Boles Wellfield to 4,671 feet extending eastward into the alluvial fan. Boles Wellfield is nearly level and is covered with spreading sand sheets and scattered playas. The wellfields south of Boles Wells (Douglas and San Andres Wellfields) are situated higher within the alluvial fans and are composed of cobbly to gravelly undivided sediments dissected by numerous ephemeral arroyos.

2.2.3 Geology and Soils

General Description of Soils on HAFB Main Base

Soils on HAFB were initially mapped by the Soil Conservation Service (now the Natural Resources Conservation Service, NRCS) on two separate soil surveys, one north of Douglas Road (Neher and Bailey 1976), and one south of Douglas Road (Derr et al. 1981) which includes the BWWSA. The NRCS recently completed reclassifying soils on main base and BWWSA as part of a region-wide survey (in association with WSMR). HAFB will be revising this section in the near future.

The soils on the main base are basin fill deposits formed primarily from alluvial (water-driven) and eolian (wind-driven) processes. All soils have a high gypsum and salt content, primarily due to the eastern migration of gypsum sands from WSMR and WSNM. Alluvial floodplains on the eastern and southern portions of the base are basin fill deposits from the western slope of the Sacramento Mountains. Subsoils are formed from sediments of Lake Otero, a Pleistocene lake formed during a climatic cycle of increased moisture. During periods of low precipitation, this large lake, reaching a depth of several hundred feet, would contract and leave salt and gypsum evaporites. These soils overlay Mesozoic and Paleozoic sedimentary rocks (Wilkins 1986).

The main base currently has three primary soil types, none of which are very productive due to high gypsum and salt content. All are highly subject to both wind and water erosion when the vegetation is sparse or the soil surface is exposed by vegetation or biological soil crust disturbance. The soils described below are likely to be changed with the new soils surveys, but the current descriptions are identified here:

- Several associations and complexes of Holloman, Gypsum Land, and Yesum soils, located in the flats
- Dune Land, found in the White Sands dunes
- Mead silty clay loam soil, found in the alluvial floodplains (including most wetlands)

Holloman-Gypsum Land-Yesum soil complex (HOB)

The most common soil type, covering approximately 66.5% of the base. It is a complex of shallow and deep well-drained soils and exposed gypsum. The soils have less than 5% slope and were deposited as both water-borne and wind-borne soil particles. Holloman soils (approximately 35% of the complex) have a light brown surface layer of very fine sandy loam about 13 inches deep. Gypsum Land, consisting of less than one inch of very fine sandy loam overlies white gypsum and is found mostly along the margins of arroyos, making up less than 30% of the mapping unit. The Yesum surface soil is a light brown, very fine, sandy loam about three inches thick, underlain by brown or pink fine sandy loam extending deeper than 60 inches. This soil type makes up approximately 20% of the complex. The remaining 15% of the complex consists of small areas of Prelo, Largo, Tome, and Bluepoint soils. These mixed alluvial and eolian sediments lie upland to the east from Holloman and are the source for the alluviated red beds found in drainages such as Hay Draw.

Duneland Yesum association

Comprises approximately 14.7% of the main base and lies north and south of the Active Dune Land Gypsum type. Both mapping units cover the western portion of the north half of the base, lying predominantly west of the Test Track. The Duneland Yesum association is 55% active dune and 30% Yesum very fine sandy loam. Yesum soils are deposited by wind, partly-stabilized gypsum dunes. The Active Dune Land is highly unstable and continually shifts, moving in a predominantly northeasterly direction. These dunes are primarily made up of very fine gypsum crystals from Lake Lucero, a relict Pleistocene lakebed.

Mead silty clay loam (MEA)

Covers approximately 4.5% of the main base. This poorly drained soil is limited to deeply incised drainages and alkali flats and playas. The soil type consists of fine textured silty soils on less than 1% slope. The soils contain a high salt content because of frequent flooding and become extremely sticky when wet. They are characterized by a 5-inch thick surface layer of reddish-brown silty clay or clay loam, underlain by approximately 48 inches of clay high in salt. Beyond 48 inches deep, the subsoils are formed from lakebed sediments. About 15% of the Mead mapping unit consists of gully sides or knolls with Holloman soils or gypsum land.

Rock Land (RL)

Mapping unit is found only on Tularosa Peak and covers less than one percent of the Holloman lands. This peak is an intrusive volcanic formation capped with limestone comprised of sedimentary units of the Yeso Formation (Doleman 1988). This Permian Age unit is 35 percent rock outcrop, 30% colluvium, and about 20% to 25% in shallow to very shallow soils. The remaining 10% to 15% of the unit is comprised of mixed alluvium and deeper soils found at further distances from the uplifted hill.

Description of Soils on Specific Areas of HAFB Main Base

Soils types on the main base are delineated in the Figure 2.2.3-1. Major Soil Units for the Main Base below.

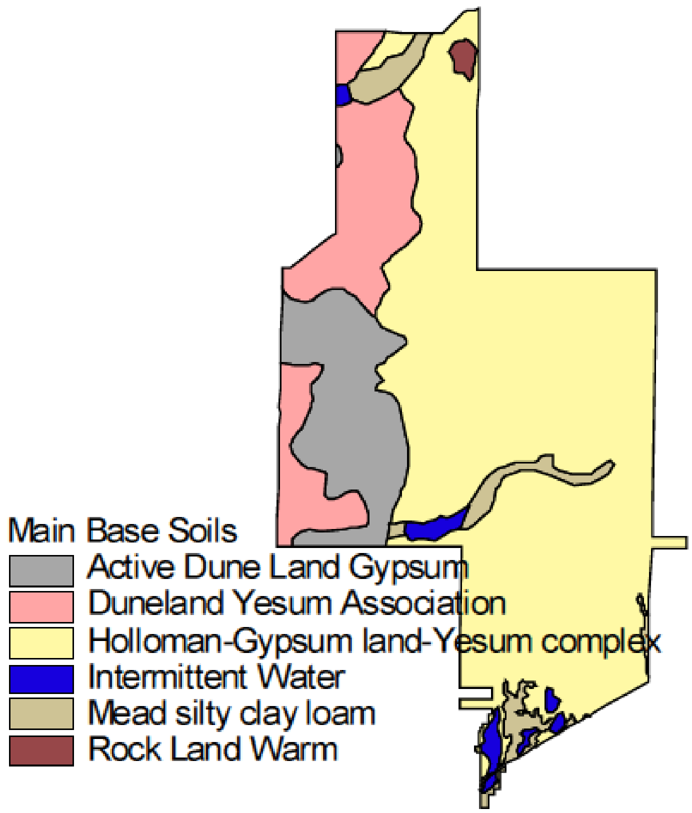


Figure 2.2.3-1. Major Soil Units for the Main Base (Neher and Bailey 1976; Derr et al. 1981)

The Cantonment area comprises approximately 8,000 acres within the southern portion of the base. The landscape has been highly modified to accommodate the majority of functions conducted by the military, including base housing and personnel support facilities. Within this upland ecosystem, topography is relatively level with elevations ranging from 4,127 feet in the far northeast corner of the area to 4,042 feet west of the airfield. Although the natural landscape has been fragmented by broad road networks and permanent structures, nearly 60% is covered in native vegetation. Holloman- Gypsum Land-Yesum complex is the soil type for this area. These are highly calcareous, well-drained soils with areas of exposed gypsum, formed in eolian gypsiferous and alluvial sediments (Derr et al. 1981). Wind erosion is severe in exposed areas of this soil type.

The dunelands area comprises approximately 15,000 acres and extends roughly from the HSTT facilities to the HAFB western boundary. The striking natural features of this management unit are the constantly transforming white gypsum sand dunes. Factors such as vegetation, sand supply, seasonal winds, and soil moisture affect sand movement. Wind direction is the primary factor responsible for variation in dune morphology. These dunes have a complex morphology and have been interpreted to grade from dome, to transverse, to barchan, to parabolic (Fryberger et al. 1990). Barchan dunes within WSNM were observed to move at a rate of 39.4 feet per year (McKee 1966), while parabolic dune movement was found to move at a rate of 6.6 feet per year (Patrick 1980). Because the White Sands dunes are vegetated, they are unique in comparison to other large dune fields such as the Great Sand Dunes in the San Luis Valley of Colorado. The duneland ecosystem is defined primarily by duneland processes and associated vegetation community types.

Three principal soil types dominate this area: Active dune land, Dune land-Yesum association, and Holloman-Gypsum Land-Yesum complex (Neher and Bailey 1976; Derr et al. 1988). The active dune land soils are gypsum crystals redeposited by wind carried from Lake Lucero, a relict lakebed. These gypsum deposits are evaporites from alluviated material brought into the lakebed from the surrounding mountains. Dune land soils become highly mobile during periods of high winds. Depositional and soil-forming processes are characteristically similar for the Dune land-Yesum and Holloman-Gypsum Land-Yesum complex. The Yesum soils occur in the level areas between semi-stabilized dunes (Doleman 1988). These soils are formed in wind-laid deposits, high in gypsum content, and moderately permeable. Throughout the soil profile are fine to very fine gypsum crystals ranging from mildly to moderately alkaline. These soils are highly susceptible to winds and become hazardous at high velocities. Cryptogams are characteristic of Duneland-Yesum and Yesum-Holloman association soil groups (Neher and Bailey 1976) and are sparsely to densely distributed. Cryptogams may contribute to soil stabilization (Doleman 1988). The Duneland-Yesum association is 55% Dune land and 30% Yesum very fine sandy loam. Yesum-Holloman association is the most widespread throughout the base. It is about 35% Yesum very fine sandy loam, 30% Holloman very fine sandy loam, and 20% hummocky Gypsum Land.

The HSTT vicinity is a complex area over 8,000 acres in size, composed principally of upland ecosystem types. Its western boundary is an ecotone with elements of the duneland system. It progressively grades eastward into the alluvial flat shrublands with gypsiferous soils. Most of the drainages that enter the base eventually dissect lands within this mapping unit. Topography near the HSTT is relatively flat, ranging in elevation from 4,055 to 4,134 feet. Three soil units dominate this area: Holloman-Gypsum Land-Yesum complex, Duneland Yesum Association, and Mead silty clay loam. The Holloman-Gypsum Land-Yesum complex covers 91% of the area with Duneland Yesum Association and Mead silty clay loam covering 6% and 3%, respectively. The Holloman-Gypsum Land-Yesum Association is made of soils formed in mixed eolian and alluvial gypsiferous sediments. They can have horizons well-drained, shallow, or deep. They are calcareous throughout and mildly alkaline, having moderate permeability and available water capacity. The Duneland Yesum Association enters the western border of the area above Hay Draw and extends approximately 2,700 feet. The Duneland-Yesum association is 55% Duneland and 30% Yesum very fine sandy loam. The Mead silty clay loam soil type occurs within the arroyo bottoms.

Although the area near the HSTT and grasslands north of Douglas Road are dominated by the same soil unit, differences in the vegetation communities between these units suggest edaphic differences. The Test Track area is dominated by Fourwing Saltbush/Gyp Dropseed Shrubland, while the grasslands area is dominated by Fourwing Saltbush/Alkali Sacaton Shrubland. Both areas contain approximately 15% Gyp Dropseed Grassland. The updated soil survey expected in 2008 should help define the soil properties that support one community over another and may explain the spatial distributions of dominant plant communities.

The grasslands north of Douglas Road contain more cryptogamic cover than all other community types. This is the largest area, comprising nearly 20,000 acres. From this nearly level and moderately undulating topography, Tularosa Peak rises abruptly 984 feet above the surrounding basin floor. Broad, deeply incised drainages move alluviated materials from upland reaches westward into the dunes. This area is a complex of upland and arroyo riparian ecosystems, creating a morphologically and biologically diverse ecological unit. With the exception of the duneland area, this area may hold the greatest potential for natural resource recovery and conservation, due to its high plant and animal diversity and large areas currently unused for military or recreational purposes.

Two broadly-classified soil units are described for this area (Derr et al. 1981): the Mead silty clay loam (MEA) that occurs within the drainages, and the Holloman-Gypsum Land-Yesum complex (HOB) that comprises the remaining upland areas. The MEA soils are flooded much of the year and have very slow permeability and low available water capacity (Derr et al. 1988). Overlying surfaces to a depth of 48 inches are reddish brown clay with a high salt content. Soil horizons extending to more than 60 inches are made of lacustrine material of variable texture and color. These soils are moderately calcareous throughout and strongly alkaline with a layer of salt that is more soluble than gypsum.

The topography within the upland reaches dominated by HOB is linear, northeast trending, and subtly undulating. This type of surface expression resembles linear dune morphology and may be the result of bi-directional wind regimes, as opposed to dunes created by winds from a single direction. These soils are formed in mixed eolian and alluvial gypsiferous sediments and can have horizons that are well-drained, shallow or deep. They are calcareous throughout and mildly alkaline, having moderate permeability and available water capacity. Tularosa Peak is described as Rock Land (Neher and Bailey 1976). This peak is an intrusive volcanic formation capped with limestone comprised of sedimentary units of the Yeso Formation (Doleman 1988). This Permian Age unit is 35% rock outcrop, 30% colluvium, and about 20% to 25% shallow to very shallow soils. The remaining 10% to 15% of the unit are mixed alluvium and deeper soils found at further distances from the uplifted hill.

The area near the Lake Holloman wetlands complex comprises approximately 1341 acres north of US 70 and 110 acres located south of the highway. This area is located directly south of the Cantonment area. Prominent physical features within the area are Lake Holloman and Stinky Playa, both former large alkali playa lakes. East of the playa lakes is a series of shallow depressions, lagoons, and intermittent drainages that were formerly part of the historic reaches of Dillard Draw (USAF 1996a). Historic connections between the upper alluvial system and the basin lowland ecosystem, including Lake Holloman and Stinky Playa, have been interrupted by road development and military construction. In 1997, in cooperation with the USFWS, HAFB built a system of berms, ditches, and control structures to create a flow-through wetland roughly encompassing the area between Lagoon G and Lake Holloman. Prior to the establishment of the constructed wetland, surface water within this area covered 222 acres and included the group of lagoons north of Lagoon G. With the constructed wetland, surface water may reach a maximum of 347 acres, depending on the output of the HAFB wastewater treatment plant, climatological conditions, and water diversion for other uses.

Yesum-Holloman soils create an uneven mosaic of moderate to highly alkaline soils with flat to moderately undulating surfaces. The Yesum Series is a deep, well-drained soil derived from wind-deposited sediments, high in gypsum. These soils contain fine gypsum crystals; surfaces are nearly level with slightly undulating areas caused by changing wind deposition patterns. The Holloman series are shallow, well drained, and moderately alkaline. This moderately permeable soil is formed from loamy and sandy alluvium deposited over gypsum beds in old lake depressions. The underlying gypsum layers range from soft to hard and are 4 to 20 inches below the sandy loam. The Gypsum Land soils in this mapping unit are partially stabilized and hummocky, derived from wind-blown gypsum crystals of relict lakebeds.

Description of Soils on BWWSA

Soils types on the BWWSA are delineated in Figure 2.2.3-2. Soil Map of BWWSA below.

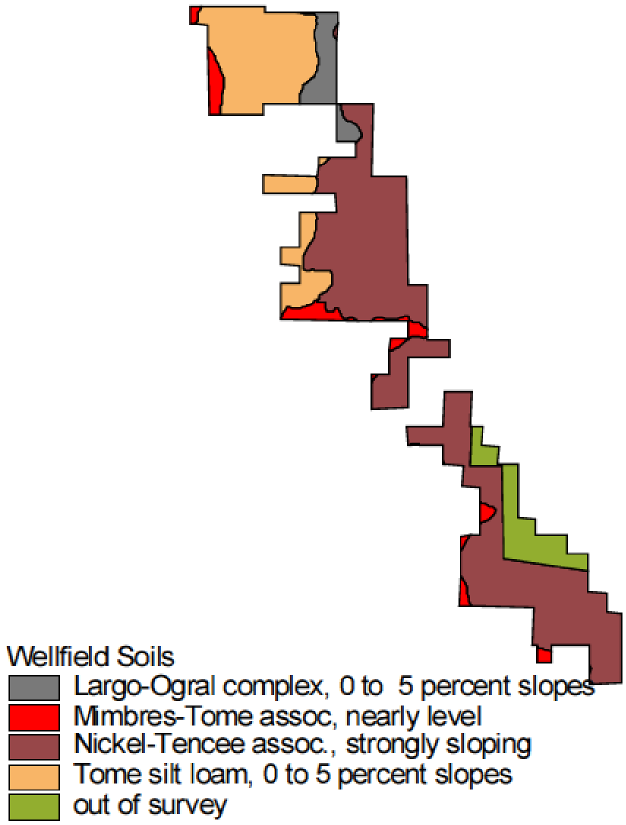


Figure 2.2.3-2. Soil Map of BWWSA (Derr et al. 1981).

The BWWSA is nearly 7,000 acres in area and lies within the alluvial fans of the Sacramento Mountains south of Alamogordo. Elevations range from 4,081 feet to 4,439 feet in the Douglas Wellfield and 4,104 feet to 4, 744 feet in the San Andres Wellfield. The BWWSA consists of two sections: the BWWSA to the north (Boles, Douglas, and San Andres wellfields), and the Southern Wellfields to the south (Frenchy and Escondido fields). The principal use of the area is to provide potable water for HAFB.

Beginning in the late 1800s, the BWWSA was used for farming and livestock grazing (Hawthorne 1994a). Much of the soil has been eroded and native grasses have been replaced by shrubs due to farming and grazing practices. Sparse vegetative cover and monsoonal precipitation events subject the area to extensive sheet erosion (Hawthorne 1994a). Three soil types dominate the BWWSA: Largo-Ogral complex, Tome silt loam, and Mimbres-Tome association. The soils form elongated bands that extend westward from the mountain front. The Largo-Ogral complex lies closest to the mountain front and consists of gently sloping pediments of very fine sandy loam. The Tome silt loam is located at the lower parts of the pediments, forming fan-shaped alluvium on nearly level to concave surfaces. These are dissected by small meandering drainages. This area is subject to flooding and, when surface soils are exposed, become susceptible to high wind erosion (Derr et al. 1981). The Tome silt loam is the major soil type for the BWWSA. The Mimbres-Tome association lies at the fringes of the alluvial fan within the basin bottom. Having a moderately slow permeability, these soils are often flooded for short periods following intense rainstorms (Derr et al. 1981).

The soils in the BWWSA were formed on the lower parts of the alluvial fan piedmont at the base of large drainages. These nearly level soils are formed from alluvial and eolian materials of mixed sedimentary and igneous rocks deposited by periodic runoff from the adjacent mountains. The Douglas and San Andres Wellfields cover more elevated units of the alluvial fan. These soils are deep and gravelly throughout.

The topographically lowest units within the BWWSA at the western edges are the nearly level Mimbres-Tome association (MTA) and the Tome silt loam (TDB). These finer-textured, deep, well drained soils are formed in medium-textured alluvium derived from limestone and siltstone having some calcareous eolian material but no caliche barrier associated with fan fringes and bottom lands (Muldavin et al. 2006). Permeability is moderately low and they may be flooded for short periods following intense rainstorms. The Largo-Orgal complex (LGB) is on the lower part of dissected toe slopes at the base of the piedmont on the eastern extent of the BWWSA and cover only 5% of the entire BWWSA. Permeability of these soils is moderately rapid and water capacity is low.

The remainder of the BWWSA on the upper-elevational bajada is covered by the Nickel-Tencee association that occurs on pediment toe slopes and alluvial fans. These soils are shallow gravelly alluvium soils. Nickel soils comprise 50% of the unit, dominating the summit platform of the bajadas, and lack a strong caliche horizon. The Tencee soils have a restrictive caliche barrier and are on the side slopes of fans and upper parts of older fans (Muldavin et al. 2006). These landscapes are deeply dissected by numerous drainages. The soils are formed in highly calcareous, coarse-textured sediment, derived from limestone. These soils are strongly calcareous throughout and moderately alkaline, with moderate permeability and very low water storage capacity. Unmapped areas are at the eastern boundary of the wellfields near the Lincoln National Forest lands.

Soils on the Douglas and San Andres fields are predominantly the Nickel-Tencee association at the pediment toe slopes and upper portion of the alluvial fans. These gravelly sandy loams grade into the Tome silt loams and Mimbres-Tome association at lower elevations on the fan to basin bottom. Areas not covered in the soil survey are shown in green (Figure 2.2.3-2. Soil Map of BWWSA).

Soils of the GSUs

Red Rio Bombing Range is situated between two subsections of the Basin and Range physiographic province. It is located at the northern extent of the Tularosa Basin within the Mexican Highlands Chapter and at the eastern boundary of the Sacramento Chapter in the northern Jornada del Muerto Plain (Hawley 1986). The site has physiographic characteristics representative of both sections. Typical of the Mexican Highland Chapter are the Oscura Mountains, a block-faulted range that dips to the east. The Oscura range is capped with Pennsylvanian limestone underlain by Middle Proterozoic plutonic rocks (Anderson 1997). Several uplifted, east-dipping cuestas and the Chupadera Mesa are situated to the east. This complex of uplifted cuestas and hills is dissected by narrow drainages that flow south into the Tularosa Basin. The cuesta-form mountains are representative of the Sacramento Chapter and are predominantly capped by Permian Age limestone and sandstone with gypsum interbedded (Hawley 1986). Exposed sedimentary sequences include the red beds of the Abo and Bursum Formations, gypsic strata of the Yeso Formation, and the San Andres limestone and Glorieta sandstone. Alluviated materials from the mostly Pennsylvanian and Permian Age sediments accumulate as basin fill at the mouth of the drainages. The largest occurrences of these Quaternary deposits occur at the mouth of Red Canyon and the sub-basin on the east side of the Oscura Mountains.

A soil survey following the Soil Taxonomy, U.S. Department of Agriculture (Soil Survey Staff 1975) identified 19 soil series and soil complexes. Shallow soils formed from alluvium, colluvium, or eolian materials of sandstone or sandstone-shale facies include the Travesilla-Rock outcrop, Rock outcrop-Lithic Torriorthents, Rock outcrop-Lithic Ustic Torriorthents-Travesilla complex, and the Loarc-Bernal-Rock outcrop complex. Deep soils formed in alluvium from sandstone, limestone, and shale members comprised the La Fonda loam, Dean-Suwanee-La Fonda association, Manzano clay loam, Suwanee clay loam, and La Fonda-Tanbark-Deama complex. Soils derived from predominantly limestone and gypsum outcrops and formed in alluvium and eolian materials are the Deama very gravelly loam, La Fonda-Neotoma-Deama complex, Winona-Rock outcrop complex, Tortugas-Rock outcrop, Rock outcrop-Tanbark-Deama complex, Deama-Tortugas-Rock outcrop, and Cuate-Deama-Tanbark complex. Soils are generally stabilized where covered in natural vegetation. However, sites disturbed by bombing experience moderate to severe soil loss.

Oscura Bombing Range lies within the northern extent of the Tularosa Basin at the base of the Oscura Mountains and Chupadera Mesa. Alluvial and aeolian processes are the primary natural mechanisms reshaping the geophysical landscape within the range today. Beginning in the northern extent of the range, elevation drops gradually from the alluvial fans of the Oscura Mountains and Chupadera Mesa into the alluvial flats and basin lowlands to the south, including portions of the Carrizozo Lava Flows. Alluvial fans within the range are derived from a composite of the limestone and sandstone members of the predominantly Permian Age formations. At increasingly larger distances from the piedmont slope, the incised drainages meet within the basin, forming a mixture of alluviated Quaternary fill (Anderson et al. 1997). The topographically lowest unit within the basin holds undifferentiated quaternary fill, primarily from the exposed sedimentary units of the Abo, Bursum, Yeso, and San Andres formations. At the southern tip of the Oscura Mountains and along the eastern border of the alluvial fans of the San Andres Mountains are mappable units of the Santa Fe Formation. The Carrizozo lava flow, located in the southeastern portion of the range, is one of the youngest volcanic flows in the United States, estimated between 1,500 and 2,000 years old. The vent for the basalt lava flows is Little Black Peak; flows extend for forty-four miles, ranging from one-half to five miles wide and are up to 160 feet thick (Stoeser et al. 1989). The volcanic rock nearly covers the underlying Pennsylvanian, Permian, Triassic, and Cretaceous rock units, with the exception of some kipukas (Hawaiian term for an island of older rocks and surficial material surrounded by lava). Piedmont alluvial deposits occur on the eastern side of the volcanic flow, at the base of the Phillips Hills.

RAMS site rests on an alluvial fan underlain by caliche and dissected by a fault scarp. The nearly level surface has sandy-loam soils with occasional limestone rock outcrops and is dissected by drainages. Vegetation cover is characterized by uniformly spaced creosote bush shrublands and may be associated with alkali sacaton or bush muhly. Creosote shrubland communities are extensive at the mid-to lower portions of the San Andres alluvial fans and are occasionally dissected by drainages. These drainages have greater plant diversity and harbor hillside, lower elevation, and desert riparian species. Drainages may contain assemblages of desert-willow (Chilopsis linearis), honey mesquite, tarbush, ocotillo (Fouquieria splendens), or soaptree yucca.

Biological Soil Crusts (formerly called cryptogamic crusts)

Biological soil crusts are living organisms composed of algae (cyanobacteria), lichen, moss, fungi, and/or liverworts, occurring as either a single taxon or in combinations (Ladyman and Muldavin 1996, Belnap et al. 2001), where neither could exist alone. These crusts provide critical functions on highly erodible soils in areas with little natural vegetation. The functions they serve include:

- Stabilizing soils by reducing erosion and increase available nitrogen in nitrogen- and carbon-deficient soils (Gottfried 1991);Nitrogen fixation in desert and semi-desert ecosystems (West and Skujins 1977)
- They bind soil particles together into hydrophilic aggregates that can reduce runoff in the soil, thus reducing nutrient loss (Ladyman and Muldavin 1996)
- Increase organic matter in soils (Fletcher and Martin 1948)
- Increase soil stabilization eolian flats with gypsic soils and potentially increase plant density (Doleman 1988)
- May increase soil temperature, which may preferentially affect seed germination for some species and hummocky microtopography of the crusts can be advantageous to seed germination by trapping water and sheltering seeds (Harper et al. 1965)
- Aid in the mineral uptake of vascular plants, increasing total mineral content (Harper and Pendleton 1993), which in turn positively affect mineral availability for herbivores (Ladyman and Muldavin 1996)

The primary natural erosional processes on HAFB are wind, rain, and sheet erosion caused by overland flows during monsoonal storms. Gypsiferous soils on HAFB can support well-developed biological crusts and are worthy of protection because of their high potential for cover for soil protection and biodiversity (Belnap et al. 2001).

Three principal types of soil crusts occur at HAFB. The first is the physical-chemical hardening of gypsum caused by rain and subsequent drying of the surface, which is not a biological crust. The second is the development of cyanobacteria, which is a biological crust. The third has more complex organisms such as lichen and mosses, both of which are biological soil crusts. Cyanobacteria are the most widespread and abundant throughout the basin and provide the greatest resistance to wind and sheet erosion (J. Belnap, NHNM, pers. comm.). Lichen and mosses, however, are most effective in protecting the soils from raindrop impact. Recovery rates for biological soil crusts on gypsum soils may be rapid compared to other biological crusts in arid environments. Crusts on gypsum soils may return to pre-disturbance levels within ten years, as compared to other biological crusts in arid regions that may take 200-250 years to re-establish to well-developed levels (J. Belnap, New Mexico Natural Heritage, pers. comm.). Successful re-establishment of crusts in these soils is more likely if rainfall occurs soon after a disturbance event such as any ground military training exercise. The rainfall accelerates gypsic crust formation, thus protecting against wind erosion. Impediments to recovery would be continued use of an area and high winds following a disturbance.

A systematic field sampling procedure covering the main base found these crusts varied from 0% to 85% coverage (NMNHP unpubl. data; J. Belnap, unpubl. data). The six most common lichens found within Holloman AFB are: *Collema tenax, Psora decipiens, Psora cerebriformis, Catepyrenium lachneum complex, Catepyrenium hepaticum, Hepia lutosa*. The most common cyanobacteria is *Nostoc flagellonus*. The geographic distribution of crusts with at least 60 percent cover is predominantly within the HSTT area and grasslands north of Douglas Road. GIS analyses suggest that particular plant communities may be associated with these crusts. These vegetation types are Fourwing Saltbush/Gyp Dropseed Shrubland, Gyp Dropseed Grassland, and Fourwing Saltbush/Alkali Sacaton Shrubland. Fourwing Saltbush/Gyp Dropseed Shrubland has the strongest association with crust cover (densities >60%).

Biological soil crusts are extremely sensitive to disturbance by trampling and fire (Ladyman and Muldavin 1996). Studies conducted in Arches National Park found lower infiltration rates (up to 90% lower) and decreased species diversity in trampled areas (Ladyman and Muldavin 1996). Fire can destroy biological soil crust communities; post-fire activities affect re-establishment rates, which may differ depending on human activities and seasonal precipitation events (West and Hassan 1985, Johansen et al. 1982, Johansen and Rushforth 1985, Johansen et al. 1993). Recovery rates depend on many factors, including disturbance type, severity, and extent; plant community structure; availability of adjacent sources; soil texture; and climate before and after disturbance, as crustal organisms are active only when wet (Belnap et al. 2001). The first to recover are cyanobacteria and algae, and moss and lichen have slower recovery rates, probably because of higher mobility across soils and through the air (Ladyman and Muldavin 1996, Belnap 2001). Lichens and mosses require stable soils surfaces for growth. Recovery rates of biological soil crusts have not been determined for Chihuahuan Desert grasslands. Recolonization rates in other arid environments range from two to five years, often with substantial changes in species composition and soil crust biomass (Ladyman and Muldavin 1996). Further research is needed to determine recovery rates following disturbance, perhaps with DoD Legacy funding.

2.2.4 Hydrology

The only permanent water in the Tularosa Basin is found in small streams between Alamogordo and Three Rivers (Garza and McLean 1977; Anschuetz et al. 1990). There are no perennial streams within HAFB or in the nearby surrounding landscape. However, a set of perennial pools exist within the base including three discrete reaches in the Malone and Ritas Draws and Lost River drainage complex that retain water year-round, as well as the Salt Lake just south of Lost River and Camera Pad Pond. The primary hydrologic processes in this desert ecosystem are summer monsoons and large storm events falling on the rocky slopes of the Sacramento Mountains.

Most of the thunderstorm precipitation is absorbed quickly into the gravels and sandy surfaces at the base of the alluvial fans. At the terminus of the alluvial fan channels, ephemeral playa-like depressions can hold water for several weeks, creating hydric soil conditions (Geo-Marine 1996). A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Alkali flats occur most notably within the low lying area between Lake Holloman and Lagoon G but also are dispersed sporadically throughout the various drainages. These flats are generally not densely vegetated but may have an algal layer on the surface (Geo-Marine 1996). During the growing season, which corresponds with summer monsoons, these vegetated and bare flats provide important wildlife habitat and essential wetland feeding areas for waterfowl and shore birds.

There are at least nine prominent east-west drainages on the main base that receive intermittent flows during seasonal thunderstorms (see Figure 2.2.4-1. Draws on Main Base, Holloman AFB), including several which are 100-year floodplain zones. These areas are associated with the presence of the poorly drained Mead soils, which are alluvial floodplain soils. These soils are present within Dillard Draw, Lagoon G, Malone, Ritas and Allen Draws, and Lost River drainages. The flood-prone areas associated with Allen, Malone, and Ritas Draws and Lost River are within the more remote, less densely developed sections of the base. These drainages are broad and deeply entrenched where extensive down cutting has occurred by as much as 50 feet below the basin floor. The largest of these drainages is the Lost River drainage system, including Malone Draw and Ritas Draw. The floodplains in this system are protected from use or development by Essential Fish Habitat designated for the White Sands Pupfish per the Interagency Cooperative Agreement (Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats).

Prior to extensive management of the surface topography and construction of U.S. Highways 70/54, Dillard Draw emptied into the main base, creating a network of alkali flats and ephemeral playas including what are now Lake Holloman, Stinky Playa, and Lagoon G. Construction activities have disrupted the natural flow of this wetland ecosystem, and flows were further changed when the existing wetlands were modified/enhanced. The floodplains in this wetlands complex area are protected for discharge of treated effluent from the HAFB wastewater treatment plant and because of ecological value, Dillard Draw is protected from development and unauthorized off-road vehicle use in the playa is prohibited. Allen and Carter Draws are in a portion of the base where development is not desired.

Changes in surface and sub-surface flow due to the diversion of drainages previously associated with Dillard Draw have increased wetlands within the Cantonment area. Ephemeral flats and vegetated wetlands have developed north of the golf course as a result of the diversion of drainages associated with the construction of US Highway 70/54 (Geo-Marine 1996). In addition, the lower portion of Dillard Draw has been altered and channelized for the base storm water drainage system, thereby creating a wetland east of housing.

Hydrologic characteristics such as water-holding capacity of the dunes and underground water systems within the dunes are unknown; however, the dunes appear to have great capacity for retaining moisture (Doleman 1988). All of the draws that dissect the base, except Dillard Draw, terminate in the dunes. It is not known how far they extend under the dune field or to what extent the dunes may alter direction of the flows. In the case of Lost River, dunes are encroaching and covering portions of the drainage.

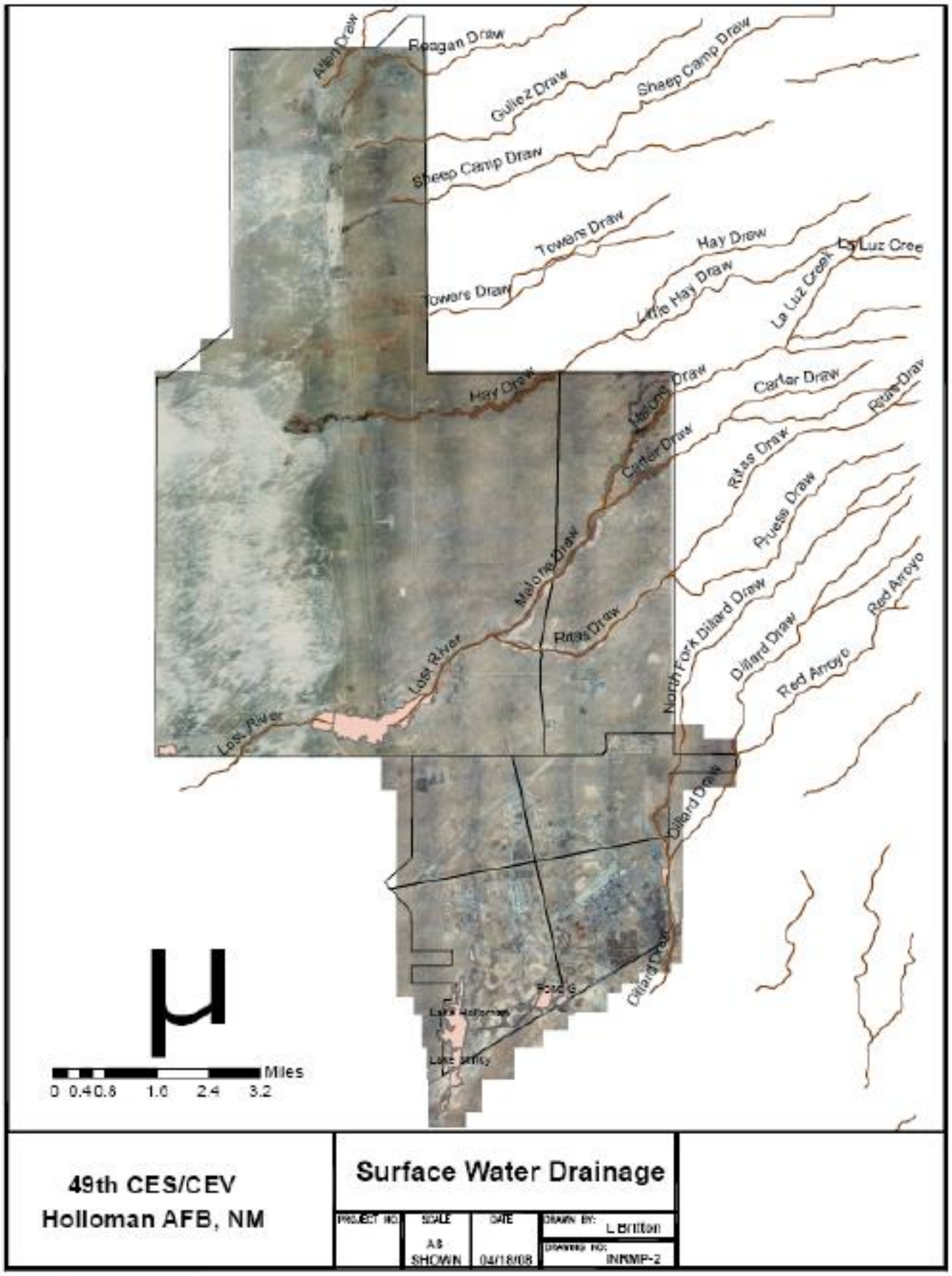


Figure 2.2.4-1. Draws on Main Base, Holloman AFB

Deeply incised drainages are an important feature of the grassland-shrub area north of Douglas Road. The intermittent surface flows provide important desert riparian habitat for wildlife. Little is known about the history of available water and water quality within the draws; however, at the turn of the century there was sufficient water to support enough saltgrass to provide forage for cattle. Conditions within the draws have changed since the turn of the century, when dry farming techniques were used within Hay Draw to grow crops such as corn, small family gardens, and grass hay. Year-round springs were once common near

Tularosa Peak and within Reagan and Sheep Camp Draws (Hawthorne-Tagg 1997). Today these draws are more xeric and alkaline-tolerant shrubs such as fourwing saltbush and pickleweed dominate. Tamarisk (also known as salt cedar, *Tamarix spp.*), an invasive, nonnative Eurasian tree, is increasing within the wetland and riparian habitats within the base. This phreatophyte poses a threat to competing native riparian plant species, can significantly alter the flow of streams, and increase wildfire frequency and severity (Malanson 1993; NMDGF 2016a; and See Section 7.11 Integrated Pest Management Program for more information).

The historic desert wetland ecosystem that existed between Lagoon G and Lake Holloman has been enhanced to form a “constructed” wetland for management of effluent from the HAFB wastewater treatment plant and to provide valuable wetland habitat for wildlife. These wetlands contain a network of earthen berms and channels to direct storm water runoff from the cantonment area and treated wastewater effluents into these alkali flats. Flows into the completed constructed wetlands began in November, 1997.

Groundwater

Groundwater recharge in the Tularosa Basin occurs largely from rainfall and snowmelt in the Sacramento and San Andres mountains, where intermittent stream flow infiltrates into the coarse, loosely consolidated alluvial fan material. Although stream flow is greatest during the summer monsoons, most recharge occurs in the winter months (Wilkins 1986). Recharge for the Tularosa Basin was estimated to be greater than 100,000 acre-feet per year, with the greatest portion accumulating at the base of the Sacramento Mountains (Meinzer and Hare 1915). HAFB lies within the ground flow gradient from the Sacramento foothills to the lowest point within the basin, Lake Lucero, to the southwest of the main base. Groundwater at the margins of the basin within the bajada of the Sacramento Mountains grade from fresh water (containing less than 1,000 milligrams per liter [mg/L] total dissolved solids [TDS]) to highly alkaline sources near the center of the basin with more than 100,000 mg/L TDS (Geo-Marine 1996).

Boles Wells Water System Annex (BWWSA) and Bonito Lake

The BWWSA comprises over 1,500 acres within the alluvial flats of the Sacramento Mountains. The BWWSA is characterized by nearly level topography dissected by natural ephemeral streams, channelized drainages, and excavated basins. Within these lowland areas, seasonal precipitation events create ponds in the saturated soils of swales and playas. A 1996 study reported that the BWWSA area contained approximately 5.5 acres and 27,589 linear feet of jurisdictional waters of the U.S., including 0.72 acres of wetlands and 4.75 acres of non-wetland waters of the U.S, including numerous ephemeral streams, occasionally flooded basins and a permanently flooded impoundment (USAF 1996a). These water resources include one non-vegetated ephemeral basin and one vegetated ephemeral basin. The remainder of the BWWSA has not been surveyed for jurisdictional water resources. The lands south of the BWWSA are dissected by many ephemeral arroyos. The BWWSA groundwater is one source for potable water of HAFB (HAFB 2002).

The wellfields receive groundwater recharge from six canyons: Lead Canyon, Muleshoe Canyon, San Andres Canyon, Dog Canyon, Deadman Canyon, and Escondido Canyon. Depth to groundwater is approximately 270 feet; however, the last well was drilled to a depth of 1,300 feet. The depths of the wells are considered sufficient to prevent contamination by sewage effluent from adjacent residential communities. The only significant drawdowns for the aquifer were recorded during the drought of 1982.

Another water source for the base comes from the Bonito Pipeline. HAFB owns 75 miles of the 90-mile pipeline, which conveys water from Bonito Lake through Carrizozo to the City of Alamogordo. HAFB has rights to a portion of the water and obtains credits during periods when the water is not in use. HAFB uses City of Alamogordo water from the Bonito pipeline for part of the year.

Non-jurisdictional Waters/Wetlands

"Geographically isolated wetlands" refers to wetlands that are completely surrounded by uplands at a local scale, as well as complexes of wetlands within a single basin. Their hydrology is driven entirely by seasonal and localized precipitation patterns. They may or may not be hydrologically connected to other waters through groundwater or surface water, and provide functions and values such as wildlife habitat and ground-water recharge. A primary concern regarding geographically isolated wetlands is the loss of regulatory protection under Chapter 404 of the Clean Water Act, as the US Army Corps of Engineers policy implements the recent Supreme Court decisions regarding jurisdictional wetlands (USACE and US EPA 2007). New Mexico has no state-level wetlands permitting program to protect its most vulnerable waters (NMDGF 2006).

In 1996, prior to the Supreme Court cases changing the definitions of jurisdictional wetlands per Section 404 of the Clean Water Act (CWA), a total of 868 acres of jurisdictional waters of the U.S., including 120 acres of wetlands and 750 acres of non-wetland waters, were delineated within HAFB (Geo-Marine 1996). HAFB requested and received approval (Action No. SPA-2014-00501-LCO) for jurisdictional determination for 53,740-acres of HAFB's main base following the new definitions of jurisdictional wetlands. It was suspected that HAFB's isolated wetlands when applied to the definitions of Waters of the US as determined by the Supreme Court may result in no jurisdictional wetlands occurring on HAFB.

The HAFB wetlands delineation survey was completed in 2012 finding that HAFB contains isolated intrastate waters with no nexus to interstate or foreign commerce, no connection to the nearest Traditional Navigable Water, the Rio Grande. Based on the information provided, the Department of the Army, Albuquerque District, Corps of Engineers determine that HAFB is not jurisdictional or subject to regulation under Section 404 of the Clean Water Act on 4 March 2015. This study identified a total of 33.03 acres of geographically isolated wetlands on HAFB; 20.53 acres of which were identified as provisional wetlands (AMEC 2014).

Management of Stormwater Runoff

On HAFB, natural and stormwater runoff contributes to the hydrology of the installation. The stormwater drainages constructed on the main base receive waters from both the developed/industrialized areas and undeveloped areas. Drainage for the industrialized portions of the base is provided by a system of above-ground ditches and underground culverts that discharge to various outfall areas and ultimately, in some cases, to the stormwater drainage canal. Water in the stormwater drainage canal flows through the constructed wetlands into Lake Holloman. Industrial areas where the stormwater drains into the canal include the main ramp, the west ramp F-16 Fighting Falcon area and BEAR base. Non-industrial areas include the cantonment area and the southern portion of base housing.

Water quality discharged from unregulated non-point sources include the base housing area and the Apache Mesa Golf Course. The primary concerns are herbicides and fertilizers used to maintain lawns and golf greens. It is not known if these chemicals reach the stormwater drainage system, but if they do, they could drain into the aquatic system at the Lake Holloman Public Access Area (Section Threatened and Endangered Species and SOC).

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

The ecosystems represented on HAFB, including the BWWSA and GSUs, are part of more extensive systems extending beyond the borders of the base known as the Chihuahuan Desert ecoregion (NMDGF 2016a). According to the NMDGF 2016 SWAP, “this ecoregion supports the highest number of SGCN” in New Mexico. Terrestrial habitats of this ecoregion include 27 naturally vegetated types, three unvegetated land covers, as well as agricultural land (NMDGF 2016a). The ecoregion is dominated by two upland habitat types: Chihuahuan Semi-Desert Grassland (34%) and Chihuahuan Desert Scrub (51%) (NMDGF 2016a). HAFB land includes both of these upland habitats as well as dunelands (Great Plains Sand Grassland and Shrubland and Intermountain Saltbrush Shrubland), Playa (Intermountain Saltbrush Shrubland), Arroyo Riparian (Warm Desert Arroyo Riparian Scrub), and Wetlands.

For the convenience of discussion, we group habitats, soils and vegetation mapping units into a higher level ecosystem hierarchy. HAFB is considered to contain four natural and two man-made ecosystems. They are:

- Upland (natural)
- Duneland (natural)
- Playa (natural)
- Arroyo Riparian / Warm Desert Arroyo Riparian Scrub (natural)
- Wetland/Constructed Wetland in the Lake Holloman public access area (man-made/enhanced playa system)
- Miscellaneous category is used to capture base facilities and the golf course (man-made)

Description of HAFB Terrestrial Habitats

<u>Upland (natural)</u>

The upland ecosystem on HAFB is composed of both Chihuahuan Semi-Desert Grassland and Chihuahuan Desert Scrub. This following information is from Partners in Flight (PIF 2003) and NMDGF (2016a) except where noted.

Chihuahuan Semi-Desert Grassland

Chihuahuan Desert Grassland covers roughly the southern third of New Mexico and is found only in the Chihuahuan Desert Physiographic Area. This habitat extends along the southern border of the state; north to Hobbs and Roswell in the Pecos Valley; Carrizozo, and WSMR/HAFB in the Tularosa Basin; and San

Acacia in the Middle Rio Grande Valley. It occurs north to Hillsboro (excluding the Plains of San Agustin) and west to the Gila River on the Arizona border. Elevations range from 2,800 to 5,500 feet.

Little of this habitat remains intact in the United States, due to persistent, large-scale impacts, primarily historical livestock grazing. It may be the most endangered biome type in North America. Small fragments of this habitat may exist on military reservations in southern New Mexico where large-scale grazing was discontinued, but are unlike the major expanses of this habitat that existed before the advent of grazing. Grazing has altered the historical composition of this habitat from primarily perennial bunch grasses to low-growing sod grasses in many areas, or where summer rainfall is low, to annuals (Brown 1982). Historically, black grama (*Bouteloua eriopoda*) was the dominant grass of this habitat, but presently blue grama (*B. gracilis*) is currently more prevalent. Other grasses include dropseeds (Sporobolus spp.) and gyp grasses (*Aristida* spp.). Major grass species include tobosa (*Hilaria mutica*), bush muhly (*Muhlenbergia porteri*), burrograss (*Scleropogon brevifolius*), and side-oats grama *(B. curtipendula*). Much of this habitat consists of creosote bush (*Larrea tridentata*) and tarbush (*Flourensia cernua*). Mesquite (*Prosopis glandulosa*) dominates in other areas. These zones may be quite organized and consistent within the overall desert habitat, depending on elevation and soil composition. In general, areas dominated by mesquite contain the lowest diversity of plants.

According to NMDGF (2016a) Chihuahuan Semi-Desert Grassland [M087] is a diverse habitat:

> ["characterized by an open to dense herbaceous layer dominated by perennial grasses, but shrubs and subshrubs are typical components. In lowland settings of broad alluvial plains and flats and swales, dominant species may include tobosagrass, alkali sacaton (*Sporobolus airoides*), giant sacaton (*S. wrightii*), or vine mesquite (*Panicum obtusum*). Grasslands of sandy sites are characterized by black grama and mesa dropseed (*Sporobolus flexuosus*), often with soaptree yucca (*Yucca elata*) and/or Torrey's jointfir (*Ephedra torreyana*) shrubs. Black grama, blue grama, hairy grama (*Bouteloua hirsuta*), curly-mesquite (*Hilaria belangeri*), bush muhly (*Muhlenbergia porteri*), and curly leaf muhly (*M. setifolia*) are representatives of upland piedmonts and foothills along with shrubs such as lechuguilla (*Agave lechuguilla*), sotols (*Dasylirion spp.*), beargrasses (*Nolina spp*.), and Torrey's yucca (*Yucca torreyi*). This habitat also includes Madrean lower montane grasslands dominated by bullgrass (*Muhlenbergia emersleyi*) and New Mexico muhly (M. pauciflora). Grasslands on gypsiferous soils include gypsum grama (*Bouteloua breviseta*) and gyp dropseed (*Sporobolus nealleyi*), along with herbaceous gypsophiles such as Hartweg's sundrops (Calylophus hartwegii) and hairy crinklemat (*Tiquilia hispidissima*).
>
> Soils range from deep, fine-textured loams or clay loams (incipient mollisols) to sandy loams and also include rocky and shallow alluvial fans and hill slopes. Impermeable caliche and argillic horizons are common. Periodic fires are prevalent in some of these grasslands with 10 to 30 year, or longer, return intervals."]

Biodiversity in Chihuahuan Semi-Desert Grassland is influenced by habitat conversion factors and non-consumptive and consumptive resource use, including livestock grazing, fire suppression, and development. Altered fire regimes, resulting from both fire suppression and removal of fine fuels by livestock grazing and wildlife may have promoted the establishment of woody vegetation and introduced nonnative species. However, the extent to which fire occurred in southwestern grasslands varied geographically and is related to climatic variables such as elevation, slope, and aspect. The historic role of fire in desert grasslands is not fully understood. Recreational off-road vehicle use has also increased in the semi-desert grasslands, and may destroy and fragment wildlife habitats, cause direct wildlife mortality, and/or adversely modify wildlife behavior through stress and disturbance. Military maneuvers and infrastructure development may destroy or modify semi-arid grasslands. Although little is known about the extent of invasive species in Chihuahuan semi-desert grasslands, invasive species such as salt cedar (*Tamarix ramosissima*) are negatively impacting the biodiversity of the grassland ecosystems (NMDGF 2006; NMDGF 2016a).

This habitat type has been identified and prioritized for conservation by the World Wildlife Fund (Ricketts et al. 1999). Semi-desert grasslands are especially important to grassland bird populations, which have been declining over the last 50 years. Reptile collection and trade is also a factor that influences the viability of reptile populations in the Chihuahuan Desert Ecoregion. In the United States portion of the Ecoregion, approximately 120 reptile and amphibian species are subject to domestic and international trade. The impact of this factor has not been investigated and is poorly understood (NMDGF 2006; NMDGF 2016a).

Grasslands comprise approximately 22.6% of vegetation cover on HAFB. Four vegetation mapping units are dominated by four distinct grassland communities. These mapping units include: Gyp Dropseed Grassland, Alkali Sacaton Grassland, Gyp Grama Interdune Grassland, and Semi-Riparian Alkali Sacaton Grasslands. During migration and in winter, these grasslands are used by large numbers of birds, particularly sparrows, meadowlarks, and mourning doves (*Zenaida macroura*), but also raptors and other species.

Chihuahuan Desert Scrub

Chihuahuan Desert Shrub occurs in basins, outwash plains, low hills, and bajadas (Brown 1982). This habitat may be relatively secure and expanding as a result of desertification. Overgrazing in some grassland areas may allow invasion of shrubland species. Where shrubs and cacti dominate, grasses are sparse or patchy. It is difficult for fire to spread, especially in creosote-dominated areas.

According to NMDGF (2016a) Chihuahuan Desert Scrub [M086] habitat:

> [“is a moderate to sparse xeromorphic shrub community characterized by a sparse to dense tall shrub layer dominated or co-dominated by whitethorn acacia (*Acacia constricta*), viscid acacia (*A. neovernicosa*), tarbush, and creosote. Other species may include catclaw acacia (*A. greggii*), sand sagebrush (*Artemisia filifolia*), fourwing saltbush (*Atriplex canescens*), Torrey’s jointfir (*Ephedra torreyana*), longleaf jointfir (*E. trifurca*), ocotillo (*Fouquieria splendens*), cactus apple (*Opuntia engelmannii*), mariola (Parthenium incanum), soaptree yucca (*Yucca elata*), Torrey’s yucca (*Y. torreyi*), skeleton-leaf goldeneye (*Viguiera stenoloba*), and lechuguilla (*Agave lechuguilla*). Many stands of this habitat type lack an herbaceous understory layer and develop a pebbly desert pavement on the soil surface, sometimes with scattered grasses and forbs. If present, the understory is a sparse to moderately dense herbaceous layer dominated by grasses including black grama, bush muhly (*Muhlenbergia porteri*), curlyleaf muhly (*M. setifolia*), tobosagrass

(*Pleuraphis mutica*) burrograss (*Scleropogon brevifolius*), and mesa dropseed (*Sporobolus flexuosus*). Forb species often are present, but have low cover.

Stands of this habitat occur in broad desert basins and plains and extend up onto dissected gravelly alluvial fans, piedmonts (bajadas), and foothills. Substrates include coarse-textured loams on well-drained, gravelly plains, slopes with soils that are typically non-saline and calcareous, sandy plains, coppice dunes, and sand sheets. Soils are fine-textured (silts, clay loams, and clays), often saline, on alluvial flats and around playas, as well as in river floodplains. Stands can extend upslope on to colluvial slopes with cobbly skeletal soils. Drought is a relatively common occurrence in this desert scrub, generally occurring every 10 to 15 years and lasting two to three years, with occasional long-term drought periods (10 to 15 years duration)."]

<u>Duneland (natural)</u>

The duneland ecosystem on HAFB is composed of a mix of Great Plains Sand Grassland and Shrubland, Intermountain Saltbrush Shrubland, as well as barren dunes. A majority of this ecosystem is located in the north portion of the main base; west of the HSTT.

Great Plains Sand Grassland and Shrubland

According to NMDGF (2016a) the Great Plains Sand Grassland and Shrubland [M052] is:

["found in the High Plains and Tablelands ecoregion, and to lesser extent in the Southern Rocky Mountains and Chihuahuan Desert ecoregions, may occur as open grasslands to closed shrublands or a mix of the two. The most common dominant grasses are sand bluestem (*Andropogon hallii*), little bluestem, and sand dropseed. Shrublands are sparse to moderately dense and typically dominated or co-dominated by sand sagebrush (*Artemisia filifolia*) and sand shinnery oak (*Quercus havardii*). Invasive honey mesquite can be common, particularly in the southern portion of the range.

Stands of this habitat occur on well-drained, often deep, sandy to loamy sand soils on nearly flat terrain to vegetated dunelands. This habitat is particularly susceptible to wind erosion. Blowouts and sand draws are some of the unique, wind-driven disturbances in the sand prairies creating a complex matrix of microhabitats across the landscape."]

Intermountain Saltbrush Shrubland

NMDGF (2016a) characterizes the Intermountain Saltbush Shrubland [M093] as:

["an open to moderately dense cover of shrubs (<2 m (7 ft) tall) with a sparse herbaceous layer composed of perennial bunchgrasses. Dominant shrubs may include fourwing saltbush, shadscale saltbush (*Atriplex confertifolia*), cattle saltbush (*A. polycarpa*), and greasewood (*Sarcobatus vermiculatus*). Sometimes stands are codominated by big sagebrush, winterfat, or species of jointfir (*Ephedra spp.*) and wolfberries (*Lycium spp*.). Medium-tall and short perennial grasses include Indian ricegrass, blue grama, saltgrass (*Distichlis spicata*), needle and thread, western wheatgrass (*Pascopyrum smithii*), and alkali sacaton (*Sporobolus airoides*). Forb cover is generally sparse.

> Sites can be found on all aspects of valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Substrates are typically saline, alkaline, fine-textured soils developed from shale or alluvium. Infiltration rate is typically low. Soils are shallow to moderately deep, poorly developed, and the product of a semi-arid climate. Their surface often is very barren, and interspaces between the characteristic plant clusters are commonly covered by a microphytic crust."]

<u>Playa (natural)</u>

NMDGF (2016a) classifies playas as Ephemeral Catchments [EC]. According to NMDGF (2016a) EC's "are bodies of standing water formed in depressions, basins or in streams. A playa is an internally drained lake found in a sandy, salty, or muddy flat floor of an arid basin, usually occupied by shallow water only after prolonged heavy precipitation. Playas tend to be surrounded by Desert Alkali-Saline Wetland habitat (see below).

<u>Arroyo Riparian / Warm Desert Arroyo Riparian Scrub (natural)</u>

According to NMDGF (2016a) Warm Desert Arroyo Riparian Scrub [M092] habitat:

> ["is primarily an open shrubland habitat with patches of vegetation occurring within and along the edges of ephemeral desert washes, dissected piedmonts, mesas, plains, and basin floors. Desert willow (*Chilopsis linearis*), Apache plume (*Fallugia paradoxa*), and littleleaf sumac (*Rhus microphylla*) are the typical dominants, with singlewhorl burrobrush (*Hymenoclea monogyra*), catclaw acacia, little walnut (*Juglans microcarpa*), and splitleaf brickellbush (*Brickellia laciniata*) as common associates. The herbaceous layer is usually sparse with widely scattered grasses and forbs. This habitat is associated with flash flooding and rapid sheet and gully flows that scour channel bottoms. The vegetation is sparse from both the high impact of flooding and the lack of moisture for the rest of the year."]

<u>Wetland/Constructed Wetland in the Lake Holloman public access area (enhanced wetland system):</u>

HAFB contains both natural wetlands and an enhanced wetland system. The natural wetland habitat is the Desert Alkali-Saline Wetland [M082] habitat type, which according to NMDGF (2016a):

> ["is dominated by salt-tolerant shrubs such as iodinebush (*Allenrolfea occidentalis*), big sagebrush, and saltbush (*Atriplex spp*.). The understory and intershrub spaces can be sparse or dominated by graminoids such as saltgrass (*Distichlis spicata*), spikerush (*Eleocharis spp*.), rushes (*Juncus spp.*), pickleweeds (*Salicornia spp.*), greasewood, and alkali sacaton.
>
> This wetland type occurs near drainages or on stream terraces or flats and may form rings around drying ponds or playas. Soils are alkaline to saline (depending upon soil moisture), which greatly affects species composition. Sites also experience intermittent, seasonal, or semi permanent flooding, resulting in surface water retained into the growing season or throughout the year (except drought years). Sites that seasonally dry develop exposed mudflats, which are colonized by annual wetland vegetation."]

2.3.2 Vegetation

The following discussion describes both the historic and current state of vegetation at Holloman AFB*..*

2.3.2.1 Historic Vegetative Cover

Vegetation remains from fossil packrat and porcupine middens in the Sacramento and San Andres mountains have documented major changes in vegetative communities of these ranges during the last 18,000 years, including the last 12,000 years for which human occupation has been documented. At upper elevations the mixed conifer forest evolved into a juniper-oak woodland during the Early and Middle Holocene. The woodland shifted toward a grassland during the Late Holocene. At lower elevations the juniper-oak woodland evolved into a desert grassland during the Middle Holocene and to a Chihuahuan desert scrub by the Late Holocene.

Historical studies have demonstrated that grazing during approximately the past 150 years has accompanied a dramatic increase in desert scrub at the expense of grasslands. For example, using an analysis of historical records covering that time period Yanoff and Muldavin (2008) report shrubland invasion of 94% of their grazed sample units and an average decline of 90% in the extent of grassland patches spread across > 40,000 ha in the Jornada Basin, to the west of the Tularosa Basin. Pollen data also reflect the change from grassland to desert scrub over the course of the past century in the Hueco Bolson (Hall 1990), and research in the Mesilla Basin, south of Las Cruces, has illuminated the linked transition to scub land and a coppice dune landscape there (Langford 2000). Frederickson and colleagues (2006) suggest that the dramatic increase in mesquite scrub in particular is related to longer-term trends initiated by the extinction of the Pleistocene megafauna and, later, reduced human use of mesquite and the introduction of domestic livestock as a vector for seed dispersal following the arrival of Europeans.

2.3.2.2 Current Vegetative Cover

For the vegetation mapping on main base and the BWWSA portion of the BWWSA, it was assumed that non-random patterns of plant assemblages repeat across the landscape in response to similar environments (Silvertown and Wilson 1994; Dick-Peddie 1993). These assemblages may contain similar species and can be grouped into a category or type called a vegetation classification (Dick-Peddie 1993). The vegetation classification used to map HAFB (Muldavin et al. 1997) is based on a hierarchically organized system developed by NHNM and corresponds to the USFWS GAP analysis classification (Muldavin and Mehlhop 1996). The classification draws on the UNESCO Framework (Driscoll et al. 1984) and the National Vegetation Classification Standard approved by the Federal Geographic Data Committee (FGDC Vegetation Subcommittee), as well as other classifications from the Southwest (Donart et al. 1978, Dick-Peddie 1993).

A study was conducted in 1996 to document the floristic diversity on the main base. The survey data were collected from April to May 1997 and included community type, floristic inventory (% cover), landform, soil surface characteristics, aspect, slope, elevation, and brief descriptive comments. Two hundred and one plant specimens were collected and vouchered for the HAFB herbarium collection. A database was developed that includes voucher number, scientific and common name, location, elevation, types of habitat, frequency of occurrence, soil unit, and field notes. Over 110 species were identified during the collection period. Some annuals and forbs may have been missed because collections did not cover the spring growing season and were collected in only one year.

An innovative methodology was used to integrate field data and remotely sensed data to map vegetation at HAFB main base and the BWWSA (Muldavin et al. 1997). Field data plots were geographically referenced using global positioning units taken in relatively homogeneous stands, representing all community types found within the base. In addition, the geographic extent of community types represented by field plots was placed on field maps. These data were used in an iterative, computer process to model community types based on spectral data. A supervised classification was run on the merged images, resulting in a vegetation classification composed of community types. These community types were then aggregated into mapping units.

Mapping units include man-made features and other non-vegetated surfaces as well as groups of floristically similar community types. Twenty-four map units were defined for the main base and the BWWSA. Twenty-two of these map units are included within the main base and seven map units are within the BWWSA (Figure 2.3.2.2-1. Vegetation Map of Main Base and Figure 2.3.2.2-2. Vegetation Map of BWWSA). In 2004 to 2005, the vegetation communities on the remaining sections of the BWWSA (Douglas, San Andres, Frenchy and Escondido Wellsfields) were mapped (Muldavin et al. 2006) (Figure 2.3.2.2-3. Vegetation Map of Southern Portion of BWWSA).

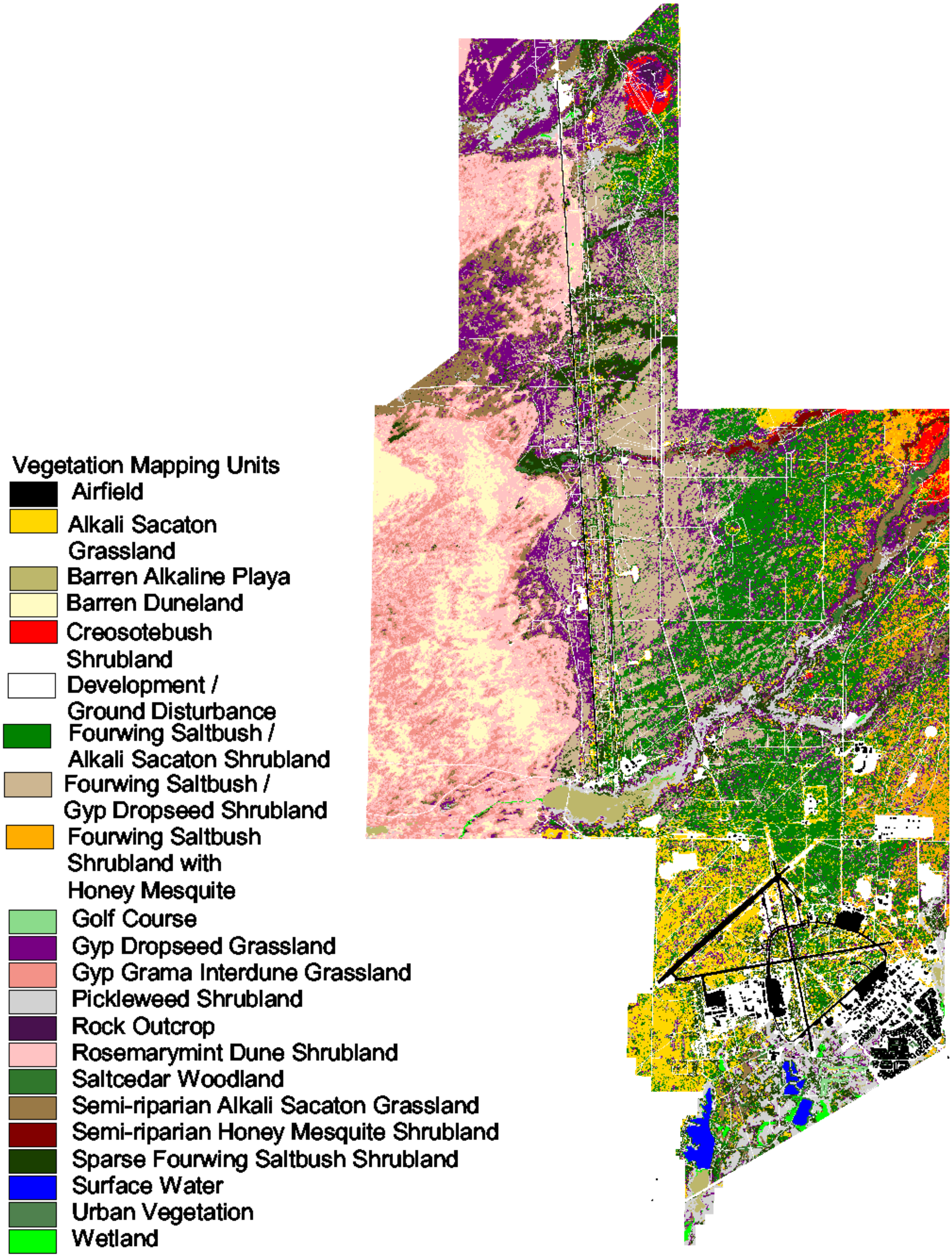


Figure 2.3.2.2-1. Vegetation Map of Main Base (Muldavin et al. 1997)

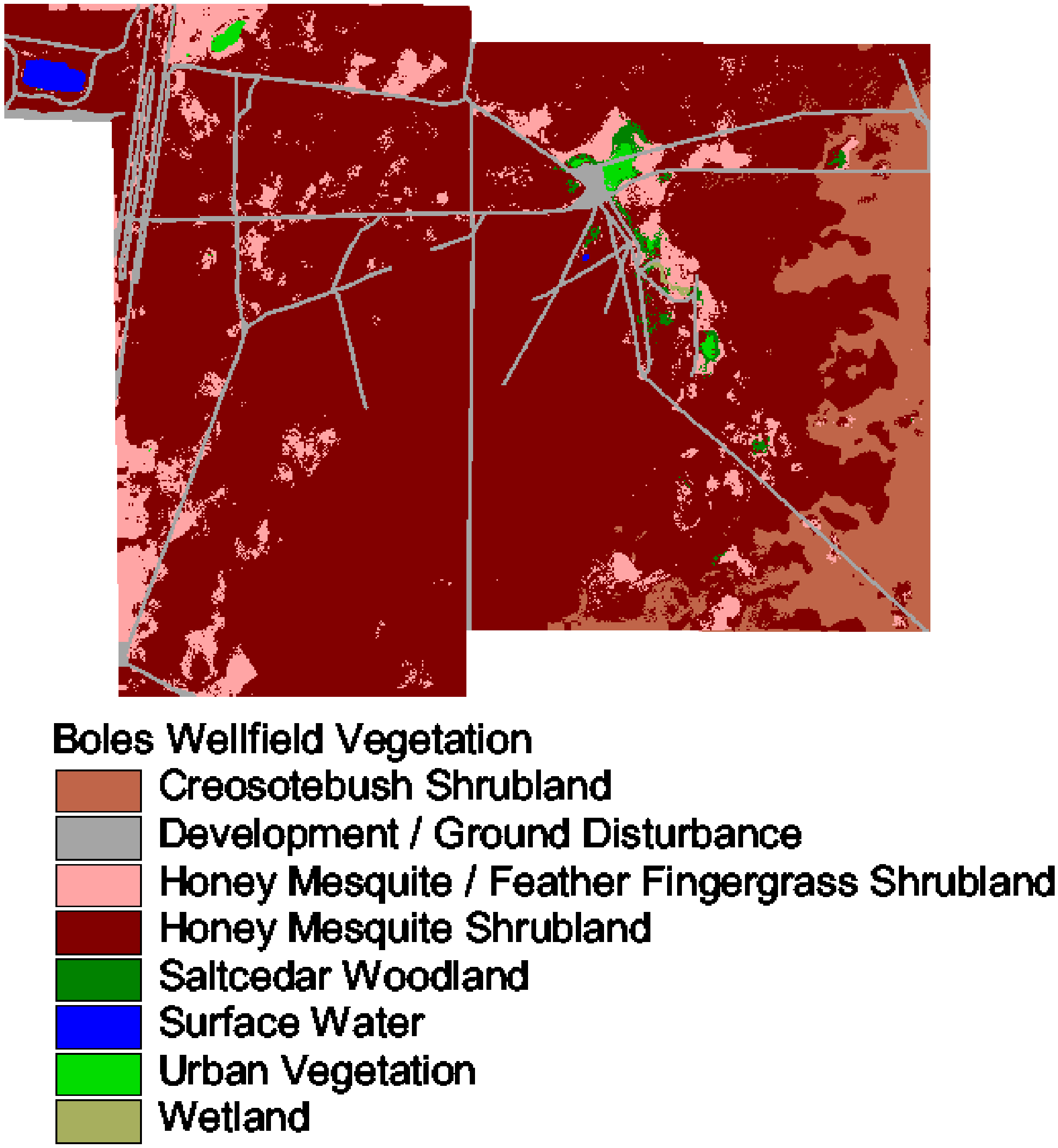


Figure 2.3.2.2-2. Vegetation Map of BWWSA (Muldavin et al. 1997)

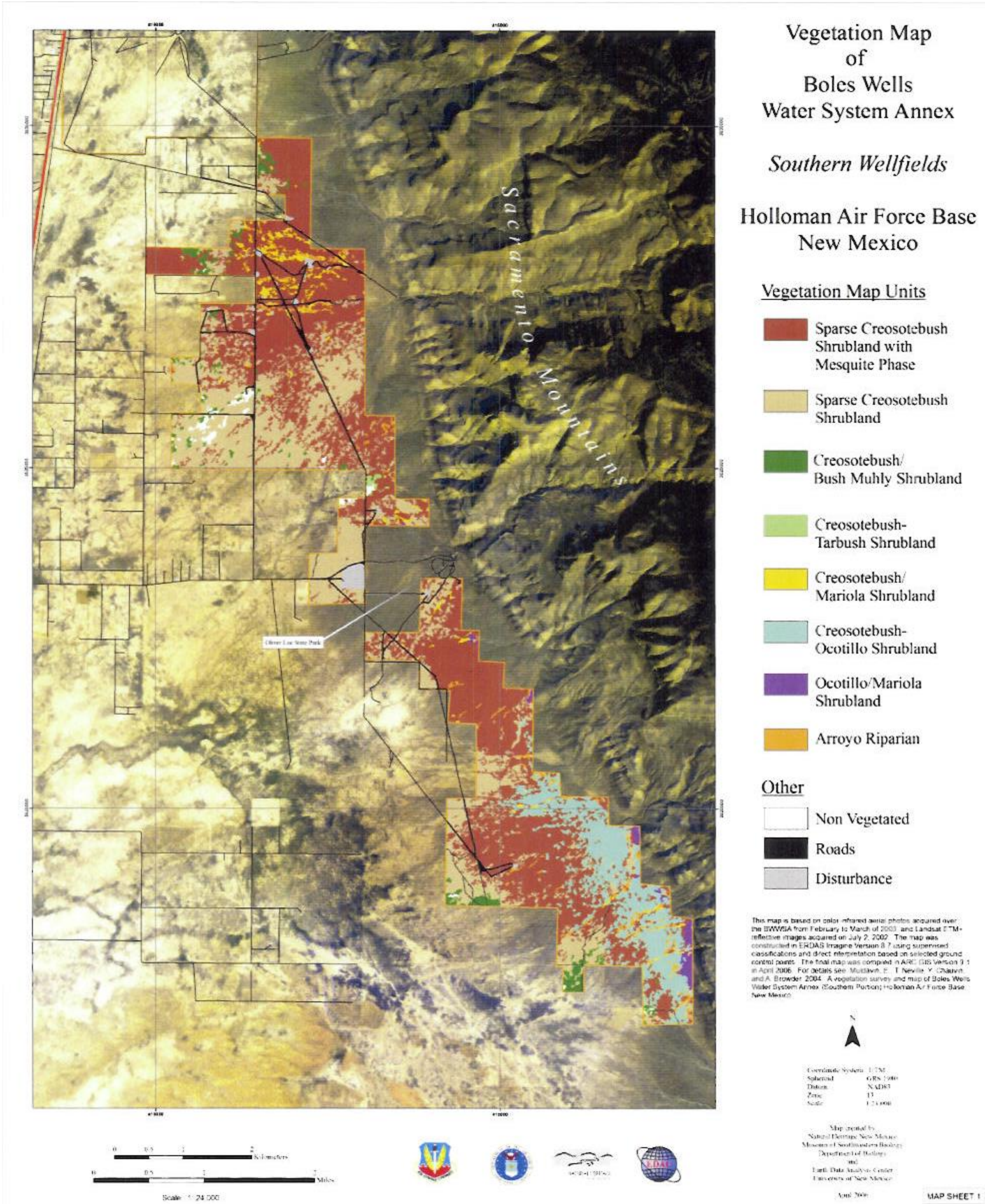


Figure 2.3.2.2-3. Vegetation Map of Southern Portion of BWWSA

Vegetation Types on the HAFB Main Base and BWWSA

HAFB is dominated by xerophytic shrubland and grassland communities having plant assemblages biogeographically related to the Chihuahuan Desert and Great Basin.

Percent of total area covered by vegetation mapping unit within each ecosystem for the main base and the BWWSA are included in the Table Percent of Total Area Represented by Each Ecosystem Type. Upland Ecosystem vegetation types dominate both the main base and the BWWSA.

Percent of Total Area Represented by Each Ecosystem Type

Ecosystem Type (%)						
	Upland	Duneland	Arroyo-Riparian	Playa	Wetland/ Constructed Wetland	Misc
Main Base	45	33	6	4	1	11
BWWSA	94	0.00	<1	0.00	<1	6

Cantonment: The Cantonment area contains the greatest total number of acres and continuous extent of alkali sacaton grasslands within HAFB. These grasslands:

- Cover 24% of the area and are characterized by moderately dense grasslands within basin bottom alluvial flats (Muldavin et al. 1998)
- Dominate the area west of Runway 16-34 up to Douglas Road and extend into WSMR (see Figure 2.3.2.2-4 Cantonment Area Vegetation Mapping Units)
- Nearly comparable in size to the most extensive alkali sacaton grassland within the Tularosa Basin, located on the alluvial flats of the Mockingbird Mountains within WSMR
- In the Northern Jornada on WSMR also follow margins of a gypsum outcrop. Within the Chihuahuan Desert and Great Basin biomes, alkali sacaton grasslands occur in lowlands and swales, typically in depositional silts or clay soils (Muldavin et al. 1997).
- Probably formed at a time when intermittent flows deposited silts and increased the development of clays, as Dillard Draw emptied into a series of playas and lowland swales

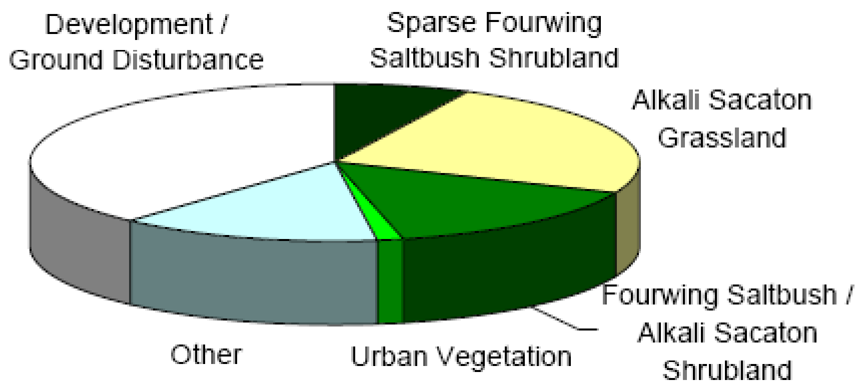


Figure 2.3.2.2-4. Cantonment Area Vegetation Mapping Units

Shrublands dominated by fourwing saltbush cover approximately one-quarter of the Cantonment area. The mapping units include Fourwing Saltbush/Alkali Sacaton (15%), Sparse Four-wing Saltbush (7%), Fourwing Saltbush/Gyp Dropseed (2%) and Fourwing Saltbush with Honey Mesquite (2%). Fourwing saltbush/alkali sacaton, with inclusions of alkali sacaton grassland, dominates the landscape east of Runway 16-34. Further east, this community grades into semi-coppicing honey mesquite/alkali sacaton communities. Sparse Four-wing Saltbush is associated with highly disturbed areas and is concentrated near the airfield. This community is also associated with pickleweed shrublands within playas formerly part of the Dillard Draw desert riparian system.

Pickleweed Shrubland and Gyp Dropseed Grassland make up the majority of the ‘Other’ category within the Cantonment (Figure 2.3.2.2-4. Cantonment Area Vegetation Mapping Units). Pickleweed Shrubland includes three plant communities: pickleweed/sparse, pickleweed-Mojave sea blite, and pickleweed/alkali sacaton. In 1939, Grazing Service inspectors noted only minor encroachments of pickleweed within the wide draws that dissect HAFB (Hawthorne-Tagg 1997). These shrublands have increased within the draws in recent history (Hawthorne-Tagg 1997), due in part to more xeric conditions created by altering the natural flow of Dillard Draw. Near these communities, small occurrences of gyp dropseed-alkali sacaton or fourwing saltbush/gyp dropseed occur at the margins of the playas and raised surfaces. Urban vegetation and the golf course make up nearly 2% of the land cover. Both urban vegetation and the golf course are comprised of nonnative species that require large inputs of energy, chemicals, and water to maintain, except where xeriscaping has been established.

<u>Duneland Area</u>: Five principal vegetation mapping units comprise the majority of the vegetation communities found within this area (Figure 2.3.2.2-5. Duneland Area Vegetation Mapping Units). These include Rosemary mint Dune Shrubland (40%), Barren Duneland (16%), Gyp Grama Interdune Grassland (15%), Gyp Dropseed Grassland (11%), and Semi-riparian Alkali Sacaton Grassland (10%). Mapping units less than seven acres are combined into the ‘other’ category.

These mapping units contain specific plant associations that occur predominantly within the Duneland Ecosystem. The Rosemary mint Dune Shrubland occurs on slopes and summits of shifting and semi-stabilized gypsum dunes. Two community types dominate this mapping unit: the Hoary Rosemary mint/Sandhill Muhly (*Poliomintha incana*/*Muhlenbergia pungens*) community type and the Hoary

Rosemary mint/Mesa Dropseed (Poliomintha incana/Sporobolus flexuosus) community type. These community types include other scattered shrubs such as soaptree yucca (*Yucca elata*), Torrey's jointfir (*Ephedra torreyana*) and skunkbush sumac (*Rhus trilobata*). Grasses are sparse, scattered, and dominated by sandhill muhly and mesa dropseed, with giant dropseed (*Sporobolus giganteus*) occurring near the duneland edges. Barren Duneland mapping unit contains non-vegetated, shifting gypsum dunes that may have inclusions of hoary rosemary mint/sandhill muhly on semi-stabilized portions of the dune field. Within the interdune, swale grasses, small shrubs (sub-shrubs), and forbs create a high diversity mosaic of gypsum-tolerant plants. The major community types are gyp grama (*Bouteloua breviseta*) associated with either New Mexico little bluestem (*Schizachyrium scoparium ssp. neomexicanum*) or hairy coldenia (*Tiquilia hispidissima*) and small inclusions of gyp dropseed (*Sporobolus nealleyi*) with hairy coldenia occurring along the duneland periphery.

The Gyp Dropseed Grassland mapping unit borders the dunelands in a long narrow band and extends to broader regions at the far northwest corner of the base. These regions at the dune periphery are characterized by three community types: gyp dropseed/hairy coldenia or gyp dropseed-alkali sacaton with inclusions of fourwing saltbush/gyp dropseed. At the margins of the dunes in lowland swales, the periodically-flooded Semi-riparian Alkali Sacaton Grassland mapping unit occurs on very alkaline, gypsic crusts. These low-lying depressions between dunes trap runoff, creating floristically dense communities dominated by alkali sacaton/James' sea heath.

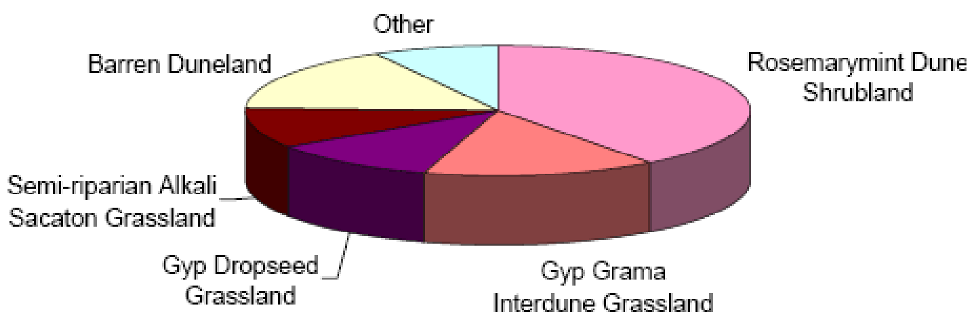


Figure 2.3.2.2-5. Duneland Area Vegetation Mapping Units

<u>High Speed Test Track Area</u>: Although the HSTT and northern shrub-grasslands area north of Douglas Road are dominated by the same soil unit, differences in the vegetation communities between these units suggest some level of soil differences as it affects the vegetation. The HSTT area is dominated by Fourwing Saltbush/Gyp Dropseed Shrubland, while the dominated by Fourwing Saltbush/Alkali Sacaton Shrubland. Both the HSTT and northern shrub-grassland areas contain approximately 15% Gyp Dropseed Grassland. A more detailed soil survey of these areas would help define the soil properties that support one community over another and help explain the spatial distributions of the dominant plant communities.

Typically, gypsic environments are small outcrops that are widely distributed in southern New Mexico to Texas but are disjunct and appear as 'islands' among a vast landscape of more broadly distributed soil substrates (Hicks and Whitcomb 1996). In contrast, Holloman gypsic conditions are derived from eolian materials that create a gypsum crust over sedimentary soils. Plant communities on the gypsic environments that are widespread on HAFB also exist on these gypsic islands in Texas. These dominant plant communities are: fourwing saltbush/gyp dropseed, gyp dropseed/hairy coldenia, and gyp dropseed-alkali sacaton, which cover over 50% of the area adjacent to the HSTT (Figure 2.3.2.2-6. Test Track Area Vegetation). Another 24% include alkaline-tolerant plant communities such as fourwing saltbush/sparse and fourwing saltbush/alkali sacaton. Other communities cover less than 3%. Development and other disturbance related primarily to HSTT activities encompass over 10% of this area (Muldavin et al. 1998).

Shrublands dominate the HSTT area. Fourwing saltbush/gyp dropseed, the most common type, occupies swales and basin bottom flats in a mildly undulating surface, often between mounds hardened by gypsic crusts dominated by gyp dropseed/hairy coldenia (Figure 12. Test Track Area Vegetation). Other common shrub associates of fourwing saltbush/gyp dropseed communities include: desert Christmas cactus (*Opuntia leptocaulis*), kingcup cactus (*Echinocereus triglochidiatus*), and Berlandier's wolfberry (*Lycium berlandieri*). Fourwing Saltbush/Alkali Sacaton Shrubland and Alkali Sacaton Grassland mapping units occur within the upland regions bounded on the south by Sheep Camp Draw and the north by Guilez Draw near the northern extent of the HSTT. Common associates of fourwing saltbush/alkali sacaton are tulip and purple pricklypear (*Opuntia phaeacantha* and *O. macrantha*) and crucifix thorn (*Koeberlinia spinosa*). This area between the draws transitions between Great Basin Shrublands and Chihuahuan Desert Scrub. Within the northern extent of the area, Creosote bush Shrubland occurs on the piedmont and alluviated surfaces of Tularosa Peak. The Creosote bush Shrubland is either sparse or dominated by an understory of alkali sacaton grasslands. Sub-shrubs such as hairy coldenia and snakeweed may be present.

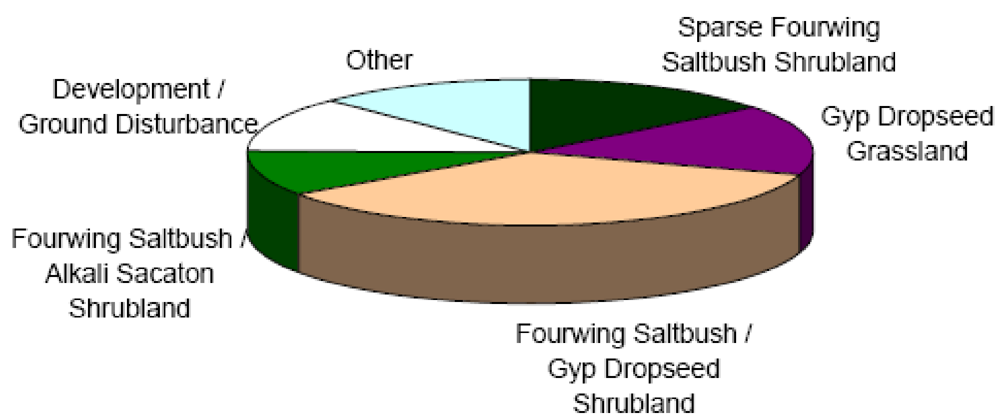


Figure 2.3.2.2-6. Test Track Area Vegetation

<u>Arroyo Riparian Ecosystems on Main Base Interspersed Through Other Vegetation Types</u>: The Arroyo Riparian Ecosystem is integral to desert processes. It contains and connects elements that affect the flow of energy, material, and species through the landscape (Malanson 1993). The plant composition of the arroyo has high potential for flux considering the disturbances caused by seasonal flooding. Three of the pervasive vegetation mapping units represented within the draws include Pickleweed Shrubland, Semi-riparian Alkali Sacaton Grassland, and Salt cedar Woodland. Occasional wetland plants such as inland saltgrass and Mojave seablite are distributed within the reaches of the draw that receive more permanent ponding or may be situated closer to a high water table. Pickleweed often occurs with fourwing saltbush within the playa-like reaches of the arroyos. There is anecdotal evidence indicating that pickleweed was less prolific than it is today (Hawthorne-Tagg 1997). Local extinction of some native plants and an increase of more xeric plants may have occurred due to historic overgrazing (Trammell 1995). Changes in plant communities and structure may also have affected native wildlife composition. Because the arroyos

receive intermittent seasonal flows, the size, density, and structure of semi-riparian alkali sacaton communities are larger and denser than adjacent upland communities of alkali sacaton.

Mixed Shrub-Grasslands North of Douglas Road: This area is dominated by shrubland communities (61%) with extensive patches of grassland communities (20%). Base development, disturbance, and roads cover about 8% of the area with the remaining communities associated with riparian habitat within the draws (10%) or rock outcrops on Tularosa Peak (1%).

Fourwing Saltbush/Alkali Sacaton Shrubland covers an extensive area within the central portion of the base (Figure 2.3.2.2-7. Mixed Shrub-Grasslands Vegetation Mapping Units). This mapping unit is widespread within the Tularosa Basin and is characterized by open canopies of fourwing saltbush with well-developed understories dominated by alkali sacaton (Muldavin et al. 1998). Adjacent to this vegetation mapping unit, fourwing saltbush forms an association with other plants. This may be due to the varying quantities of gypsum in the soils. Although the soil classification does not identify this change, these plant associations are good indicators of soil differences. Westward toward the dunes, the Fourwing Saltbush/Gyp Dropseed Shrubland mapping unit dominates and may have inclusions of gyp dropseed/hairy coldenia and gyp dropseed-alkali sacaton communities (Muldavin et al. 1998). This mapping unit contains more cryptogamic cover than all other community types. In addition, these northern grasslands and the Test Track area combined account for 93% of the total geographic distribution of this vegetation mapping unit. The easternmost shrublands are dominated by Fourwing Saltbush Shrubland with Honey Mesquite. The major community type for this mapping unit is fourwing saltbush/alkali sacaton with scattered honey mesquite throughout, as well as inclusions of honey mesquite/alkali sacaton communities. These communities lack a significant fourwing saltbush component. Two disjunct sites of alkali sacaton/monotypic with scattered honey mesquite are located at the far northeast corner of Malone Draw and west of Dillard Draw near Douglas Road. Creosote Shrubland, although only a small component of this area (less than 2%), is found at higher elevations at the base of Tularosa Peak and on a short rise between upper Malone Draw and Carter Draw. Covering the limestone outcrops are high densities of claret cup cactus (Echinocereus triglochidiatus). Claret cup cactus has a broad range from west Texas through central New Mexico and into northwestern Arizona and Colorado.

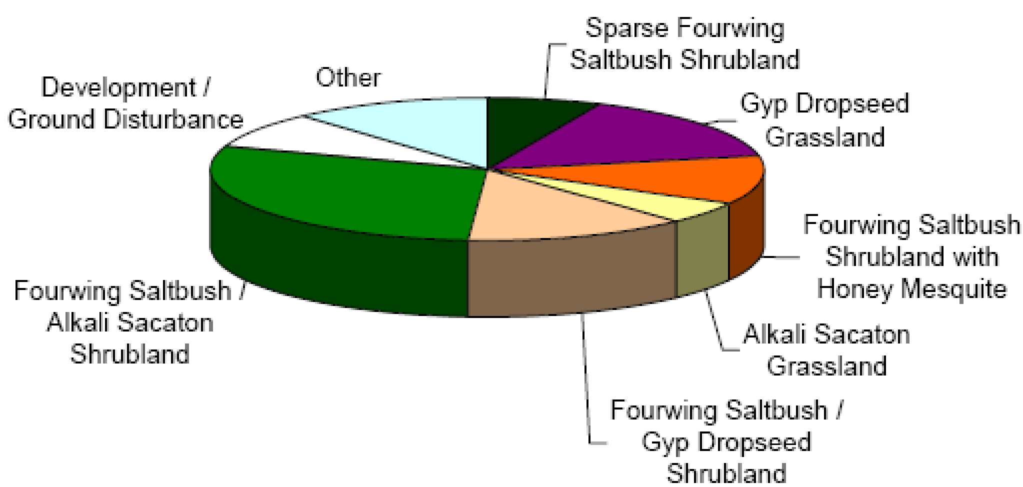


Figure 2.3.2.2-7. Mixed Shrub-Grasslands Vegetation Mapping Units

Although shrublands dominate this area, patches and inclusions of grasslands add to the structural diversity of the area, providing variation in habitat types that increase biodiversity. The two principal upland grassland mapping units are Gyp Dropseed Grassland and Alkali Sacaton Grassland. Gyp dropseed/hairy coldenia community types within this management unit commonly occur in linear bands along the upland edges of the drainages and on gypsum mounds (outcrops) that form on the northeast trending raised surfaces (Muldavin et al. 1998). Inclusions of fourwing saltbush/gyp dropseed communities may occur within the mapping unit and are also are associated in nearby patches. Gyp dropseed-alkali sacaton communities are also included within this mapping unit. Alkali Sacaton Grassland mapping unit is comprised of monotypic alkali sacaton communities at densities varying from open to moderate and may include scattered fourwing saltbush. A large area of this grassland lies north of Hay Draw in the northeast corner of the base. These grasslands are often surrounded by fourwing saltbush/alkali sacaton communities.

The drainages within this area are dominated by Arroyo Riparian Ecosystem species (over 4%), including Semi-riparian Alkali Sacaton Grassland, Semi-riparian Honey Mesquite Shrubland, and Salt cedar Woodland. Pickleweed Shrubland has increased within the more playa-like depressions within Lost River, Malone Draw, Ritas Draw and at the confluence of Carter and upper Malone Draw (almost 4%). Semi-riparian Alkali Sacaton Grasslands are dense monotypic grasslands throughout the more mesic reaches of the drainages; however, near the dune periphery alkali sacaton/James' sea heath communities tend to increase. Semi-riparian Honey Mesquite Shrubland contains open-to-closed stands of honey mesquite with dense understories of alkali sacaton. These shrublands are principally located within Hay Draw. Salt cedar Woodland may have sparse to moderate understories of alkali sacaton or saltgrass and occasionally be associated with fourwing saltbush or Mojave sea blite (*Suaeda moquinii*). These woodlands can have open or closed canopies and are located predominantly within the Malone Draw complex of drainages that include Lost River, Carter Draw, and Ritas Draw. These areas were treated with herbicides in September 2006, potentially decreasing their densities and distribution once the herbicide and associated prescribed burning treatments are completed.

<u>Lake Holloman Public Access Area Wetland Complex</u>: Fluctuating water levels, topographic variation, and proximity to military facilities have resulted in a diverse mix of natural and introduced vegetation types at the Lake Holloman wetland complex area. The Playa and Upland Ecosystem each contribute to approximately 30% of cover types, followed by Constructed Wetland with 16% (Figure 2.3.2.2-8. Lake Holloman Public Access Area Wetlands Complex Vegetation Mapping Units). Arroyo Riparian Ecosystem, including salt cedar woodlands, cover 11% of the area. Development and disturbance cover 8%, and the remaining variation is gyp dropseed grasslands.

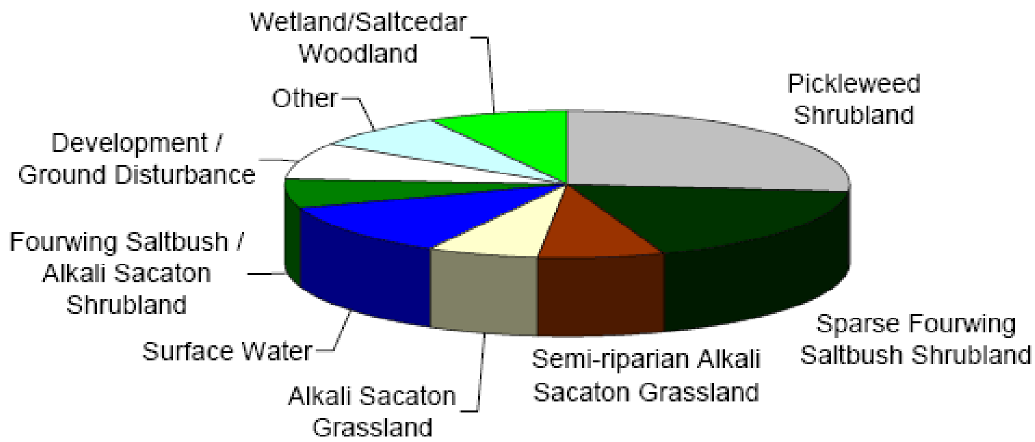


Figure 2.3.2.2-8. Lake Holloman Public Access Area Wetlands Complex Vegetation Mapping Units

The Playa Ecosystem represented in this mixed wetland/upland area includes the vegetation mapping units of Pickleweed Shrubland and Barren Alkaline Playa. The distribution of Pickleweed Shrubland, which contains the community types of pickleweed/sparse, pickleweed-Mojave sea blite, and pickleweed/alkali sacaton, is an indicator of lowland depressions and periodically flooded areas (Figure Lake Holloman Public Access Area Wetlands Complex Vegetation Mapping Units). Most of these vegetation communities and barren alkaline playas are now included within the constructed wetland complex and comprise the majority of cover types in the disjunct section south of US Highway 70.

Vegetation mapping units represented in the Upland Ecosystem type are: Alkali Sacaton Grassland, Fourwing Saltbush/Alkali Sacaton Shrubland, and Sparse Fourwing Saltbush Shrubland. The major community types included within these mapping units are: fourwing saltbush/alkali sacaton, fourwing saltbush/sparse, and alkali sacaton/monotypic. These communities occur within both upland and lowland depressions and are distributed east of Lake Holloman, north of the constructed wetlands, often surrounding lowland playas. Arroyo Riparian Ecosystem types include Semi-riparian Alkali Sacaton Grasslands and Salt cedar Woodland mapping units. Salt cedar woodlands surround Lake Holloman and Lagoon G and line ditches at the constructed wetland. The Constructed Wetland Ecosystem includes the Wetland mapping unit that occurs at the fringes of Lake Holloman, Stinky Playa, and Lagoon G (Figure Lake Holloman Public Access Area Wetlands Complex Vegetation Mapping Units). Other wetland sites, near Lagoon G and the constructed wetland control structures, have been enhanced due to diversion and channelization of stormwater drainages (USAF 1996a). The dominant Wetland Ecosystem community type is inland saltgrass/monotypic and may also include spreading alkali weed (*Cressa truxillensis*), Mojave seablite, alkali bulrush (*Scirpus maritimus*), seep willow (*Baccharis salicifolia*), smooth [desert] seepweed (*Suaweda suffrutescens*), and TransPecos sealavender (*Limonium limbatum*) (Figure 2.3.2.2-8. Lake Holloman Public Access Area Wetlands Complex Vegetation Mapping Units).

BWWSA (BWWSA): With respect to the general vegetation of the BWWSA, the site sits within Chihuahuan Desert Scrub as defined by Brown et al. (1998) and mapped by Brown and Lowe (1980). The scrub shrub vegetation is dominated by creosote bush (*Larrea tridentate*), honey mesquite (*Prosopis glandulosa*), mariola (*Parthenium incanum*), and ocotillo (*Fouquieria spendens*). The upper elevations lie at the cusp with Chihuahuan Semi-desert Grasslands and support grassland elements such as black grama (*Bouteloua eriopoda*) and bush muhly (*Muhlenbergia porteri*) (Muldavin et al. 2006; Figure 2.3.2.2-8. Vegetation Map of BWWSA).

Honey Mesquite Shrubland is the dominant vegetation cover in the BWWSA, the northernmost wellfield of the BWWSA, comprising over 75% of the total vegetation cover. This shrubland is dominated by honey mesquite, but it may include other broad-leaf Chihuahuan Scrub, such as fourwing saltbush, tarbush, and lotebush (*Ziziphus obtusifolia*). This sparse shrubland is generally devoid of grasses, or grasses may be very scattered (Muldavin et al. 1998). This vegetation type is ubiquitous in the BWWSA lower alluvial and basin flats. Honey Mesquite/Feather Fingergrass Shrubland occurs in shallow swales and drainages and covers 7% of vegetation cover within this wellfield. Feather Fingergrass (*Chloris virgata*) exists within the understory of the honey mesquite, sometimes with scattered clumps of alkali sacaton (Muldavin et al. 1998) and is quick to colonize disturbed areas. Creosote bush Shrubland covers almost 10% of the area and occurs on the Largo-Ogral soil complex on the upper alluvial. The understory of this shrubland is typically sparse and may contain scattered occurrences of black grama (*Bouteloua eriopoda*) or mariola (*Parthenium incanum*). Several roads, buildings, and dump sites account for over 5% of surface cover. Urban vegetation, salt cedar, surface water, and wetlands make up less than 1% of the area.

<u>BWWSA San Andres, Frenchy, Douglas and Escondido Wellfields</u>: Surveys of the San Andres, Frenchy, Douglas, and Escondido Wellfields to the south of the BWWSA were conducted in 2004 to 2005. Ten plant associations were identified for these areas. The vegetation is dominated by the Chihuahuan Desert Shrub type with ocotillo and mariola shrublands.

The creosote bush communities are generally distributed along a topographic gradient occurring near the foot of the alluvial fan piedmont bajada and in some areas extending onto the basin floor. In the Creosote bush-Tarbush Sparse plant association the canopy reaches 40% cover with creosote bush and tarbush as codominants. The understory is typically sparse, with scattered forbs and grasses. The Creosote bush/Bush Muhly plant association has a grassy ground cover dominated by bush muhly with up to 50% ground cover. Further upslope onto the mid-portion of the bajada, the Creosote bush/Sparse Shrublands plant association tends to dominate, with or without honey mesquite as a codominant. Shrub canopies can range from 40% to 60%, with few or absent grass or forb plants and exposed soils or gravel desert pavements in the intershrub spaces.

Interspersed with this association is Creosote bush/Mariola Shrubland, which is more diverse and characterized by the subshrub mariola distributed in the intershrub spaces along with broom snakeweed and various mixtures of cacti. This plant association is typically found on rockier sites and becomes more prevalent near the top of the bajada, where it is found in a complex mosaic with Creosote bush/Ocotillo and Ocotillo-Mariola Shrubland plant associations. These plant associations can be quite diverse, particularly in respect to cacti, and the area of the upper bajada and lower mountain footslopes form what is locally referred to as a 'cactus belt.' Cacti can include *Opuntia engelmannii*, *O. macrocentra*, and *O. leptocaulis*, *Echinocereus dasyacanthus*, *E. stramineus*, and *E. horizonthalonius*, *Escorbaria* spp., and. Along with the ocotillo, conspicuous Torrey's yucca (*Yucca torreyi*) dot the landscape and tend to define the limits of the cactus belt.

The arroyo riparian communities include the Desert Willow Shrubland/Apache plume Shrubland, Skeleton-leaf Goldeneye-TransPecos Poreleaf Shrubland, and Mariola Shrubland. These are also highly diverse, particularly in the shrub layer. Besides the dominants, such as desert willow or skeleton-leaf goldeneye, the arroyos also support Wright's beebush (*Aloysia wrightii*), fourwing saltbush (*Atriplex canescens*), splitleaf brickellbush (*Brickellia laciniata*), littleleaf sumac (*Rhus microphylla*) and tarbush. Mixed in with the shrubs can be up to 20 species of grass and forbs. The complex structure and diversity of these communities adds heterogeneity to the landscape beyond what their limited aerial coverage suggests. The relatively mesic environments and vertical structural complexity likely provide key habitats for wildlife, particularly birds (Muldavin et al. 2006; Figure Vegetation Map of Southern Portion of BWWSA).

<u>GSUs</u>: The Red Rio Bombing Range is a topographically complex area that supports a high diversity of plant community types. Temperate montane shrublands cover the steep to moderate western and southern slopes of the Oscura range and nearby cuestas. Plant communities included in this map unit are mountain mahogany (*Cercocarpus montanus*), usually with grassy undergrowth of either sideoats grama (*Bouteloua curtipendula*) or blue grama, and shrub live oak (*Quercus turbinella*), with either blue grama or black grama grasslands. Gently dipping slopes and platform summits at higher elevations within the Oscura range and nearby cuestas with northerly aspects are dominated by pinyon pine (*Pinus edulis*) woodlands. Community types most often encountered within this mapping unit are pinyon pine/Scribner's needlegrass (*Stipa scribneri*), or pinyon pine/wavyleaf oak (*Quercus undulata*). Juniper woodlands occur on drier, east-facing slopes of the Oscura range and Chupadera Mesa. One-seed juniper (*Juniperus monosperma*) is found with either New Mexico needlegrass (*Stipa neomexicana*), curlyleaf muhly (*Muhlenbergia setifolia*), or blue grama grasslands. Foothill montane grasslands largely dominated by blue grama or New Mexico needlegrass cover the foothill slopes of the mountain-valley fans, particularly the northern Red Canyon Valley. Gypsum outcrops of the Yeso Formation at the western extent of Chupadera Mesa are largely populated with gyp dropseed/hairy coldenia foothill grasslands. Mixed foothill-piedmont grasslands occur at mid-to low-elevation slopes, foothills, and upper alluvial fan piedmonts and alternate with mixed lowland desert scrub. Grama grasses, creosote bush (*Larrea tridentata*) and fourwing saltbush (*Atriplex canescens*) populate these areas in the southern portion of Red Rio Bombing Range (Muldavin et al. 1997).

Representative vegetation mapping units within the Oscura Bombing Range are Mixed Foothill-Piedmont Desert Grasslands, Creosote bush Shrubland, Mixed Lowland Desert Scrub, Fourwing Saltbush Shrubland, Lowland Basin Grasslands, and Malpais Lava Scrub (Muldavin et al. 1997). Mixed Foothill-Piedmont Desert Grasslands found within this mapping unit occur within the northern extent of the range of the Oscura Mountain foothills and on the upper piedmont of the Phillips Hills. Major community types encountered in this range map unit are black grama-blue grama, black grama-sideoats grama, and black grama-purple threeawn (*B. eriopoda-Aristida purpurea*). Continuing further downslope onto alluvial fan piedmonts, Creosote bush Shrublands and other Lowland Desert Scrub are prominent. Creosote bush-mariola communities cover rocky surfaces, while more gravelly surfaces will have creosote bush/bush muhly (*L. tridentata/Muhlenbergia porteri*) or creosote bush/alkali sacaton (*L. tridentata/Sporobolus airoides*) communities. Tarbush (*Flourensia cernua*) and honey mesquite inclusions are found within the creosote bush shrublands and often at lower elevations within the alluvial plains or within drainages. Fourwing Saltbush Shrublands, dominated in this area by fourwing saltbush/alkali sacaton communities, occur on silty and clayey alluvial flats west of the lava flows adjacent to drainages. Within swales or broad drainages

Lowland Basin Grasslands contain nearly monotypic stands of alkali sacaton or tobosa grass-alkali sacaton (*Hilaria mutica-Sporobolus airoides*) communities. Malpais Lava Scrub includes a high diversity of shrub and grass species, including creosote bush, honey mesquite, Wright's beebrush and tarbush, along with black grama, sideoats grama, bush muhly, threeawn, and assorted annual forbs and grasses (Muldavin et al. 1997).

2.3.2.3 Turf and Landscaped Areas

Landscaping at HAFB is accomplished through the use of native plants. The use of native plants adapted to the arid Chihuahuan Desert Ecosystem has many benefits. Native plants are hardy because they have adapted to local conditions, the dry environment, and poorer soils. Once established, native plants do not need pesticides or fertilizers and require little or no mowing or watering. Native landscapes, including lawns of native, warm season grasses, do not need to be mowed, reducing both effort and air emissions. Application of pesticides may kill beneficial insects. Eliminating the use of pesticides and fertilizers prevents these pollutants from running into wetlands and groundwater. Landscaping with native wildflowers, shrubs, trees, groundcovers, and grasses provides habitat for native mammals, birds, reptiles, and insects, thus enhancing the biodiversity of the area. Environmentally sound landscaping practices restore beneficial soil bacteria, earthworms, and most importantly, mycorrhizae, which are soil fungi that plants need to derive nutrients and moisture from lean, dry soils. Standard practices that use herbicides, pesticides, and fertilizers destroy these below-ground organisms. The beauty of native wildflowers and grasses creates a sense of place, both at home and work. The native plants increase our connection to nature, help educate our neighbors, and provide a beautiful, peaceful place to relax.

2.3.3 Fish and Wildlife

Descriptions of Terrestrial Fauna

Considering its relatively small size, HAFB provides a large diversity of habitats for aquatic and terrestrial species. Throughout the Tularosa Basin, suitable wildlife habitat is limited, due to ranching, farming, and urban and rural development. Within this patchwork, wildlife is typically left to survive in increasingly smaller pockets of native habitat further fragmented by roads and fences. Because larger areas can accommodate natural or anthropogenic disturbances easier than small, fragmented landscapes (Leslie et al. 1996), a regional perspective and approach are used in the management of wildlife on HAFB. Particular species are considered in more detail under their respective sections.

Little work has been done to reconstruct some of the faunal history of this region; however, oral histories taken from early settlers provide some clues (Hawthorne-Tagg 1997). For instance, prairie dogs resided on HAFB around the turn of the century and, with the exception of one sighting in 1988 (Doleman 1988), no other observations have been made. Grassland habitats of the basin and its drainages have been structurally altered, probably changing the native invertebrate and small mammal communities. Because little is known of pre-settlement fauna and their environments within HAFB and the BWWSA, this plan discusses inventory, research, maintenance, and monitoring of contemporary fauna and their habitats.

<u>Main Base and BWWSA</u>

Habitats on HAFB and BWWSA support a wide variety of vertebrates and invertebrate species. The following discussion is organized by class and provides a general summary of documented species in each class as well as an overview of previous research. Species considered threatened, endangered or a SGCN are discussed in more detail in Section 2.3.4. Management strategies are discussed in Section 7.1 Fish and Wildlife Management and Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats.

MAMMALS

New Mexico has one of the most diverse mammal faunas in North America, with eighty-nine taxa described from New Mexico, ten of which are holotypes from Otero County (Blair 1941, Frey and Yates (1996). Mammals range from small bat and rodent species to medium carnivores and large artiodactyla such as the nonnative gemsbok (*Oryx gazelle*). Common wildlife in the area include coyote (*Canis latrans*), desert cottontail (*Sylvilagus auduboni*), and black-tailed jackrabbit (*Lepus californicus*).

Bats

Bats return from migration and awaken from hibernation as early as March in most of the United States, but may stay active year-round in the extreme southern U.S. They are typically abundant throughout the summer and into late fall.

Bats forage in a variety of habitats, but must have a suitable supply of the preferred kind of prey within a commuting distance from the day roost so that energy can be built up and maintained over time. Most bats capture insects on the wing during the night, using echolocation, although some species, such as pallid bats, may eat ground insects as well (O'Shea and Vaughan 1977). Insects are attracted to lights and water bodies, so bats tend to forage in these areas.

Roosting habitat is critical for bats to preserve energy as well as interact socially. Night roosts provide resting places between feeding bouts. Day roosts include nursery roosts, which provide protection from predators and have a microclimate suitable for gestation, lactation, and development of the young. Day roosts may also be used by congregations of males and resting areas during migration. Many species of bats are strongly attached to specific nursery or hibernation sites and may try to return if disturbed or excluded (Humphrey 1982).

Table 2.3.3-1. HAFB Bat Species Inventory, lists species identified during the most recent bat survey (ESI 2011) as well as species discussed in previous HAFB INRMPs or neighboring agency reports from WSMR (WSMR INCRMP). HAFB manages land used by potentially at least 16 different species of bats. See sections 2.3.4 and 7.4 for more information on NM bats that are considered SGCN; Pale Townsend's Big-eared Bat (*Corynorhinus townsendii*) and Spotted Bat *(Euderma maculatum).*

Many of the playas and smaller wetlands on HAFB are important foraging areas for resident and migrating bats, including wetlands by the HSTT, and scattered wetlands and playas in the northland grassland areas, in the Cantonment area and on the BWWSA (Johnson et al. 1997a, Mehlhop et al. 1998). The small wetlands that abut the HSTT at the mouth of Guilez Draw are known foraging sites for pallid and hoary bats. Bright lights at the airfield and in the Cantonment area also attract bats for the abundance of insects.

Table 2.3.3-1. HAFB Bat Species Inventory

Family	Common Name	Scientific Name	Recently Documented Survey
Molossidae	Big Free-tailed Bat	*Nyctinomops macrotis*	*HAFB 2011 Study (anabat) ESI 2011; Previous HAFB INRMP*
Molossidae	Brazilian or Mexican Free-tailed Bat	*Tadarida brasiliensis*	*HAFB 2011 Study (anabat) ESI 2011; Previous HAFB INRMP*
Vespertilionidae	Big Brown Bat	*Eptesicus fuscus*	*Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	California Myotis	*Myotis californicus*	*HAFB 2011 Study (mist net) ESI 2011; Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	Cave Myotis	*Myotis velifer*	*Listed in WSMR INCRMP*
Vespertilionidae	Fringed Myotis	*Myotis thysanodes*	*Listed in WSMR INCRMP*
Vespertilionidae	Hoary Bat	*Lasiurus cinereus*	*HAFB 2011 Study (anabat) ESI 2011; Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	Long-legged Myotis	*Myotis volans*	*Listed in WSMR INCRMP*
Vespertilionidae	Pale Townsend's Big-eared Bat	*Corynorhinus townsendii*	*Previous HAFB INRMP; Listed in WSMR INCRMP; SWAP SGCN (NMDGF 2016a)*
Vespertilionidae	Pallid Bat	*Antrozous pallidus*	*HAFB 2011 Study (anabat) ESI 2011; Previous HAFB INRMP*
Vespertilionidae	Silver-haired Bat	*Lasionycteris noctivagans*	*Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	Southwestern Little Brown Myotis	*Myotis occultus*	*Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	Spotted Bat	*Euderma maculatum*	*Previous HAFB INRMP; Listed in WSMR INCRMP; SWAP SGCN (NMDGF 2016a)*
Vespertilionidae	Western Pipistrelle or Canyon Bat	*Parastrellus hesperus*	*HAFB 2011 study (anabat) ESI 2011*
Vespertilionidae	Western Small-footed Myotis	*Myotis ciliolabrum*	*HAFB 2011 Study (mist net possible) ESI 2011; Previous HAFB INRMP; Listed in WSMR INCRMP*
Vespertilionidae	Yuma Myotis	*Myotis yumanensis*	*HAFB 2011 study (anabat possible) ESI 2011*

NOTE: Green highlighted species were identified during the most recently documented bat diversity study by Envirological Services, Inc. (2011).

Recent Bat Diversity and Roosting Studies

Envirological Services, Inc. (ESI 2011) completed the most recent bat diversity and maternity roosting survey. Using mist-net and acoustic (Anabat) monitoring, at least six different species of bats were detected. See the highlighted species on Table 2.3.3-1. HAFB Bat Species Inventory.

Mist-netting identified two species (65 Pallid Bats - *Antrozous pallidus* and one California Myotis - *Myotis californicus* or Western Pipistrelle - *M. ciliolabrum*, field identification was uncertain*).* The Pallid bat was the most common species caught during mist-netting, Figure 2.3.3-2. Common Bats on HAFB; A) Pallid Bat - *Antrozous pallidus.*

Anabat monitoring detected an additional four to five species including the most common bat noted on HAFB the Brazilian or Mexican Free-tailed Bat (*Tadarida brasiliensis*) (see Figure 2.3.3-2. Common Bats on HAFB; B) Mexican Free-tailed Bat - *Tadarida brasiliensis*) as well as Big Free-tailed Bat (*Nyctinomops macrotis*), Hoary Bat (*Lasiurus cinereus*), Western Pipistrelle or Canyon Bat (*Parastrellus Hesperus*), and possibly Yuma Myotis *(Myotis yumanensis)*. Year round acoustic monitoring indicated that bat activity peaks March through July. Roosts were located using radio telemetry confirming that bats on HAFB roost in rock crevices, culverts, abandoned and inhabited buildings, as well as artificial roosts with minimal to no disturbance (ESI 2011).

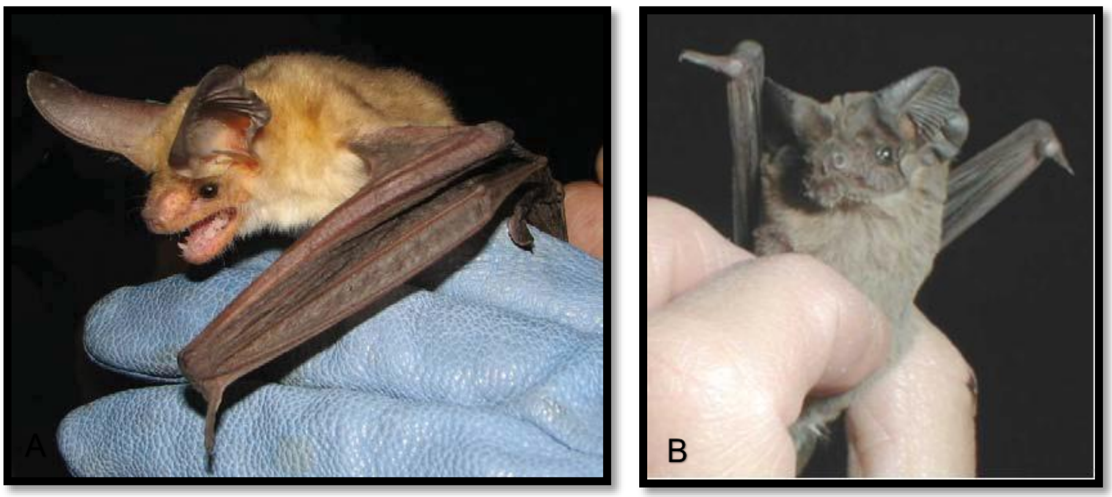


Figure 2.3.3-2. Common Bats on HAFB. A) Pallid Bat - *Antrozous pallidus* photo from ESI 2011; B) Mexican Free-tailed Bat - *Tadarida brasiliensis photo from*

Figure 2.3.3-3. below shows some of the buildings periodically occupied by bats within the cantonment area. Bats have been observed roosting in Buildings such as #500, #524 and #296, respectively as well as Building #806, #824 in the west area. Roosting colonies of Mexican free-tailed bats also occur in several of the larger hangar-like buildings (e.g., Building #1174). A large Mexican free-tailed bat colony used Buildings #592, #593, and #594 starting in the fall 1998. This colony has grown to about 3,000 individuals by spring 2007. Two maternity roosts for pallid bats have been documented within the HSTT buildings north of Lost River (Buildings #1169 and #1503). West of the HSTT, pallid and other bat species have occupied Building #1162. Buildings #1108 (King 1) and #1270 have been historically occupied by pallid bats.

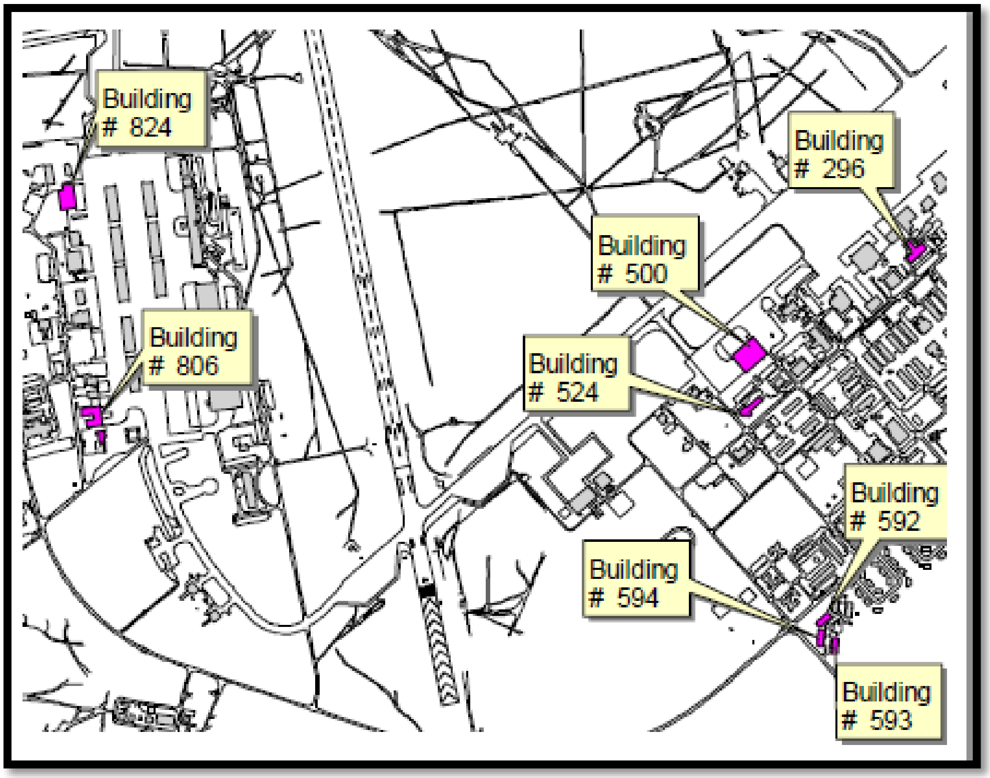


Figure 2.3.3-3. Buildings Periodically Occupied by Bats within the Cantonment Area

Rodents

Rodent surveys conducted in the 1990s within Rosemary mint Dune Shrubland, Gyp Grama Interdune Grassland, and Fourwing Saltbush/Gyp Dropseed Shrubland habitats at the periphery of the dune found fourteen species of rodents (Root and Demarais 1997, Johnson et al. 1997a, Johnson et al. 1997b) see Table 2.3.3-4. Rodents Trapped with the HAFB Dune Periphery. No known federal or state listed rodent is documented on HAFB. To date, the federal and state listed endangered New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*) has not been identified on base. Recent camera trapping studies in the Lake Holloman Wetland Complex area (Pierce et al. 2017) did not detect the presence of the species. Rodents are managed as a nuisance species and are addressed in Section 7.11 Integrated Pest Management Program.

The Ord's kangaroo rat (*Dipodomys ordii*), desert pocket mouse (*Chaetodipus penicillatus*) and plains pocket mouse (*Perognathus flavescens gypsi*) were found primarily within the dunes, while others were found equally distributed among habitats or in numbers too small to allow determination of habitat affinity. Eight species of rodents were captured with deer mouse and Merriam kangaroo rat most often captured during surveys conducted near the dune area. Studies at the dune periphery to identify rodents and their respective habitats can be used to extrapolate to other portions of the base. For instance, rodents found within the fourwing saltbush/gyp dropseed shrubland (White Sands woodrat and house mouse) could potentially occur within the grass-shrublands north of Douglas Road because the same community type is represented there (Johnson et al. 1997a).

Table 2.3.3-4. Rodents Identified on HAFB

SCIENTIFIC NAME	COMMON NAME	HABITAT
Chaetodipus intermedius	Rock Pocket Mouse	
Chaetodipus penicillatus	Desert pocket mouse	Primarily dunes
Dipodomys merriami	Merriam's kangaroo rat	Equally distributed
Dipodomys ordii	Ord's kangaroo rat	Primarily dunes
Mus musculus	House mouse	Too few captured to determine habitat
Neotoma micropus leucophaea	Southern plains woodrat	Too few captured to determine habitat
Onychomys arenicola	Mearn's grasshopper mouse	Too few captured to determine habitat
Onychomys leucogaster	Northern grasshopper mouse	
Perognathus flavescens	Plains Pocket Mouse	Too few captured to determine habitat
Perognathus flavescens gypsi	Plains pocket mouse (lighter pelage)	Primarily dunes
Perognathus flavus	Silky pocket mouse	Equally distributed
Peromyscus eremicus	Cactus Mouse	Too few captured to determine habitat
Peromyscus leucopus	White-footed mouse	Too few captured to determine habitat
Peromyscus maniculatus	Deer mouse	Too few captured to determine habitat
Reithrodontomys megalotis	Western harvest mouse	Too few captured to determine habitat
Spermophilus spilosoma	Spotted ground squirrel	Equally distributed

The White Sands woodrat (*Neotoma micropus leucophaea*) was first recorded in WSNM. It is a medium-sized woodrat which occurs in xeric habitat on HAFB, living in burrows surrounded by debris and thorny vegetation at the entrance. Nine White Sands woodrats were captured at seven middens during surveys conducted by NHNM, June to November, 1994, all within the general vicinity of the Test Track (Mehlhop et al. 1998). Six of the midden sites were within Fourwing Saltbush/Gyp Dropseed Shrubland, the dominant vegetation mapping unit of that area. Middens were also found beneath honey mesquite (Prosopis glandulosa). Short surveys conducted for the White Sands woodrat in 1994 (HAFB in-house GIS layer) found a midden and female woodrat at the easternmost boundary of the grass-shrubland area north of Douglas Road.

Porcupine (*Erethizon dorsatum*) has been observed near the BWWSA facilities. Porcupines are common in most habitat types and are occasionally observed on WSMR from grasslands and shrublands to higher elevation woodlands (Burkett and Kamees 1996); no observations have been made on the main base, but the species may occur there.

Camera trapping surveys were conducted between 2016 and 2017 by Texas A&M (Pierce et al. 2017) in the constructed wetlands/artificial riparian grassland to determine the presence or absence of the federal and NM State endangered New Mexico Jumping Mouse (*Zapus hudsonius luteus*) on HAFB. The survey employed novel methodology using infra-red triggered cameras to allow for continuous monitoring of five trapping locations. Over the course of the first six months, 80,618 capture events occurred recording several classes of animals including snakes, lizards, amphibians, birds, rodents, and a few raccoons. Final results from this study are not yet available. HAFB is not optimal habitat for the New Mexico Jumping Mouse and the species was not detected during the course of this study.

Carnivores

Coyote (*Canis latrans*) are most common in grasslands but are found in all habitats in New Mexico (BISON-M 2015). On HAFB coyotes are documented in all habitat types and are considered a BASH hazard. See Sections 7.11 for more information.

The kit fox (*Vulpes macrotis neomexicanus*) inhabits the marginal and interior dunes of the White Sands dune field (BISON-M 2015), preying primarily on rodents in the dunelands, especially kangaroo rats. Kit fox inhabit desert shrub, shrub-grass, and xeric riparian areas (Zoellick et al. 1989). Kit fox range usually extends no more than 2 miles from the den. They prefer loose, sandy soils to dig burrows and dens, which are noticeable due to the mounds of dirt and sand they excavate from their burrows. Nearby dunelands provide a broad and elongated corridor connecting numerous reaches of the basin, including the San Andres Wildlife Refuge and south to the coppice dunes of Ft. Bliss. During summer 2017, BASH camera traps documented kit fox just to the northwest of the HSTT along the dune margin.

Though rarely sighted, long-tailed weasel (*Mustela frenata*) are known to occur on HAFB. The last reported observation was during the summer of 1994, when an individual was spotted crossing the west perimeter road near the Cantonment area. The surrounding vegetation community was mostly pure stands of alkali sacaton grasslands. Ringtails (*Bassariscus astutus*) are infrequently observed on the main base. Raccoon tracks have also been observed in the Lost River drainage and the Public Access area adjacent to Lake Holloman.

Artiodactyla

Mule deer are regularly observed in upper Malone and Carter Draws, and the BWWSA area. Two subspecies of mule deer are reported to occur within this region, the Rocky Mountain mule deer (*Odocoileus hemionus*) and the desert mule deer (*Odocoileus hemionus crooki*). However it is likely that the desert mule deer, with a range in the southern one-third of the state, is the sub-species that occurs in the southern Sacramento Mountains and HAFB (Haussamen 1995).

The gemsbok, commonly known as oryx (*Oryx gazella*), is a nonnative (African antelope), introduced game animal, brought from the Kalahari Desert to an experimental range at Red Rock, New Mexico (Figure 2.3.3-5. Oryx (*Oryx gazella*)). Oryx are highly adapted to desert life and require little free water. They eat desert grasses, yucca, buffalo gourds, mesquite bean pods, and tumbleweeds. Ninety-three offspring from this original stock were introduced onto WSMR as a game animal between 1969 and 1973 and numbers have increased to over 3,000 since. Annual hunts have been conducted on WSMR since 1974. Reproduction averages over one calf per cow annually, which indicates a healthy growing population on base and elsewhere in the Tularosa Basin.

Figure 2.3.3-5. Oryx (*Oryx gazella*)

The gemsbok or oryx (*Oryx gazella*), is currently a resident of HAFB. Oryx range into most grassland habitats found within HAFB (HAFB 2002). Oryx are managed as a BASH priority species due to their size and habitat preference (see Section 7.12 Bird/Wildlife Aircraft Strike Hazard (BASH).

BIRDS

With such a wide diversity of habitats, New Mexico has recorded the second highest number of bird species of any land-locked state in the U.S. More than 280 species of birds breed in New Mexico and the extensive grasslands are important for wintering birds. The Rio Grande serves as an important flyway for migrants. In the east, the Playa Lakes region is one of the most significant wetland habitats in the southern quarter of the Central Flyway for migrating and wintering birds.

During the course of previous surveys, at least 264 bird species were inventoried on HAFB & BWWSA (Appendix H. HAFB Bird Species Inventory-Inventoried Bird Species). Within the last 12 years there has been a vast amount of bird survey work completed on Holloman by Envirological Services, Inc. (ESI) and Natural Heritage New Mexico (NHNM). Table 2.3.3-6. Bird Surveys Conducted on HAFB, 2006-2017, lists the most recent surveys conducted on HAFB. Surveys focused on grassland, shrublands and wetland habitats and SOC such as Neotropical Migratory Birds, Raptor species including the Northern Aplomado Falcon (*Falco femoralis septenrionalis*) and Western Burrowing Owl (*Athene cunicularia hypugaea)*, as well as wetland breeding birds such as Snowy Plover (*Charadrius nivosus*).

Of the 264 species of birds detected, 81 species are currently listed by at least one agency or organization as a SOC (see Table 2.3.3-7. HAFB Birds of Conservation Concern). Twenty six of these species are listed as NMDGF SGCN (2016). Five species are listed as federally or state threatened or endangered. A total of 58 species of birds have been documented as breeding on HAFB (see Appendix H. HAFB Bird Species Inventory-Breeding Birds), 16 of which are also considered SOC (see Table 2.3.3-7. HAFB Birds of Conservation Concern); shading indicates known breeders at HAFB. There are also other bird SOC that occur on nearby lands or have the potential to occur in the surrounding area that have not been officially documented on HAFB (see Table 2.3.3-8 HAFB Possible Bird Species of Concern (SOC)). It is possible these species occur on HAFB or have the potential to occur in the future and are discussed as potential SOC. For more information on threatened, endangered, SOC or breeding birds see Section 2.3.4. and Section 7.4.

Table 2.3.3-6. Bird Surveys Conducted on HAFB, 2006-2017

Year	Author	Report Title	Type
2006	Envirological Services, Inc.	Raptor Survey on Holloman Air Force Base. 37pp.	Grassland/ Shrubland - Raptor
2006b	Envirological Services, Inc.	Power Line Assessment for Electrocution Risk	Built Environment
2006	Smith and Johnson	Holloman Air Force Base Boles Wells Water System Annex Bird Surveys	BWWSA
2007	Envirological Services, Inc.	Raptor Surveys on Holloman Air Force Base	Raptor
2007b	Envirological Services, Inc.	First Annual Report of the Wetland Habitat Monitoring on Holloman Air Force Base, New Mexico, 2006-2007	Wetland Monitoring
2009	Envirological Services, Inc.	Raptor Surveys on Holloman Air Force Base, 2009	Raptor
2009b	Envirological Services, Inc.	Aplomado Falcon Surveys on Holloman Air Force Base, 2009	Aplomado
2010	Envirological Services, Inc.	Monitoring Neotropical Migratory Bird Populations in Four Grassland Habitats on Holloman Air Force Base, New Mexico.	Grassland/ Shrublands Neotropical Migratory Birds
2011	Johnson et al.	Grassland/Shrubland Raptor Survey at Holloman Air Force Base 2009-2010	Grassland/ Shrubland - Raptor
2011b	Johnson et al.	Revised Operational Plan for the Lake Holloman Wetlands Complex Area	LHWC Op Plan
2012	Smith and Johnson	Grassland and Shrubland Bird Surveys at Holloman Air Force Base, NM 2009-2010	Grassland/ Shrubland
2013	Smith and Johnson	Grassland and Shrubland Bird Surveys at Holloman Air Force Base, NM 2009-2013	Grassland/ Shrubland
2016	Johnson et al.	Grassland/Shrubland Species of Conservation Concern at Holloman Air Force Base: Pilot Study of Nesting Priority Species	Grassland/ Shrubland - Nesting
2016	Sadoti et al.	Seasonal Habitat Use by Grassland and Shrubland Birds at Holloman Air Force Base 2011-2014	Grassland/ Shrubland
2016	Smith et al.	Grassland and Shrubland Raptor Surveys at Holloman Air Force Base, NM 2009-2014	Grassland/ Shrubland- Raptor
2016b	Smith et al.	Lake Holloman Wetland Complex Area Invertebrate and Bird Monitoring.	LHWC Monitoring
2017	Freehling et al.	Lake Holloman Wetland Complex Area Invertebrate and Bird Monitoring	Wetland Monitoring
2017	Johnson et al.	Surveys for Northern Aplomado Falcon and Other Raptors at Holloman Air Force Base 2009-2016.	Raptor/ Aplomado
2017	Petersen et al.	Nesting Success of Wetland Birds at Lake Holloman Wetland Complex Area	LHWC - Nesting Success
2017	Turner et al.	Draft Final Report: HAFB Burrowing Owl Surveys	Grassland/ Shrubland - Burrowing Owl

Table 2.3.3-7. HAFB Birds of Conservation Concern

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIFwatchlist	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season SP	S	F	W
American Avocet	*Recurvirostra americana*										BC2	S4	A	A	A	
American Bittern	*Botaurus lentiginosus*						X				BC1	S3	V	V	V	V
American Coot	*Fulica americana*										BC2	S5	A	A	A	C
American Kestrel	*Falco sparverius*				X							S5	U	U	U	U
American Pipit	*Anthus rubescens*										BC1	S3B/S5N	U	O	R	R
Baird's Sparrow	*Ammodramus bairdii*	X	X	X	X	X	X	X	T		BC1	S1N	V	V	V	V
Bald Eagle	*Haliaeetus leucocephalus*	X	X	X	X		X	X	T			S1B/S4N	V	V	V	V
Band-tailed Pigeon	*Columba fasciata*										SC2	S3B/S4N	V	V	V	V
Bank Swallow	*Riparia riparia*						X				BC1	S2B/S5N	R	O	R	
Belted Kingfisher	*Megaceryle alcyon*										BC2	S4N	R	O	R	
Bendire's Thrasher	*Toxostoma bendirei*	X	X	X	X	X	X				SC1	S3	V	V	V	V
Black Tern	*Chlidonias niger*			X								S3N	O	O	R	
Black-tailed Gnatcatcher	*Polioptila melanura*										BC1	S3	U	R	U	R
Black Tern	*Chlidonias niger*			X								S3				
Brewer's Sparrow	*Spizella breweri*				X							S3B/S4N	C	R	C	U
Broad-tailed Hummingbird	*Selasphorus plactycercus*										SC2	S4	R	R	R	
Buff-breasted Sandpiper	*Tryngites subruficollis*		X		X							SNA	V	V	V	V
Cassin's Sparrow	*Peucaea cassinii*	X					X				SC2	S5	U	C	R	
Chestnut-collared Longspur	*Calcarius ornatus*	X	X	X		X	X				SC1	S3N			U	U
Chipping Sparrow	*Spizella passerina*										BC2	S4B/S5N	C	U	A	U
Common Nighthawk	*Chordeiles minor*				X		X					S4		R		
Crissal Thrasher	*Toxostoma crissale*				X						SC2	S4B/S5N	R	R	R	R
Dickcissel	*Spiza americana*				X						BC2	S1B/S4N	V	V	V	V
Eared Grebe	*Podiceps nigricollis*						X					S3B/S5N	C	R	C	R
Eastern Meadowlark	*Sturnella magna*				X							S4B/S5B	C	C	U	R
Ferruginous Hawk	*Buteo regalis*	X		X								S2B/S2N				O
Golden Eagle	*Aquila chrysaetos*	X	X		X							S3B/S4N	O		O	R

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIFwatchlist	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season			
													SP	S	F	W
Green Heron	*Butorides virescens*										BC2	S4	O	O	O	
Green-tailed Towhee	*Pipilo chlorurus*										SC2	S3B/S4N			R	
Harris's Hawk	*Parabuteo unicinctus*										BC2	S2B/S3N	O		R	R
Horned Lark	*Eremophila alpestris*				X							S5	C	C	C	A
House Wren	*Troglodytes aedon*										BC1	S5		O	O	
Hudsonian Godwit	*Limosa haemastica*		X									SNA	V	V	V	V
Lark Bunting	*Calamospiza melanocorys*	X	X								SC2 BC2	S3B/S5N	C	R	C	R
Least Tern	*Sternula antillarum athalassos*				X		X		E	E	BC1	S1B/S2N	V	V	V	V
Lesser Yellowlegs	*Tringa flavipes*		X									S4N	R	U	U	O
Loggerhead Shrike	*Lanius ludovicianus*	X	X	X	X		X				SC2	S3B/S4N	C	C	C	C
Long-billed Curlew	*Numenius americanus*	X	X		X		X				BC1	S3B/S4N	R	U	R	
Long-eared Owl	*Asio otus*					X					BC2	S4B/S4N	V	V	V	V
Lucy's Warbler	*Oreothlypis luciae*		X		X		X				SC2	S3B/S4N	V	V	V	V
MacGillivray's Warbler	*Geothlypis tolmiei*										BC2	S5B/S5N			R	
Mountain Bluebird	*Sialia currucoides*						X				SC2	S4B/S4N	V	V	V	V
Mountain Chickadee	*Poecile gambeli*	X	X								SC1	S5B/S5N			O	O
Mountain Plover	*Charadrius montanus*	X	X		X		X				BC1	S2B/S4N	V	V	V	V
Neotropic Cormorant	*Phalacrocorax brasilianus*						X		T			S3B/S4N	V	V	V	V
Northern Harrier	*Circus cyaneus*										BC2	S2B/S5N	R	O	R	U
Northern Pintail	*Anas acuta*										BC2	S4B/S5N	R	R	C	C
Olive-sided Flycatcher	*Contopus cooperi*				X	X	X				BC2	S3B/S4N	V	V	V	V
Orchard Oriole	*Icterus spurius*										BC2	S3B/S5N	V	V	V	V
Peregrine Falcon	*Falco peregrinus*	X	X				X	X	T			S2B/S3N	R	O	R	O
Pied-billed Grebe	*Podilymbus podiceps*										BC2	S5B/S5N	R	R	R	O

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIFwatchlist	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season			
													SP	S	F	W
Prairie Falcon	*Falco mexicanus*				X							S4B/S4N			R	O
Prothonotary Warbler	*Protonotaria citrea*		X			X						S4N	V	V	V	V
Red Knot	*Calidris canutus*		X									SNA	V	V	V	V
Redhead	*Aythya americana*										BC1	S4B/S5N	U	R	U	R
Rock Wren	*Salpinctes obsoletus*										SC2	S5B/S5N	R		R	
Rusty Blackbird	*Euphagus carolinus*		X		X							S2N	V	V	V	V
Sage Thrasher	*Oreoscoptes montanus*				X						BC2	S3B/S4N	R	O	C	C
Sagebrush Sparrow	*Artemisiospiza nevadensis*				X		X				SC2	S3B/S4N	R		U	C
Scaled Quail	*Callipepla squamata*					X					SC1	S3B/S4N	U	U	U	U
Short-billed Dowitcher	*Limnodromus griseus*		X									S3N	V	V	V	V
Snowy Plover	*Charadrius nivosus*	X	X		X		X				BC1	S2	C	C	R	
Solitary Sandpiper	*Tringa solitaria*		X									S4N	O		O	
Sprague's Pipit	*Anthus spragueii*	X		X	X	X	X	X			BC1	S2N	V	V	V	V
Vesper Sparrow	*Pooecetes gramineus*						X				SC2	S5B/S4N	R	C	R	
Violet-green Swallow	*Tachycineta thalassina*										SC2	S3B/S4N	C	R	C	
Virginia's Warbler	*Oreothlypis virginiae*	X				X	X				SC1	S3B/S4N			O	
Western Bluebird	*Sialia mexicana*						X				SC2	S4B/S4N				O
Western Burrowing Owl	*Athene cunicularia*	X	X	X	X		X	X				S3	U	U	U	
Western Grebe	*Aechmophorus occidentalis*										BC2	S3B/S5N	R	O	R	
Whimbrel	*Numenius phaeopus*		X									SNA	O	O		
White-faced Ibis	*Plegadis chihi*			X								S3B/S4N	C	C	U	
Wilson's Phalarope	*Phalaropus tricolor*										BC2	S2B/S4N	A	A	A	
Wilson's Warbler	*Cardellina pusilla*										BC2	S2B/S5N	R		U	
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*										SC1	S5B/S5N	O		R	
Yellow Warbler (Sonoran)	*Setophaga petechia sonorana*	X	X									S4B/S4N (SNR)		R	R	

Table 2.3.3-8 HAFB Possible Bird Species of Concern (SOC)

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIFwatchlist	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	StateRank	Closest eBird Sightings & Notes
Bell's Vireo	*Vireo bellii*	X	X	X			x	X	T		BC1	S2B/S3N	San Andres Mnts.
Black-chinned Sparrow	*Spizella atrogularis*	X	X		X	X	X				SC2	S3B/S3N	White Sands National Monument, San Andres/Organ Mnts, and Lincoln NF
Broad-billed Hummingbird	*Cynanthus latirostris*						x		T		BC1	S1B/S1N	Organ Mountains & Mescalero Reservation area
Brown Creeper	*Certhia americana*										BC1	S4B/S4N	North of HAFB, Alamogordo, La Luz, Lincoln NF & Organ Mnts.
Brown Pelican	*Pelecanus occidentalis*								E			SNA	Along Rio Grande, Elephant Butte, & Bosque del Apache
Cassin's Finch	*Haemorhous cassinii*					X	x				BC2	S3B/S5N	Lincoln NF, La Luz, San Andres Mtns.
Common Black-Hawk	*Buteogallus anthracinus*	X	X				X		T		BC1	S2B/S3N	Tularosa and Dripping Springs
Common Ground-dove	*Columbina passerina*						X		E		BC1	S1B/S1N	WSMR Golf Course, Las Cruces
Grace's Warbler	*Setophaga graciae*	X	X			X	X				SC1	S3B/S4N	Lincoln NF & Organ Mnts.
Gray Vireo	*Vireo vicinior*	X	X		X	X	X	X	T		SC2	S4B/S3N	San Andres & Organ Mnts,
Northern Aplomado Falcon	*Falco femoralis septentrionalis*						X		E; EXPN	E; EXPN		S1B/S1N	Dona Ana & Bosque del Apache
Northern Goshawk	*Accipiter gentilis*			X	X			X			BC2	S2B/S3N	Lincoln NF (Oliver Lee SP), Along Rio Grande
Painted Bunting	*Passerina ciris*	X	X	X	X						BC2	S4B/S4N	Lincoln NF (Oliver Lee SP), Boles wells area, & organ Mnts
Piping Plover	*Charadrius melodus*								T	E		SNA	Bosque del Apache
Reddish Egret	*Egretta rufescens*		X									SNA	Along the Rio Grande & Elephant Butte
Red-faced Warbler	*Cardellina rubrifrons*	X	X				X				SC1	S3B/S4N	Lincoln NF & Organs
Southwestern Willow Flycatcher	*Empidonax traillii extimus*						X		E	E		S1B/S1N	Bosque del Apache. One "Willow" Flycatcher recorded on HAFB during the fall of 2009 (ESI 2010); subspecies extimus not ID'd. Habitat on HAFB is not ideal for this subspecies.
Varied Bunting	*Passerina versicolor*	X	X				X	X	T		BC2	S1B/S1N	San Andres Mnts. 2011 surveys on the SANWR - least 3 breeding pairs
Williamson's Sapsucker	*Sphyrapicus thyroideus*						X				SC2	S4B/S5N	Western slopes of san andres, Lincoln NF, & La Luz
Yellow-billed Cuckoo	*Coccyzus americanus*	X	X				X			T	BC1	S3B/S3N	Near boles wells (2006), Tularosa (1982)

*These species have not been officially documented on HAFB but have been sighted in the surrounding area. It is possible these species may be sighted in the future

Table 2.3.3-7 & 2.3.3-8 References and Codes

BCC2008BCR35=US Fish and Wildlife Service Bird of Conservation Concern in the Chihuahuan Desert (USFWS 2008); BCC2008Region2=US Fish and Wildlife Service Bird of Conservation Concern in the Southwest US (USFWS 2008); BLMSensitiveNMSO=BLM Sensitive Species (Biota Information System of New Mexico 2015); DoDPIFpriority=Department of Defense Partners in Flight mission-sensitive priority birds (DoD PIF 2014); PIF Watch List= Partners in Flight Species of Continental Concern(land birds only; Rosenberg et al. 2016); SGCN=NM Species of Greatest Conservation Need (NMDGF 2016a); USFS Sensitive=US Forest Service Sensitive Species (USFS 2013); NMDGF Status= NM Wildlife Conservation Act status (T= threatened, E=endangered; NMDGF 2016b); Federal Status=Endangered Species Act (E=Endangered; 1973, 16 USC 1531-1544); NMACP 2017 = New Mexico Avian Conservation Partners priority list status (SC = Species Conservation Level 1 or 2, BC = Biodiversity Conservation Level 1 or 2); State rank=NM Natural Heritage state rank (lower numbers indicate higher conservation priority; NatureServe 2015). Shading indicates known breeders at HAFB.

Code	Definition
A	Abundant
BC1	NMACP - Biodiversity Conservation Level 1
BC2	NMACP - Biodiversity Conservation Level 2
C	Common
CS	Candidate Species
E	Endangered
EXPN	Experimental Population
O	Occasional
R	Rare
SC1	NMACP - Species Conservation Level 1
SC2	NMACP - Species Conservation Level 2
S*B	NM State Rank Breeding
S*N	NM State Rank Nonbreeding
T	Threatened
U	Uncommon
V	Vagrant

Shorebirds

The term ‘shorebird’ is applied in North America to a large group of birds commonly called sandpipers and plovers, but also including avocets and stilts. The United States Bird Conservation Plan (Brown et al. 2001) states that the goal for the conservation of shorebirds is to ensure that all of our species of shorebirds are protected or restored, and that shorebirds continue to have stable populations that are capable of sustaining themselves in the long-term future. Shorebirds have several conservation challenges (Brown et al. 2001):

- Extremely long migrations, requiring that protection of critical sites must be coordinated over vast distances often involving several countries
- Low rates of reproduction, making it difficult to reverse past declines and recover populations rapidly
- Extraordinary degree to which some species depend on one or a small number of strategic migration stopover sites and that they tend to concentrate in these sites in large numbers
- Dependence on often seasonal habitats that are widely dispersed across the landscape and may only be available every several years

- High loss of wetland habitat, especially for temperate zone species like the snowy plover
- Likely significant population declines, with poor population data

Shorebirds are the group of birds of primary conservation concern at the LHWC wetlands. Since shorebird surveys began in 1994, at least 73 species of wetland birds have been detected at the LHWC. Raptors were also recorded foraging and nesting at the LHWC; indicating the LHWC provides important shorebird habitat in the Tularosa Basin.

On HAFB, shorebird species fall into several groups, including grebes, herons, ducks, waders, and sandpipers. A reasonably large number of species in the family parulidae (warblers), towhees, sparrows, and blackbirds were also observed, especially considering the virtual absence of riparian or forested areas with permanent water. The wetland complex is used by at least 22 species of ducks, 15 of which are frequent visitors. The most abundant are northern shoveler (*Anas clypeata*) and ruddy duck (*Oxyura jamaicensis*).

Shorebirds forage on wet and drying mudflats and at water depths ranging from 0 to 7 inches. Their principal diet is macroinvertebrates found in aquatic and mudflat habitats. Shorebirds of three main foraging guilds (sandpipers, plovers, and avocets/stilts) used shallow water and saturated soil habitats preferentially over dry soil and deep water (Freehling et al. 1999). Shorebirds are found in vegetation cover ranging from 0-75%; however, most species use sites with less than 25% cover and prefer vegetation heights to be less than half their body height (Helmers 1993). Peak spring migrations for shorebirds generally occur from March through May and summer/autumn migrations occur from July through September (Helmers 1993). Stopover areas with an abundance of food and resting sites free from human disturbance are particularly important during shorebird spring migration (Eldridge 1992).

Grassland & Shrubland Birds

From 2009 to 2016, NHNM conducted bird surveys in grassland and shrubland habitats at HAFB (Johnson et al. 2011, 2016, 2017; Sadoti et al. 2016; Smith and Johnson 2012, 2013; Smith et al. 2016). Studies focused on gaining a better understanding of how grassland and shrubland birds used HAFB habitats during four sampling periods: fall migration, winter, spring migration, and breeding. Overall, these surveys identified a diversity of sparrows and other typical species such as Swainson's hawk (*Buteo swainsoni*), prairie falcon (*Falco mexicanus*), eastern and western meadowlark (*Sturnella magna* and *S. neglecta*), and several species of wrens, thrashers, longspurs, and quail. Two species that have the potential to occur on HAFB, the Northern Aplomado Falcon (*Falco femoralis septenrionalis*) and Baird's sparrow (*Ammodramus bairdii*), were not documented during these surveys.

Raptors on HAFB occupy grasslands, mixed shrub grasslands and shrublands. Surveys indicated that in grassland habitats on base the most common sensitive bird species is the Western Burrowing Owl (*Athene cunicularia hypugaea*). This SOC is a year-round resident and successful breeder. The burrowing owl lives in burrows in grasslands and mixed shrub-grasslands, using mounds, shrubs and posts for vertical structure. Western Burrowing Owl surveys are resuming by Texas A&M (TAMU) and preliminary results have been compiled (Turner et al. 2017). See Section 2.3.4 for more information.

Several species showed evidence of breeding at the BWWSA: black-throated sparrow (*Amphispiza bilineata*), Scott's oriole (*Icterus parisorum*), cactus wren (*Campylorhynchus brunneicapillus*) and northern mockingbird (*Mimus polyglottos*) were all observed carrying nesting material. Blue grosbeak (*Passerina caerulea*), Bullock's oriole (*Icterus bullockii*), and Gambel's quail (*Callipepla gambelii*) had fledglings at the Boles Wells Wellfield. Black-tailed gnatcatchers (*Polioptila melanura*) nested on Douglas Wellfield and Swainson's hawks (*Buteo swainsoni*) nested near the west main gate on Boles Wells Wellfield (Smith and Johnson 2003).

SOC detected on BWWSA include Black-tailed gnatcatcher (*Polioptila melanura*); Crissal thrasher (*Toxostoma crissale*), loggerhead shrike (*Lanius ludovicianus*), scaled quail (*Callipepla chukar*), black-chinned hummingbird (*Archilochus alexandri*), cactus wren (*Campylorhynchus brunneicapillus*), rock wren (*Salpinctes obsoletus*), and canyon towhee (*Pipilo fuscus*). Many of these species breed and/or were detected in relatively large numbers on the BWWSA. However, bird species richness on the BWWSA was not particularly high, but the Wellsfields provide important bird habitat for several high-priority species. Future monitoring of the BWWSA is needed to ensure the protection of this habitat.

AMPHIBIANS & REPTILES

HAFB manages habitat for a variety of amphibians, lizard and snake species. See Table 2.3.3.-9. Reptiles Observed During Surveys on HAFB, for a listing of documented species. According to previous surveys, HAFB is home to at least 3 amphibian, 11 lizard, and nine snake species. Currently the only documented reptile on HAFB listed as a NM SGCN is the Desert Massasauga (*Sistrurus tergeminus*); highlighted in gray in the table below. See Sections 2.3.4 and 7.4 for more detailed information on this species and the Texas Horned Lizard (*Phrynosoma cornutum*) which was previously considered a SOC. TAMU innovative camera trapping studies (2017) are underway that may shed additional light on species diversity.

Table 2.3.3-9. Amphibians & Reptiles Observed During Surveys on HAFB[1]

Scientific Name	Common Name	Recently Documented Surveys	Habitat[2]
Anaxyrus cognatus	Great Plains Toad	Hobert et al. 2016	
Scaphiopus couchii	Couch's spadefoot toad	Hobert et al. 2016; Johnson et al. 1997a	
Ambystoma mavortium	Tiger Salamander	CEIE observation during restoration project	
Cnemidophorus inornatus	Little striped whiptail	Hobert et al. 2016; Johnson et al. 1997a	Sandy soil on bottomlands and grasslands
Cnemidophorus neomexicanus	New Mexican whiptail	Johnson et al. 1997a	Desert playas
Cnemidophorus tesselatus	Checkered whiptail	Previous INRMP	Canyons, grassy hills, base slope of mesas, sparsely vegetated areas with few trees, rocky areas
Crotaphytus collaris	Common collared lizard	Hobert et al. 2016	Arid and semi-arid regions, limestone-topped hills and bluffs, unshaded hillsides
Gambelia wislizenii	Long-nosed leopard lizard	Previous INRMP	Arid and semiarid plains of sparse vegetation, with sandy and coarse gravelly soil and hardpan; occasionally among sand dunes and in rocky areas
Uta stansburiana	Side-blotched lizard	Hobert et al. 2016; Johnson et al. 1997a	Arid and semiarid regions of sand and gravel, rocky places, washes, arroyos, rocky flats and hillsides

Scientific Name	Common Name	Recently Documented Surveys	Habitat[2]
Holbrookia maculata	Lesser earless lizard	Hobert et al. 2016	Sandy or gravelly flats and dry rocky areas with sparse vegetation
Phrynosoma cornutum	Texas Horned Lizard	Kamienski et al. 2009	
Phrynosoma modestum	Round-tailed horned lizard	Hobert et al. 2016	Semiarid shortgrass plains, hardpan, sandy and rocky terrains; most widely distributed lizard in North America and reaches to over 10,000 feet elevation
Sceloporus magister	Desert spiny lizard	Previous INRMP	Semiarid regions among rocks, yuccas, creosote bush, and cacti
Sceloporus cowlesi	Southern Plateau Lizard aka Southwestern Fence Lizard	Hobert et al. 2016	
Masticophis flagellum	Coachwhip	Hobert et al. 2016	Dry uplands, arid and semiarid regions, creosote bush, mesquite flats, sagebrush, roadsides
Sistrurus tergeminus	Desert Massasauga	Hobert et al. 2016	Edges of streams, ponds, grasslands, fields
Pituophis melanoleucus	Gopher snake	Hobert et al. 2016	Wide variety of habitats and elevations
Sonora semiannulata	Ground snake	Previous INRMP	Arid and semiarid regions of loose, sandy soil on slopes or flats with or without rocks
Crotalus atrox	Western Diamondback rattlesnake	Hobert et al. 2016	Desert flats, brushy areas
Crotalus viridis	Prairie rattlesnake	Hobert et al. 2016	Rock crevices and rodent burrows
Hypsiglena jani	Chihuahuan Nightsnake	Hobert et al. 2016	
Arizona elegans	Painted Desert Glossy Snake	Hobert et al. 2016	
Tantilla nigriceps	Plains Black-headed Snake	Hobert et al. 2016	

1 Collected by New Mexico Natural Heritage Program (1995) and HAFB personnel on Main Base and BWWSA; 2 Ransom 1981. Species highlighted in gray are considered NM SGCN.

Surveys conducted on HAFB in the mid-1990s collected herpetofauna data: (1) along roads for the Texas horned lizard (*Phrynosoma cornutum*; Mehlhop et al. 1998), and (2) at the cinetheodolite missile towers (Johnson et al. 1997a) as part of a general survey. In 2009 spatial analysis of Texas horned lizard habitat was conducted on HAFB (Kamienski et al. 2009). Recently, white lizard planning level surveys were conducted on HAFB and WSMR (Hobert et al. 2016) along the dune field margins. The purpose of this study was: 1) to determine the distribution of the little striped whiptail, lesser earless lizard, and southern plateau lizard along the leading edge of the gypsum dune field; 2) monitor population status and distribution within ecotones; 3) examine genetic variability (Hobert et al. 2016).

FISH

White Sands Pupfish (*Cyprinodon tularosa*)

The White Sands pupfish (*Cyprinodon tularosa*) is endemic to the Tularosa Basin; inhabiting clear, shallow, strongly alkaline pools and streams with fine mud-silt and sand bottoms. The two translocated populations were introduced in 1970: the Mound Springs populations on WSMR and the Lost River population on HAFB (Pittenger and Springer 1996, Pittenger & Springer 1999, Mehlhop et al. 1998, WSMR & HAFB 2015). The refuge populations were established and are maintained as a hedge against catastrophic events.

The species is considered threatened under the New Mexico Wildlife Conservation Act and is under review for listing under the Endangered Species Act. The NMDGF is initiating a Species Status Assessment of the pupfish pursuant to the Wildlife Conservation Act, 17-2-37 NMSA 1978 (NMDGF letter dated 14 Feb 18). The species is currently managed under the White Sands Pupfish Conservation Plan which identifies actions that can be implemented on WSMR and HAFB to improve the security of the species (WSMR & HAFB 2015). For more detailed information see Sections 2.3.4 and 7.4.

Mosquito Fish *(Gambusia* spp.)

The mosquito fish (*Gambusia affinis*) is the most common fish species in the LHWCs. Mosquito fish were introduced by NMDGF into ditches, lagoons, and Lake Holloman to control mosquito populations. Additionally, pest management personnel restock the main storm water ditch that runs parallel to Lagoon G. Exact population figures are unknown, but the populations are large due to the lack of natural predators. The best mosquito fish habitat within the Lake Holloman wetlands complex is in storm water runoff ditches. The population seems reasonably secure, even in the alkaline and saline waters of the area. Because the constructed wetland receives treated effluent from Lagoon G and the storm water ditches, mosquito fish have entered the constructed wetlands. It would be difficult to eliminate Gambusia from Lake Holloman because, mosquito fish are considered an “attained use”, and water quality must be maintained at standards protective to the fish, even if the fish are eliminated by some outside event. The water is too saline and alkaline to support other species of fish.

INVERTEBRATES

Invertebrates are an important component of desert ecosystems and little is known about their diversity in arid lands. Plant-feeding arthropods are beneficial pollinators, parasites, and predators, as well as being efficient detritivores in plant decomposition and nutrient recycling (Ford and McPherson 1996, Lightfoot and Whitford 1990). Additionally, they are important prey for small mammals, reptiles and birds. To date there have been no studies on HAFB to determine arthropod species diversity base wide.

There have been studies on the prey species of fish, reptile, and bird SOC that suggest the roles of these invertebrates contribute to ecosystem function. For example, pupfish populations located in Lost River feed on mosquitoes, amphipods and annelid worms (Suminski 1977; Turner 1987). The preferred diet of the Texas horned lizard is harvester ants (*Pogonomyrmex* spp.); however, studies to date indicate that honeypot ants (*Myrmecocystus* spp.) were more common throughout the base. On BWWSA, harvester ant nests appeared to be abundant along roadsides (Mehlhop et al. 1998). Insects such as grasshoppers

(*Orthoptera*), butterflies and moths (*Lepidoptera*), and beetles (Coleoptera) make up a large percentage of food items in western burrowing owl diets (Bison-M 2015).

Studies in the LHWC have been the most active and have begun to fill in gaps in our understanding of macroinvertebrate prey species diversity in the wetlands (Freehling et al. 1999; Smith et al. 2003; 2016b). The wetland complex provides habitat for macroinvertebrates from at least 24 families. Both diversity and numbers of invertebrates indicate that the wetlands are an important potential source of food for migrating shorebirds and other wetland birds. Much of the invertebrate taxonomic diversity is due to aquatic species that colonized the area in response to the introduced water from the wastewater treatment plant (Freehling et al. 1999). Since invertebrate surveys began, the most consistently abundant taxa have been the Ostracoda (seed shrimps), Corixidae (water boatmen), Dytiscidae (predaceous diving beetles), Hydrophilidae (water scavenging beetles), Chironomidae (midges) and Ceratopogonidae (biting midges). Several taxa abundant in shallow water and emergent habitats are probably important shorebird foods; for example, corixids, hydrophilid beetles, and chironomid larvae (Freehling et al. 2002). Beetles of the genus Bledius (*Staphylinidae*) are an abundant and potentially important food source for Snowy Plovers (*Charadrius alexandrinus*; Freehling et al. 1999).

Invertebrate species have colonized and established populations in the constructed wetlands in patterns similar to those observed in similar habitats. Other studies show early dominance by crustaceans, followed by increasing numbers of insects, followed by increasing dominance by predaceous insect species. Soil samples of wet to moist mudflat habitat at the constructed wetland, Lake Holloman, and Stinky Playa show that the majority of invertebrate composition is Diptera (primarily chironomids and ceratopogonids (Freehlings et al. 1999). Freehling et al. (2002) found that chironomids, water boatmen (*Hemiptera*), aquatic beetles (*Hydrophilidae*), and moist-soil inhabiting beetles (*Staphylinidae: Bledius* spp.) were early colonizers of the wetland. As of September 2001, populations of these and other taxa had become well established. In addition, diversity and numbers of predaceous insects (*hemipterans*, aquatic beetles, and dragonfly/damselfly larvae) had increased (Smith et al. 2003).

Johnson and Freeling (2005) found that ongoing drought and inadequate water delivery to the wetland ponds had greatly reduced diversity and precluded further development of the macroinvertebrate community in the constructed wetlands (Johnson and Freehling 2005). Habitats for aquatic macroinvertebrates are affected when water levels and availability fluctuate. According to Smith et al. (2016b), two important habitat types are (1) moist-soil environments on mud flats and salt flats and (2) shallow-water habitats with or without emergent vegetation.

Little work has been done to document the insect fauna in gypsic environments (Hicks and Whitcomb 1996). Research in lower elevation areas of the Chihuahuan Desert in New Mexico and Texas identified three leafhopper specialists within grassland communities dominated by either gyp grama (*Bouteloua breviseta*), gyp dropseed (*Sporobolis neaeyi*), or inland saltgrass (*Distichlis spicata*). These species are *Athysanella blockerii*, *A. stylosa*, and *A. pastora* (Hicks and Whitcomb 1996). This study found leafhopper composition was explained almost entirely by the plant composition of gyp communities. These plant communities are well represented on HAFB and may host these endemic insect fauna (Hicks and Whitcomb 1996).

GSUs

HAFB has collaborative natural resource management responsibilities for GSUs located on WSMR and McGregor Range (see Figure 2.1.1-1. Location of Holloman AFB and GSUs and Appendix D. Memoranda of Agreements and Cooperative Agreement). Red Rio Bombing Range, Oscura Bombing Range, and RATSCAT Advanced Measurement Site (RAMS) lie entirely within the boundaries of the US Army WSMR and Centennial Bombing Range lies within the US Army McGregor Range. HAFB has not conducted formal surveys on GSUs in over 10 years. Therefore, it is a priority goal to conduct planning level surveys in the near future. For additional descriptions of each GSU see Sections 2.1.1 Location and Area; 2.2.3 Geology and Soil; 2.3.1 Ecosystem Classification; & 2.3.2 Vegetation.

Red Rio Bombing Range

There is high wildlife diversity in the Red Rio Bombing Range, in part due to variability in elevation (average elevation is 6,000 feet) and high diversity of plant communities. This region provides suitable habitat and extensive ranges for Native American pronghorn (*Antilocapra americana*), mule deer, coyote, and bobcat (*Lynx rufus*). Oryx also inhabit the range. Most feral horses (*Equus caballus*) have been removed since the summer of 1999 (P. Morrow, WSMR, pers. comm.). Small mammals such as desert cottontail, woodrat (*Neotoma* sp.), and chipmunk (*Tamias* sp.) are common. During surveys conducted in September, 1995, five species of snake, nine lizards, one skink and a turtle were identified (Holloman AFB 1996). Desert sands and alluvial plains within the southern extent of Red Rio Bombing Range are the preferred habitat of the round-tailed horned lizard (*Phrynosoma modestum*), New Mexico whiptail (*Cnemidophorus neomexicanus*), and lesser earless lizard (*Holbrookia maculata*). Striped whipsnake (*Masticophis taeniatus*), mountain patch-nosed snake (*Salvadora grahamiae*), and western whiptail (*Cnemidophorus tigris*) exist in open and sparsely vegetated areas of the alluvial fans and rocky slopes (Degenhardt et al. 1996).

The complex of hills with steep slopes on one side and gentle slopes on the other (known as a cuesta) dissected by drainages and large contiguous areas covered with natural grasses and lowland shrubs and occasional trees for perching makes the Red Rio Bombing Range particularly suitable habitat for birds such as hawks and owls, including great horned owl, red-tailed hawk, prairie falcon, and Swainson’s hawk (Hall et al. 1988, BISON-M 2015). There is a high diversity of small mammals and reptiles in these xeric communities (HAFB 1996). Seventy-three species of birds were observed during surveys conducted in September 1995 within the Red Rio Bombing Range (HAFB 1996).

Oscura Bombing Range

Wildlife, however, is abundant and diverse within the range, due to extensive, nearly contiguous vegetation communities. Bird, mammal, and reptile fauna are similar to those at the adjacent RRBR. Small mammals like the black-tailed jackrabbit forage on grasses, sub-shrubs and cactus. Although the reptiles found within this region are quite common throughout New Mexico, lizards such as the little striped whiptail (*Cnemidophorus inornatus*), desert grassland whiptail (*Cnemidophorus uniparens*), and lesser earless lizard prefer the sparse desert grasslands typical of this area (Degenhardt et al. 1996). Lava flows support a variety of wildlife including deer, badgers, skunks, coyotes, ring-tailed cats and rattlesnakes. During a brief survey in April/May 1996 on the Oscura Bombing Range (average elevation of 4,000 feet), no candidate, threatened, or endangered species were identified within the impact area during surveys (HAFB 1997). Thirty species of birds were identified during the surveys conducted in May 1996 (HAFB 1996).

2.3.4 Threatened and Endangered Species and Species of Concern

HAFB and its GSUs have high biodiversity, including multiple SOC. HAFB manages habitat used by a small number of federal and/or State of NM listed threatened or endangered species including five bird species and one fish species (Table 2.3.4-1. HAFB Threatened & Endangered Species). All of the threatened or endangered birds are considered vagrant except the Peregrine Falcon (*Falco peregrinus*). The White Sands Pupfish (*Cyprinodon tularosa*) is considered threatened under the New Mexico Wildlife Conservation Act and is under review for listing under the Endangered Species Act. The NMDGF is initiating a Species Status Assessment of the pupfish pursuant to the Wildlife Conservation Act, 17-2-37 NMSA 1978 (NMDGF letter dated 14 Feb 18). For more detailed information on the status, threats, and management of these species see Section 7.4.Management of Threatened and Endangered Species, Species of Concern and Habitats.

Other species of conservation concern occur on HAFB including an additional 76 bird species, 22 of which are considered NMDGF SGCN (see Table 2.3.3-7. HAFB Birds of Conservation Concern). Two bat species (Pale Townsend's Big-eared Bat- Corynorhinus townsendii & Spotted Bat - Euderma maculatum) and one reptile species (Desert Massasauga - Sistrurus catenatus) occur on HAFB and are also considered NMDGF SGCN. The following discussion is organized by class and provides a general summary of priority SOC in each class.

Table 2.3.4-1. HAFB Threatened & Endangered Species

Common Name	**Scientific Name**	***State Status**	***Federal Status**	**Presence on HAFB**
Baird's Sparrow	*Ammodramus bairdii*	T	--	Vagrant
Bald Eagle	Haliaeetus leucocephalus	T	--	Vagrant
Least Tern	Sternula antillarum athalassos	E	E	Vagrant
Neotropic Cormorant	*Phalacrocorax brasilianus*	T	--	Vagrant
Peregrine Falcon	*Falco peregrinus*	T	--	Rare to Occasional
White Sands Pupfish	*Cyprinodon tularosa*	T	UR	Translocated Resident Population

*CS=Candidate Species; E=Endangered; T=Threatened; UR=Under Review

MAMMALS

Bats

The Pale Townsend's Big-eared Bat (*Corynorhinus townsendii*) and Spotted Bat (*Euderma maculatum*) are both listed as a SGCN in the SWAP (NMDGF 2016a). Both of these species have been documented in the surrounding area (draft WSMR INCRMP 2014) and were listed in HAFB's previous INRMP's. According to previous HAFB INRMPs, Townsend's big-eared bats were mist-netted over Camera Pad Pond in June, 1999 and in a 1996-1997 survey, a Cinetheodolite Missile Tower was used commonly as a night roost for small bats (probably small-footed myotis) (Johnson et al. 1997a). Neither species was detected during the last bat survey (ESI 2011). See Section 7.4 for more details on species status, potential threats, and HAFB management strategies.

Rodents

A survey was recently conducted by TAMU in 2016-2017 (Pierce et al. 2017) to determine the presence or absence of the federal and NM State endangered New Mexico Jumping Mouse *(Zapus hudsonius*) on HAFB. According to preliminary result this species was not identified in any of the camera trapping data. Management of rodent species is discussed in more detail in Section 7.11 Integrated Pest Management Program.

Carnivores

Currently no known federally or state listed carnivore has been documented on HAFB.

Artiodactyla

No known federally or state listed artiodactyla species documented on HAFB.

BIRDS

At least 264 bird species are documented on HAFB & BWWSA (Appendix H. HAFB Bird Species Inventory-Inventoried Bird Species), 81 species are currently listed by at least one agency or organization as a SOC (see Table 2.3.3-7. HAFB Birds of Conservation Concern). NMDGF classifies 26 bird species on HAFB as SGCN (NMDGF 2016a). A total of 58 species of birds have been documented as breeding on HAFB (see Appendix H. HAFB Bird Species Inventory-Breeding Birds), 16 of which are also considered SOC (see Table 2.3.3-7. HAFB Birds of Conservation Concern). Table 2.3.3-7. HAFB Birds of Conservation Concern, lists all birds of conservation concern recorded during recent Envirological Services, Inc. (ESI) and NHNM surveys (ESI 2007, 2007b, 2009, 2009b, 2010; Smith and Johnson 2006, 2012, 2013; Smith et al. 2003, 2016, 2016b; Johnson et al. 2011, 2011b, 2016, 2017; Sadoti et al. 2016; Freeling et al. 2017; Petersen et al. 2017; NHNM 2017) shading indicates which species of conservation concern are known breeders at HAFB (Freeling et al. 2017; Petersen et al. 2017; NHNM 2017).

Federal and State Threatened & Endangered Bird Species

The following provides brief descriptions of the five bird species which occur on HAFB that are listed under the Endangered Species Act (ESA) or the NM Wildlife Conservation Act as Threatened or Endangered (Table 2.3.4-1 HAFB Threatened & Endangered Species). All of these species are considered vagrant or accidental visitors on HAFB except the Peregrine Falcon (*Falco peregrinus*) which is sighted on HAFB rarely to occasionally. For more information about the management of these species see Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats.

Baird's Sparrow (*Ammodramus bairdii*) – typically occur in relatively undisturbed grasslands and are rarely reported in New Mexico. The Baird's sparrow was not sighted on HAFB during the 2011-2014 NHNM surveys. Baird's sparrows have no legal protection under the Endangered Species Act but they are protected by the MBTA and are listed by the State of NM as threatened. It is also listed on NHNM's 2017 checklist as a vagrant species indicating sightings have been documented in the past but more research is needed to determine when and where. The Baird's Sparrow is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016).

Bald Eagle (*Haliaeetus leucocephalus*) and Neotropic Cormorant (*Phalacrocorax brasillianus*): are both listed as threatened by the State of NM. It is unclear if these species have ever officially been documented during HAFB bird surveys but there are recently reported bird sightings at Lake Holloman (Bald Eagle 2016; Neotropic Cormorant 2009; 2015). The NHNM checklist (2017) lists both as vagrant species indicating sighting may have been documented in the past but more research is needed. PIF Land Bird Conservation indicates a 131% population increases for the Bald Eagle since 1970 (PIF 2017; Rosenberg et al. 2016).

Interior Least Tern (*Sternula antillarum athalassos*): Are considered rare vagrants to southern New Mexico wetlands and an accidental visitor to the Holloman wetlands during migration. It is the only federally endangered species detected at HAFB (Freeling et al. 2017). The interior least tern is protected under the Migratory Bird Treaty Act and was listed as federally endangered on 28 May 1985 (Department of Interior 1994). The species is also listed as endangered under NM Wildlife Conservation Act as well as a SGCN (NMDGF 2016a). Additionally it is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016).

Nesting habitat for the interior least tern is similar to that of the snowy plover, where vegetation is sparse and playas are ephemerally inundated. It has been observed nesting in the vicinity of Roswell on the lower Pecos River, Bitter Lake National Wildlife Refuge, and rarely at Bottomless Lakes State Park and Wade's Bog. However, it is unlikely the species would breed at HAFB wetlands because the breeding biology of the species does not favor New Mexico (Mehlhop et al. 1998). The tern nests in colonies on vegetated, bare sand or dried mudflats with low topographic relief. The site of the colony is influenced by changes in cover, human disturbance, or flooding. An abundance and high density of small prey fish up to 4 inches in length is required for suitable nesting habitat which the LHWC does not support. Nesting colonies are often near those of other species, such as the snowy plover (Mehlhop et al. 1998, Rosenberg et al. 2016).

Peregrine Falcon (*Falco peregrinus*): listed as threatened by the State of NM but was removed from the federal Endangered list in 2005. According to NHNM, peregrine falcons are occasionally present at HAFB during summer and winter and are rare during spring and fall (NHNM 2017). The Peregrine falcon uses the wetlands as foraging habitat. This species has been observed taking blue-winged teal (*Anas discors*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), and sandpiper species (M. Proctor, D. Ripley, A. Ripley, and H. Reiser, pers. comm.). PIF Land Bird Conservation indicates a 105% population increase for the Peregrine Falcon since 1970 (PIF 2017; Rosenberg et al. 2016).

Northern Aplomado Falcon (*Falco femoralis septenrionalis*): is a raptor species of particular concern in Chihuahuan Desert grassland. The species was listed as Endangered by the USFWS in 1986 (USFWS 1986) and by the State of New Mexico in 1990 (New Mexico Department of Game & Fish [NMDGF] 1991). The USFWS in cooperation with the Peregrine Fund, BLM, Turner Endangered Species Fund, DoD and other agencies, released an experimental population of over 80 Northern Aplomado Falcons on WSMR near HAFB (Johnson et al. 2017). Therefore individuals from this experimental population might be sighted at HAFB. According to surveys conducted by NHNM for Northern Aplomado Falcon and other raptors at Holloman AFB from 2009 through 2016 (Johnson et al. 2017), no Aplomado Falcons were detected on any of the surveys and no previous raptor or targeted Northern Aplomado Falcon survey detected the species at HAFB (Envirological Services, Inc. (ESI) 2006, 2007, 2008, 2009). We can find no record of sightings on HAFB, but an Aplomado Falcon was seen as recently as 2014 about 25 km west of Las Cruces, NM (about 120 km southwest of HAFB; eBird 2013) and on WSMR in 2015 (Eco Inc 2017).

Species of Greatest Conservation Need (SGCN)

The following provides brief descriptions of bird species which occur on HAFB that are not listed under the Endangered Species Act (ESA) or the NM Wildlife Conservation Act as Threatened or Endangered but are considered SGCN. SGCN listed as vagrant on HAFB are not included in the descriptions below. For more information on management of bird SGCN see Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats.

Bank Swallow (*Riparia riparia*): Are habitat generalists that nest in burrows typically near the top of a vertical bank (Terres 1982). They are rare on HAFB during spring and fall and occasional during the summer (NHNM 2017). There is no known evidence of Bank Swallow nesting on HAFB. PIF Land Bird Conservation lists the Bank Swallow as one of the Common Birds in Steep Decline (CBSC). Bank Swallows have seen an 89% decline in numbers since 1970 (PIF 2017; Rosenberg et al. 2016).

Cassin's Sparrow (*Peucaea cassinii*): are Chihuahuan Grassland birds that are in decline. Breeding has been documented on HAFB. This species is uncommon in the spring but common in the summer and rare in the fall (NHNM 2017). PIF Land Bird Conservation indicates a 24% population increase since 1970 (PIF 2017; Rosenberg et al. 2016).

Chestnut-collard Longspur and McCown's Longspur: In southern New Mexico Chestnut-collared Longspur and McCown's Longspur are often seen within, or in association with, open grassland habitats with open stands of creosote bush and large succulents (USDA 1991). On HAFB they are uncommon in the fall and winter (NHNM 2017). Both species are listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016). Future studies should focus on determining longspur occurrence and density on HAFB, which would inform habitat suitability models. Surveys should occur during fall migration and winter periods. Habitat selection variables should be measured to understand how management activities influence these species.

Common Nighthawk (*Chordeiles minor*): This species is considered a habitat generalist and is listed by PIF as a CBSC that has seen a 58% population decline since 1970 (PIF 2017; Rosenberg et al. 2016). They are rare in the spring on HAFB (NHNM 2017).

Eared Grebe (*Podiceps nigricollis*): Are in the family Podicipedidae, and mainly feed on aquatic and land insects and their larvae (BISON-M 2015). Eared Grebes are found in in the LHWCA and breeding has been previously documented on HAFB. This species is common during spring and fall migration and rare in the summer and winter (NHNM 2017).

Golden Eagle (*Aquila chrysaetos*): Golden eagles weigh from 7 to 13 pounds and adults and have a wingspread of 6 to 7 1/2 feet. Females are about one-third larger than males and their plumage color changes with age. Birds in their first year are predominantly dark brown, with considerable areas of white on the underside of their wing flight feathers. The tail has a broad white band with a dark terminal band at the tip. The back of the neck may or may not appear gold or bronze, depending upon light conditions and the individual bird. Adult eagles are dark brown or bronze (O'Gara, 1994 cited on BISON-M 2015).

Golden Eagles were formerly classified as a SGCN. PIF Land Bird Conservation indicates a 6% population increase since 1970 (PIF 2017; Rosenberg et al. 2016). On HAFB this species is occasional in the spring and fall and rare in winter (NHNM 2017). The abundance and habitat preference of this species on HAFB is poorly understood. More focused research is needed in the future to determine habitat suitability for this species on main base, BWWSA, and HAFB GSUs.

Loggerhead Shrike (*Lanius luduviaianus*): This grassland bird is small and gray with black wings and tail. It also has broad black lines through the eye meeting over the bill which is heavy and hooked (Robbins et al. 1966). They consume large insects and small mammals and frequently impale their prey on thorns or barbed wire (BISON-M 2015). On HAFB this species is common in all seasons and breeding has been documented on base (NHNM 2017). The species is listed by PIF as a CBSC that has seen a 74% population decline since 1970 (PIF 2017; Rosenberg et al. 2016). This species breeds between May and July and if their nest is destroyed they will often renest (Porter et al. 1975).

Long-billed Curlew (*Numenius americanus*): Is a grassland breeding bird that prefers to nest in a damp grassy hollow or on slope and occasionally near dry cow patties (BISON-M 2015). This species is rare in the spring and fall and an uncommon nester in the summer (NHNM 2017).

Sagebrush Sparrow (*Artemisiospiza nevadensis*): Rare in the spring, uncommon in the fall and common in the winter (NHNM 2017).

Scaled Quail: is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats and PIF Land Bird Conservation indicates a 67% population decrease since 1970 (PIF 2017; Rosenberg et al. 2016). They are uncommon on HAFB in all season (NHNM 2017).

Vesper Sparrow (*Pooecetes gramineus*): PIF Land Bird Conservation indicates a 30% population decrease for the Vesper Sparrow since 1970 (PIF 2017; Rosenberg et al. 2016). They are rare on HAFB in spring and fall but common in summer (NHNM 2017). There is no known evidence of Vesper Sparrow nesting on HAFB.

Virginia's Warbler (*Oreothlypis virginiae*): Are occasional visitors to HAFB in the fall (NHNM 2017). They are listed on PIF's "R" Yellow Watch List for species that are not declining but vulnerable due to their small range or population and moderate threats (PIF 2017; Rosenberg et al. 2016).

Western Bluebird (*Sialia)*: They are primarily found in Douglas-fir, redwood, ponderosa pine, western white pine-larch, lodgepole pine, fir-spruce, aspen (hardwood), chaparral, and pinyon juniper forests but sometimes in Chihuhuan Desert Grasslands (USDA 1991). PIF Land Bird Conservation indicates a 36% population increase since 1970 (PIF 2017; Rosenberg et al. 2016). Western Bluebirds are occasional visitors to HAFB in the winter (NHNM 2017).

Western Snowy Plover (*Charadrius alexandrinus nivosus*): In comparison to other shorebirds, the plover tends to be compact, chunky, and short-necked with a very short bill (see Figure 2.3.4-2. Snowy Plover). This species is common in the LHWC during spring and summer and rare during the fall (NHNM 2017). It is protected under the Migratory Bird Treaty Act, is a SGCN (NMDGF 2016a) and is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016).

Figure 2.3.4-2. Snowy Plover, Photo by Michael L. Baird from the Lake Holloman Wetland Complex Area Invertebrate and Bird Monitoring 2016 Final Report

Snowy Plover breed in small numbers on Stinky Playa and Lagoon G and are fairly abundant during migration (Freehling et al. 1999). Snowy plovers arrive in New Mexico in late March and breed in late April and May (possibly later if a second brood occurs). Numbers of snowy plovers peak from April through June, and again in August (Freehling et al. 1999). Snowy plovers are probably out of the state by November, although there are a few winter records in the southeast. In New Mexico, the snowy plover breeds on barren alkali playas near water (Hubbard 1978). In addition to breeding birds, nonbreeding snowy plovers use the area as a stopover during spring and fall migrations and occasionally during the winter (Mehlhop et al. 1998, Freehling et al. 1999).

They forage at or just under the ground surface for small aquatic invertebrates, insects, worms, and small fish. Examination of fecal collections taken at Lake Stinky revealed that 56% contained Bledius spp. beetle remains, along with ants (*Formicidae*), water boatmen (*Corixidae*), tiger beetles (*Cicindelidae*), shoreflies (*Ephydridae*), and ground beetles (*Carabidae*). Bledius spp. may be an important indicator of habitat quality for the snowy plover and other shorebirds at the Lake Holloman wetlands complex (Mehlhop et al. 1998, Freehling et al. 1999). Much of the preferred snowy plover foraging habitat around Lake Holloman was inundated during construction of the Lake Holloman constructed wetlands throughout 1997 and the number of snowy plover pairs nesting on Holloman AFB was reduced during that time. Birds apparently moved to Lagoon G, which had been drained as part of the construction (Freehling et al. 1999). See breeding bird section below for recent study results.

<u>White-faced ibis (Plegadis chihi):</u> The white-faced ibis is a long-legged wader with a long decurved bill and is commonly documented on HAFB in Spring and Summer (NHNM 2017 checklist). It is a HAFB SOC observed regularly at the LHWC during migration periods. It has no legal protection under the ESA or NM Wildlife Conservation Act, but it is a protected species under the MBTA. The species has been previously documented as breeding in the LHWC. See breeding bird section below.

Western Burrowing Owl (*Athene cunicularia hypugea*) Listed by NHNM (2017) as uncommon in the spring, summer and fall. The Western burrowing owl (BUOW [*Athene cunicularia hypogea*]) is a NM SGCN (NMDGF 2016a), US Fish and Wildlife Service (USFWS) Bird of Conservation Concern (BCC, USFWS 2008), BLM Sensitive Species (Biota Information System of New Mexico [BISON-M] 2015), and DoD Partners in Flight (PIF) Sensitive Species (DoD PIF 2014). It is associated with grassland habitats in the western United States and is one of the more common SGCN that breeds on HAFB. BUOW do pose a BASH hazard (see Section 7.12 for more information). PIF Land Bird Conservation indicates a 35% population decrease since 1970 (PIF 2017; Rosenberg et al. 2016).

BUOWs prefer open, treeless areas with short vegetation in grassland habitats and utilize burrows. Suitable nesting habitat at HAFB often tend to be located near areas of high human activity, such as the HSTT, airfield, or cantonment area, and can be of natural or artificial origin. Figure 2.3.4-3. Burrowing owl located across from Building 1266 on Holloman Air Force Base. However, BUOW have been previously documented in Hay Draw, an isolated area with low human activity in the northeastern portion of the base. The BUOW is a year-round resident and has been a successful breeder (Johnson et al. 1997).

Figure 2.3.4-3. Burrowing owl located across from Building 1266 on Holloman Air Force Base. Photograph by A. Harvey.

Insects such as grasshoppers (Orthoptera), butterflies and moths (Lepidoptera), and beetles (Coleoptera) make up a large percentage of food items in western burrowing owl diets (Johnson et al. 2016). Informal observations of prey remains at burrows indicate that breeding owls consume several species of beetles, grasshoppers, lizards, small rodents, and passerine birds (H. Reiser, 49 CES/CEIEN pers. comm.). There was also evidence that owls were foraging on spadefoot toads in rainwater collected between the rails of the HSTT. BUOW at HAFB may be taking advantage of the insects and bats attracted to street and runway lights near the airfield, as well as small sinkholes in the gypsiferous soils. BUOW activities near the runway do not appear to adversely impact military mission; however, there is a concern regarding burrows near runway lights. Personnel at the HSTT are generally able to set up equipment, cameras, and mobile launchers to avoid burrows; however, camera set-up can occur extremely close to burrow entrances.

Previous Studies

The HAFB Natural Resources Program (49 CES/CEIEN) has been involved with a number of BUOW research investigations on HAFB in cooperation with UNM (NHNM), NMSU, and others such as Hawks Aloft and ESI. Periodical surveys of BUOW on HAFB include revisiting historic nesting burrows, monitoring reproductive success, and evaluating artificial burrow use. See Table 2.3.4-4. Summary of Burrowing Owl Surveys on HAFB.

Table 2.3.4-4. Summary of Burrowing Owl Surveys on HAFB

Year	Active Nest	SN[a]	Young	Fledglings/SN[a]	%SN[a]	Source
1996	18	7	11	2.14	39	Johnson et al. 1997
1997	19	10	31	2.70	53	Johnson et al. 1997
1998						No Surveys
1999						No Surveys
2000	2	2	5	2.50	100	Borgman et al. 2003
2001	2	2	6	3.00	100	Borgman et al. 2003
2002	3	3	9	3.00	100	Borgman et al. 2003
2003	0	0	0	-	-	49 CES/CEIE
2004	0	0	0	-	-	49 CES/CEIE
2005	1	1	5	5.00	100	Envirological 2007
2006	11	5	12	2.6	45	Envirological 2007
2007	10	10	41	4.10	67	Envirological 2009
2008	24	12	26	2.17	50	Envirological 2009
2009	28	20	66	3.3	71	Envirological 2009
2010	10	2	-	-	20	Johnson and Smith 2012
2011	10	5	-	-	50	Johnson and Smith 2012
2012						No Surveys
2013						No Surveys
2014						No Surveys
2015	9	6	-	-	66.7	Johnson et al. 2016
2016						No Surveys
2017	8	4	-	-	50	49 CES/CEIE

[a]Number of successful nests.

Previous surveys conducted on main base of HAFB:

1996 and 1997: The New Mexico Natural Heritage Program associated with the University of New Mexico (UNM) conducted surveys during the spring and summer of 1996 and 1997. They found the greatest density of occupied and nesting owl burrows was located near the HSTT (Johnson et al. 1997). During that survey, owl burrows were found primarily in sparsely vegetated areas dominated by gyp dropseed/alkali sacaton grasslands (Johnson et al. 1997). Although available burrows existed in less disturbed sites, such as north of Dezonia Road in the northern shrublands area, owls appeared to prefer locations with relatively high human activity, such as the HSTT and the airfield. Johnson et al. (1997) suggested that owls may be avoiding predation by badgers that inhabit habitats with lower human impact, although the owls also rely on badgers and rodents such as prairie dogs for creating the burrows.

<u>2000 to 2002:</u> Hawks Aloft, Inc. found in 2000 that two pair of burrowing owls successfully fledged chicks from natural burrows. Two chicks were fledged along Camera Pad Road and three chicks were fledged near the airfield at Taxiway Alpha. In 2001, two pair fledged a total of six young in two natural burrows: four chicks from the Taxiway Alpha burrow and two along Camera Pad Road. In 2002, three pair were observed but only two fledged chicks (Borgman et al. 2003). Five chicks fledged from the Taxiway Alpha burrows and four chicks along Camera Pad Road using one natural and one artificial burrow (Borgman et al. 2003).

<u>2000-2001:</u> Artificial burrows were installed at fifteen locations by Hawks Aloft, Inc., selected based on areas of historic use data, with three artificial burrows clustered at each site to provide primary and auxiliary burrows for a pair. Thirty-three were installed in November 2000 and twelve more in January and February 2001. Of these 45 burrows, nine were installed along Camera Pad Road east of the Test Track, 30 on both side and at the northern end of the HSTT , and six near Taxiway Alpha at the airfield (which were damaged by rain and subsequently removed) (Borgman et al. 2003).

<u>2003-2004:</u> Informal surveys were conducted in 2003 to 2004 by 49 CES/CEIE. No burrows were officially recorded. Studies conducted after 2003 included evaluating the effectiveness of artificial nest burrows.

<u>2005, 2006:</u> Envirological Services, Inc. (ESI) conducted burrowing owl surveys on HAFB. In the 2005 to 2006 surveys, an additional survey area was added east of the eastern boundary of the HSTT area along a ditch paralleling Camera Pad Road. In 2005, one pair returned to the HSTT area and fledged five young and a solitary male was observed. In 2006, of the 10 monitored pairs, 5 pairs successfully fledged twelve young, resulting in an average of 2.6 chicks per breeding pair for the population that did breed or 1.18 per pair of the total number of pairs documented (Mershon and Bailey 2006).Breeding was not successful at six of the original eleven nests: two burrows were abandoned for unknown reasons, a third had signs of predation and an adult flushed from the burrow when approached, and a fourth pair may have shifted to another burrow for breeding. Only one pair in the ditch successfully reproduced (Mershon and Bailey 2006). Artificial burrow were repaired in 2006 and those originally located on the taxiway were removed for flight safety.

<u>2007, 2008:</u> There was no formal burrowing owl surveys in 2007 but numbers were obtained from a combination of other survey data and represent “at least” numbers (ESI 2009). In 2008, 24 active nests were recorded with 12 successfully fledging a total of 26 young (ESI 2009).

<u>2009:</u> During 2009, ESI documented a total of 28 pairs of breeding Burrowing Owls with active nests. Twenty of these pairs fledged at least one young, for a 71% success rate. Sixty six fledglings were documented from these 20 nests for an average of 3.3 fledglings per successful nest, and 2.36 fledglings per active nest (ESI 2009).

<u>2010-2011</u>: NHNM (Johnson and Smith 2012). In 2010, 10 BUOW territories were located; five with breeding pairs and five with individual owls. Two of the breeding pairs had successful nests. In 2011, there were 12 territories. Five had successful nesting attempts, four had failed attempts, one was held by an unmated male seen in April but not later, one was held by an individual seen only once, and the last showed evidence of owl use at a burrow but no owls were observed. Surveys conducted by Guy et al. (2012) identified a total of eight active nests during the 2011 nesting season and three nest were considered successful. Guy et al. (2012) concluded that Burrowing Owl habitat is at risk of encroachment by invasive plants, particularly African rue (*Peganum harmala*) and Russian thistle (*Salsola kali*), which

render burrows unusable. African rue grows in dense stands, reducing the amount of open area preferred by Burrowing Owls, and Russian thistle can physically obstruct burrows.

2012-2014: No surveys were conducted.

2015: Between April and July 2015 NHNM conducted visual and auditory surveys and visited 23 historical burrow locations (Johnson et al. 2016). Nine active nests were located six of which fledged young.

2016: No surveys were conducted.

2017: HAFB 49th Civil Engineering Squadron (CES) personnel conducted BUOW surveys between 20 June and 24 July 2017. Survey protocol followed methods utilized in previous years, in which historical burrows (both natural and artificial) were identified and surveyed to determine viability and occupancy. Historic burrows were located using coordinates provided by previous reports. CES personnel visited each burrow location and recorded the viability of a burrow (condition or potential to support a nest), occupancy of the burrow if inhabited, and if the burrow was a natural or artificial structure. Upon visiting a location, each burrow was marked using a Garmin Montana 680t™ GPS unit in order to update historic locations. Additionally, CES personnel conducted vehicular road surveys across the installation to locate any new burrowing locations. If an owl or potential burrow site was located, CES personnel surveyed the site as per the previous methodology. Upon the completion of historic site surveys and road surveys, visited burrows were mapped using ArcGIS® version 10.3™ with supporting data such as viability, occupancy, and structure type recorded as attributes. From this, total population, number of active nests, and successful nesting percentage was calculated (Table 2.3.4-4. Summary of Burrowing Owl Surveys on HAFB.) A total of 80 burrow locations were documented by CES personnel. 17 burrows were either artificial or constructed from anthropogenic resources (i.e. culverts) and 63 were natural burrows (Figure 2.3.4-5. Origins of burrows surveyed on HAFB in 2017). Of these sites, 72 were historical burrows and 8 were new locations (Figure 2.3.4-6. Location of historic and new burrows on HAFB). Of the 8 occupied burrows, seven were new burrow locations and one was a historical burrow (HAB_060). A total of 20 individual owls were counted, with at least 8 of the 20 owls being verified as juveniles. During the course of this survey it was determined that all thirteen remaining artificial burrow territories (each containing a cluster of three burrows) were unoccupied and not viable. Future projects should include repairing or installing new artificial burrows.

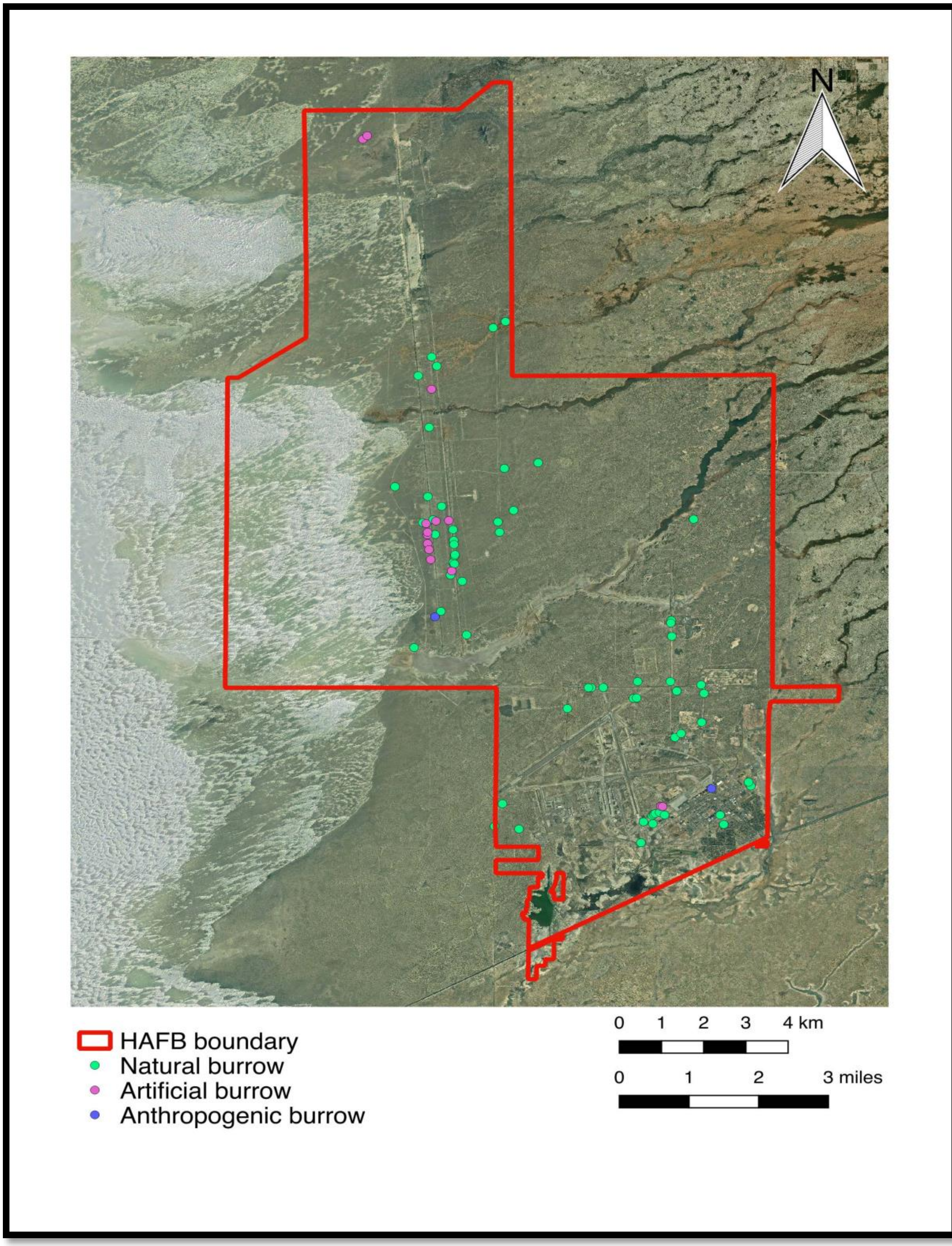


Figure 2.3.4-5. Origins of burrows surveyed on HAFB in 2017. From Draft report (Turner et. al. 2017).

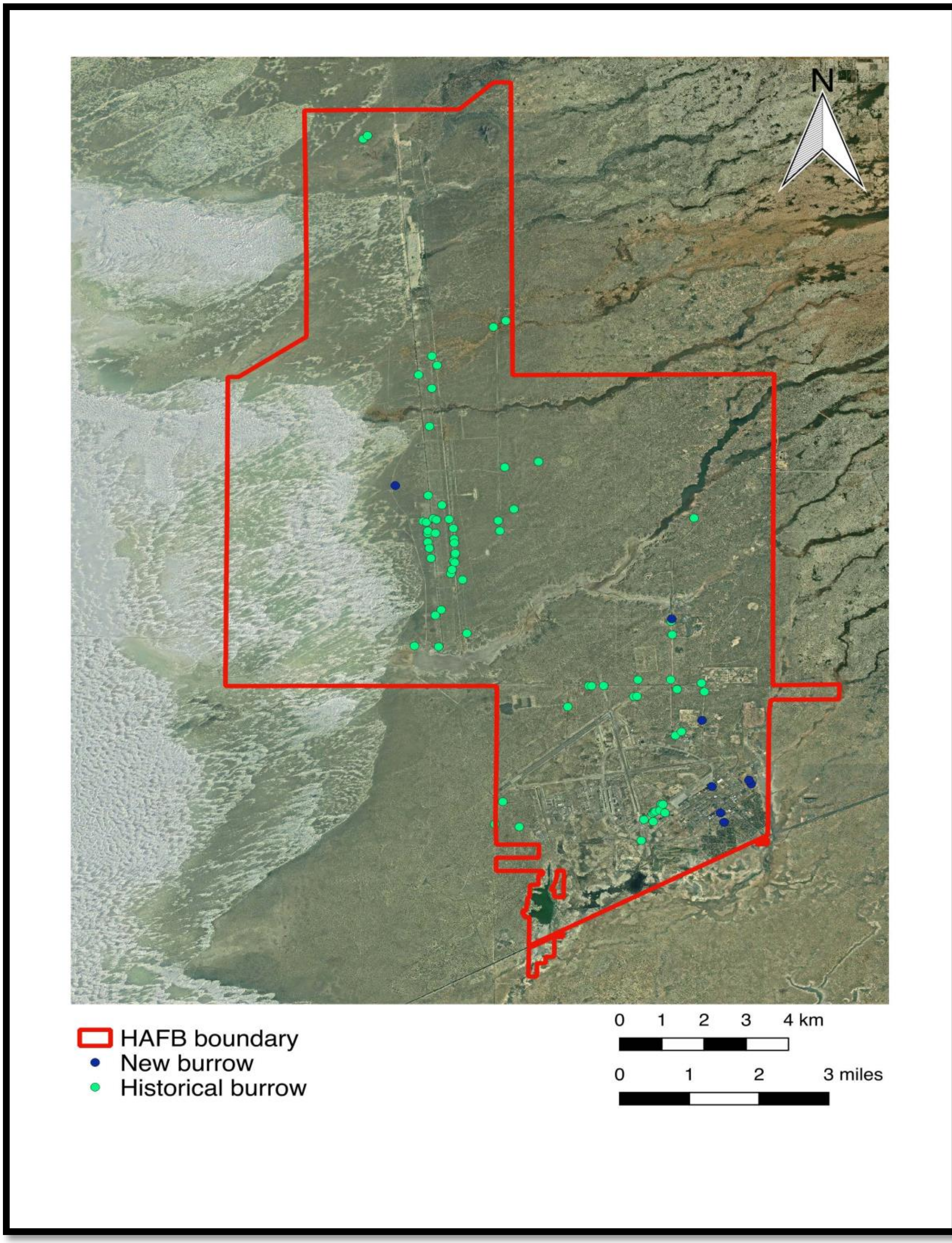


Figure 2.3.4-6. Location of historic and new burrows on HAFB.
From Draft report (Turner et. al. 2017).

BUOW Trends

Overall, the numbers of breeding pairs found on HAFB and the total number of young produced were considerably higher in 2006 than in any year since 1997. This dramatic increase follows several years of no production (2003 and 2004) and only one pair successfully reproducing in 2005. This notable upswing in the population on HAFB, along with the observed population increase at Kirtland AFB in Albuquerque, New Mexico as recorded in surveys conducted by Envirological Services, Inc. in 2006, appeared to be encouraging signs regarding the regional status of the burrowing owl (Mershon and Bailey 2006). The increase in young peaked in 2007 (41) and was again high in 2008 (26). Numbers of nest and fledglings declined in 2010 and 2011 (Johnson and Smith 2012) and remained lower in 2015. It is uncertain if this is due to predation, human disturbance, invasive species, or the lack of suitable natural and/or artificial burrows.

Other SGCN – All of the species listed below are considered vagrants on HAFB (NHNM 2017).

American Bittern (*Botaurus lentiginosus*) – Nests and forges in wetlands while wading a few inches above and below water level, on the ground (BISON-M 2015).

Bendire's Thrasher –Identified as New Mexico's number one priority species by NMACP. The Bendire's Thrasher has seen 87% population declines since 1970 and is listed on PIF's Landbird Conservation Plan as highest priority on the Red Watch List (PIF 2017; Rosenberg et al. 2016). Information regarding most aspects of this species' biology and population is lacking (NHNM 2017). There is no known evidence of Bendire's Thrasher nesting on HAFB.

Lucy's Warbler (*Oreothlypis luciae*) – PIF Land Bird Conservation indicates a 24% population increase since 1970 (PIF 2017; Rosenberg et al. 2016).

Mountain Bluebird (*Sialia currucoides*) – PIF Land Bird Conservation indicates a 21% population decrease since 1970 (PIF 2017; Rosenberg et al. 2016).

Mountain Plover (*Charadrius montanus)*: This species is not protected under the ESA but it is a SGCN (NMDGF 2016a). The Mountain Plover is listed on PIF's Landbird Conservation Plan as highest priority on the Red Watch List (PIF 2017; Rosenberg et al. 2016). In NM, nesting habitat of mountain plovers is primarily on either grazed or ungrazed grasslands where blue grama (*Bouteloua gracilis*) or buffalo grass (*Buchloe dactyloides*) dominates. Breeding birds have also been found at playas and other sites associated with bare ground and disturbance (i.e., windmills and stock tanks) (Sager 1996).

It is considered a vagrant in the Lake Holloman area but at least one successful nesting attempt occurred over 30 years ago (NHNM 2017). A pair with two chicks was observed in the Lake Holloman area in June 1987 (Sager 1996). Other sighting have occurred in summer and in September (Mehlhop et al. 1998). No known recent sightings on HAFB (NHNM 2017 checklist as vagrant).

Olive-sided Flycatcher (*Contopus cooperi*) - is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016). PIF Land Bird Conservation indicates a 78% population decrease since 1970 (PIF 2017; Rosenberg et al. 2016).

Sprague's Pipit (*Anthus spraqueii*) - is listed on PIF's "D" Yellow Watch List for species with population declines and moderate to high threats (PIF 2017; Rosenberg et al. 2016). PIF Land Bird Conservation indicates a 75% population decrease since 1970 (PIF 2017; Rosenberg et al. 2016).

Breeding Birds

Wetlands

The long-term use of the LHWC area by migrating, resident and nesting birds has been well documented (USAF 1995; Freehling et al. 2002, 1999). Although previous studies documented nesting, no systematic searches for nests or the fate of nests was quantified prior to 2003 (Smith et al. 2003). The most well documented breeders in LHWC are American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), western snowy plover (*Charadrius alexandrinus nivosus)*, and killdeer (*Charadrius vociferous*) (Smith et al. 2003; Smith and Johnson 2005; Petersen et al. 2017). Gadwall (*Anas strepera*), Mallard (*Anas platyrhynchos*), American Coot (*Fulica americana*), Pied-billed Grebe (*Podilymbus podiceps)*, Eared Grebe (*Podiceps nigricollis*), and Northern Shoveler (*Anas clypeata*) have also been observed on nests or with fledglings (Smith and Johnson 2005). Snowy egret (Egretta thula) and white-faced ibis (*Plegadis chihi*) nested at the wetlands in 1999 (Freehling et al. 1999).

American avocet (*Recurvirostra americana*): According to recent breeding bird surveys (Petersen et al. 2017) avocets are the most common nesting wetland bird at the LHWC. Although the species breeds throughout NM the core population centers for the American avocet in New Mexico are at the Bitter Lakes National Wildlife Refuge and HAFB. It is protected under the MBTA, The U.S. Shorebird Conservation Plan for the Intermountain West Region (IMW) discuss the importance of hyper saline lakes to breeding avocets (Oring et al. 2011).

Avocet habitat in New Mexico is primarily saline ponds or shallow alkali wetlands or lake mudflats with no vegetation. It nests in wet areas on soft substrate with minimal vegetation near the water's edge or on small islands with patches of saltgrass or open salt pans near playas. Avocets no longer use an area for nesting once wetland vegetation, such as cattails, sedges, and rushes, begins to be established (Smith et al. 2003).

Black-Necked Stilt (*Himantopus mexicanus*): Black-necked stilts nest on raised areas near edges of ponds and wetlands and on short emergent vegetation from at least 4 May until 13 July, with the peak between 19 and 31 May (Johnsgard 1981; Smith et al. 2003).

Western Snowy Plover (*Charadrius alexandrinus nivosus*): The mudflats within the Lake Holloman public access area wetland complex are a known breeding area for this species (Hubbard 1978) and they have successfully nested at the LHWC every year since at least 1994, when surveys were started. The U.S. Shorebird Conservation Plan-IMW estimates a total of approximately 14,000 to 16,000 breeding Snowy Plovers occur in IMW (Oring et al. 2011). Snowy plovers nest on dry salt flats, flat playas, and other similar habitats, often on small rises. They may need some structure such as a tuft of grass, tumbleweed, iodinebush, or *Salicornia spp*., but can nest on completely bare area, as they typically do at HAFB. Nests are simple scrapes, generally on slopes of less than 3% (Partners in Flight 2003). Nesting in the Lake Holloman wetlands complex occurs from at least 16 May through 11 July, with the peak between 13 and

19 June (Smith et al. 2003). The species is most common at Stinky Playa on mudflats within close proximity to standing water and dense clumps of inland saltgrass. Surveys in 2001 indicated that the number of breeding snowy plovers in the wetlands complex have not increased greatly since the constructed wetlands were created (Freehling et al. 2002).

Killdeer (Charadrius vociferous): Killdeer typically nest on open sites above surrounding flat terrain from at May through July, with a peak populations in June.

White-faced ibis (*Plegadis chihi*): The white-faced ibis is a long-legged wader with a long decurved bill and is commonly documented on HAFB in Spring and Summer (NHNM 2017 checklist). The white-faced ibis is a HAFB SOC observed regularly at the LHWC during migration periods. It has no legal protection under the ESA or NM Wildlife Conservation Act, but it is a protected species under the MBTA.

White faced ibis nest above shallow water in emergent vegetation, in low trees or shrubs, or on the ground in small islands. It commonly uses mudflat and emergent vegetation at the wetlands on HAFB (Mehlhop et al. 1998), when periodic flooding provides a continuous supply of invertebrate forage. Five white-faced ibis remained in the constructed wetlands from November 1998 until summer 1999. White-faced Ibis were observed throughout the breeding season in 2001, but no evidence of nesting was found during the surveys (Smith et al. 2003). No White-faced-Ibis were documented nesting during 2016 wetland nesting success surveys (Petersen et al. 2017)

Results of Shorebird Nesting Studies

Studies were conducted in the Lake Holloman wetlands complex to better understand use of the complex as a breeding area for wetland birds, including documenting and quantifying nesting success, evaluating suitability of breeding habitat for shorebirds and waders, identifying data on the aquatic macroinvertebrate prey base, and providing recommendation for managing resources in the complex. Surveys were conducted in 2001, 2002, (Smith et al. 2003); 2003, 2004 (Smith and Johnson 2005) and again in 2016 (Petersen et al.2017). See Table 2.3.4-7. Shorebird Nests at the Lake Holloman Wetland Complex, 2001-2004 & 2016.

Table 2.3.4-7. Shorebird Nests at the Lake Holloman Wetland Complex, 2001-2004 & 2016

Species	2001/% success	2002/% success	2003/% success	2016/% success
American avocet	56/14.3	59/37.3	29/3.5	52/5.8
Black-necked stilts	33/18.2	9/20	12/16.7	9/0
Snowy plover	11/54.5	37/43.2	18/38.8	9/44.4
Killdeer	7/42.9	4/25	0-	9/22.2

Nest success of the four most common LHWCA nesting wetland bird species. Known success is based on nests where hatchlings were observed. Success rates 2001 – 2003 from Smith and Johnson 2004). Success rates 2016 (Petersen et al. 2017).

Surveys in 2001 indicated that the number of breeding snowy plovers in the wetlands complex had not increased greatly since the constructed wetlands were created. In contrast, the numbers of American avocets and black-necked stilt nests have increased substantially since 1998 to 1999, with the first evidence of avocet breeding in 1998 (2 nests). In 2001, 56 avocet nests were monitored, including 15 at

Lake Holloman, 19 in the CW, 7 in Stinky Playa, 3 at the experimental ponds, and 2 at Lagoon G. By 2001, there were 33 stilt nests, 25 in the CW, 7 at Lake Holloman, and 1 at Lagoon G, a substantial increase over the 10 nests found in 1999 (Freehling et al. 2002).

After 2001, although Lagoon G continued to receive effluent, drought combined with low delivery of water resulted in water levels that were not sufficiently high to flow into Lagoon G and vegetation rapidly encroached into shorebird nesting and foraging habitats.

In 2002 and 2003, avocets, stilts and snowy plovers nested only at Lake Holloman and Lagoon G and very rarely at the experimental ponds. No shorebirds nested at Lagoon G in 2003, but American coots, pied-billed grebes and northern shovelers nested there. Stilts and avocets nested only at Lake Holloman throughout the summer of 2003. The number of nests of avocets, stilts and snowy plovers were reduced drastically in the constructed wetlands (Lagoon G) from 2001 to 2004 due to encroachment of vegetation from low water levels (Smith and Johnson 2004, Table Number of Shorebird Nests at the Lake Holloman Wetland Complex, 2001-2004). In 2002, drought conditions and inability to deliver adequate water to the constructed wetlands had many negative effects, including reducing the numbers of stilts and stilt nests present during the 2002 breeding season compared to 2001 as well as reduction of white-faced ibis and green herons (Smith et al. 2003).

In 2004, much of the previously-existing shorebird habitat in the area had been overgrown by plants, mostly salt cedar, alkali bulrush, and five-horn smotherweed. Stinky Playa was relatively unchanged. Lake Holloman shorebird habitat was similar to that in 2001 except that, as water levels decreased in 2003 and 2004, more shoreline habitat was created at the north end. The ponds of the constructed wetlands and lagoon G had much less shorebird habitat than in previous years because of encroachment of dense vegetation. In general, numbers of shorebirds decreased in 2004 compared to previous years and numbers of American coots and pied-billed grebe (*Podilymbus podiceps*) increased.

The decreased numbers of stilts was associated with a decrease in unvegetated beach and loss of appropriate emergent vegetation. Lagoon G was invaded by salt cedar, bulrush, and cattail, none of which support stilt nests. The habitat was suitable for the pied-billed grebe, northern shoveler, and American coot, all of which prefer nesting in shallow wetlands with emergent vegetation (Smith and Johnson 2005).

In addition to decreased nesting in 2004, a decrease in abundance of every species of shorebird occurred (non-breeding birds). Snowy plovers and avocets had much lower numbers post-breeding (July) in 2004 than in previous years, probably because less foraging habitat was available. Stilts occurred in numbers only slightly lower than in previous years, possibly because they forage on vegetated shorelines and areas of emergent vegetation as well as open areas (Smith and Johnson 2004; Smith et al. 2016).

In 2016, another shorebird nesting study was completed (Petersen et al. 2017). See Table 2.3.4-7. Shorebird Nests at the Lake Holloman Wetland Complex, 2001-2004 & 2016, for a summary of nest success rates and Figure 2.3.4-8. through Figure 2.3.4-12. for Shorebird nest locations at LHWCA. Water availability and water use priorities for the wetlands had changed since 2003, modifying the suitability and availability of wetland bird nesting habitat. Therefore, nesting success was monitored in 2016 and assess the effects of water and vegetation management on abundance and success of nesting wetland birds at the LHWCA (Petersen et al. 2017).

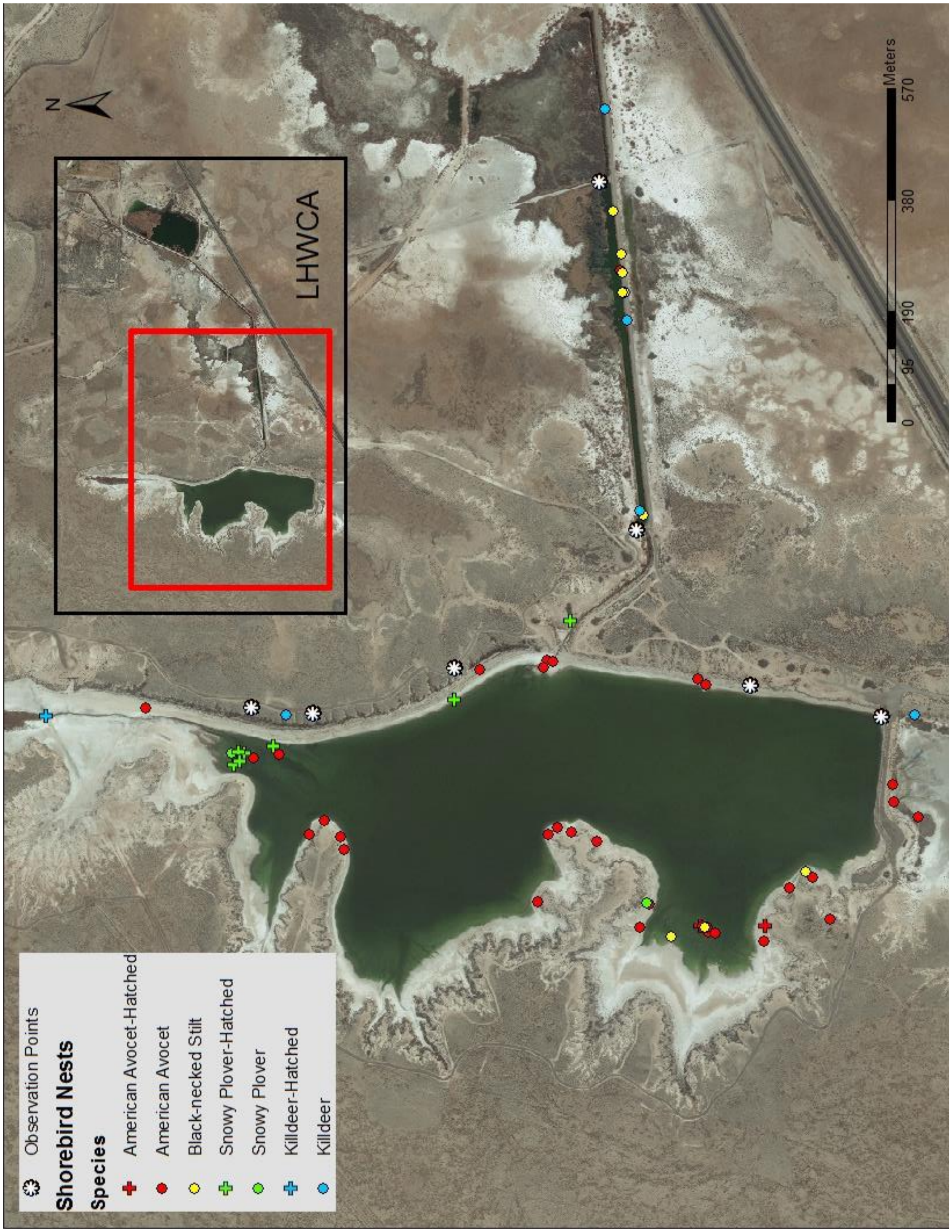


Table 2.3.3-8 HAFB Possible Bird Species of Concern (SOC)

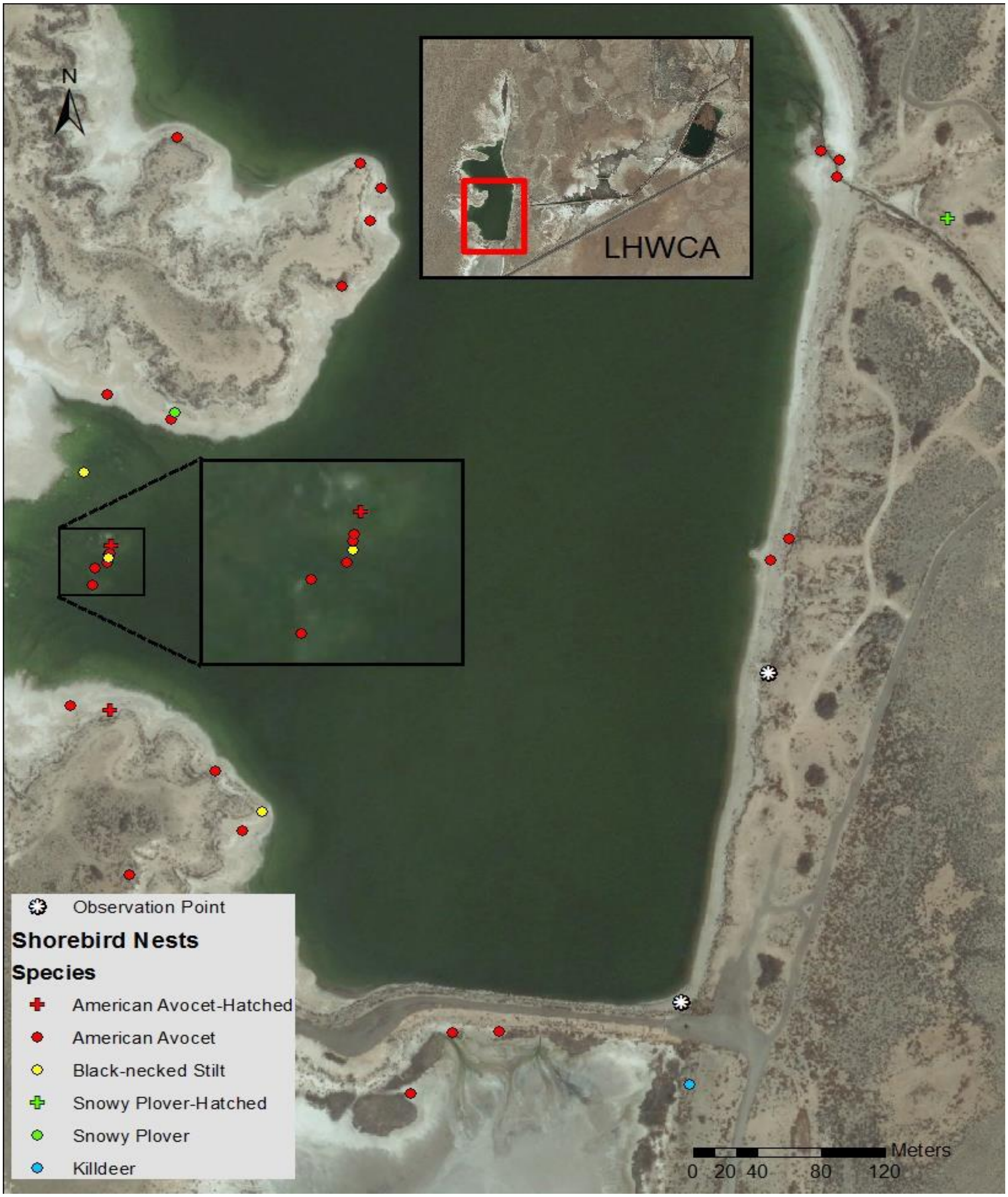


Figure 2.3.4-9. Shorebird nests at LHWCA, southern portion of Lake Holloman and northern portion of Stinky Playa, 2016. (Petersen et al. 2017)

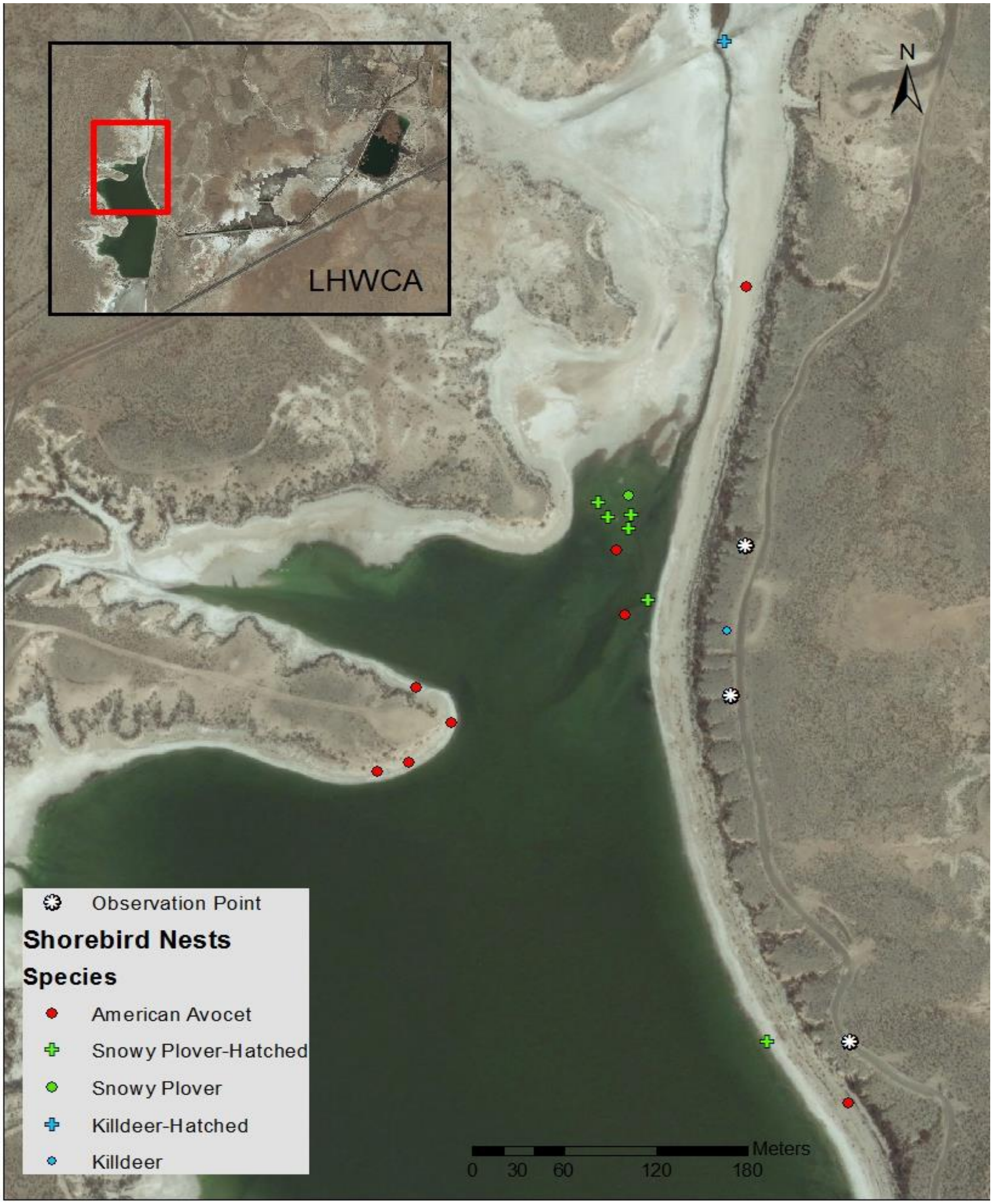


Figure 2.3.4-10. Shorebird nests at LHWCA, northern portion of Lake Holloman, 2016. (Petersen et al. 2017)

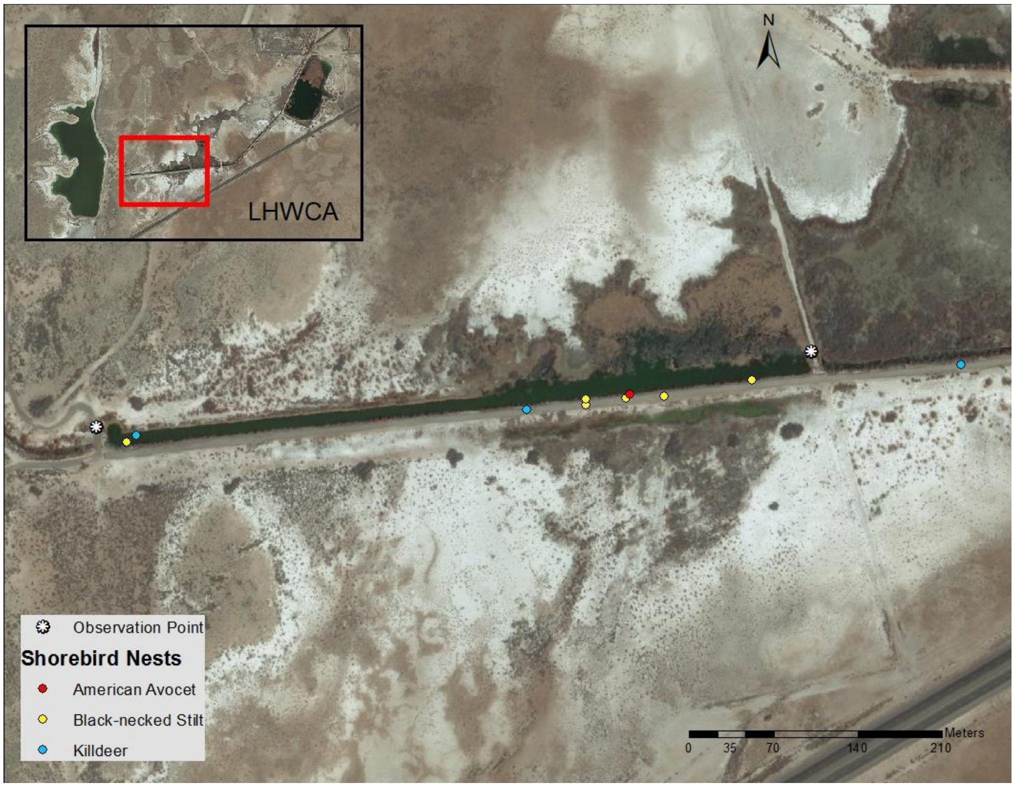


Figure 2.3.4-11. Shorebird nests at LHWCA canal, 2016. (Petersen et al. 2017)

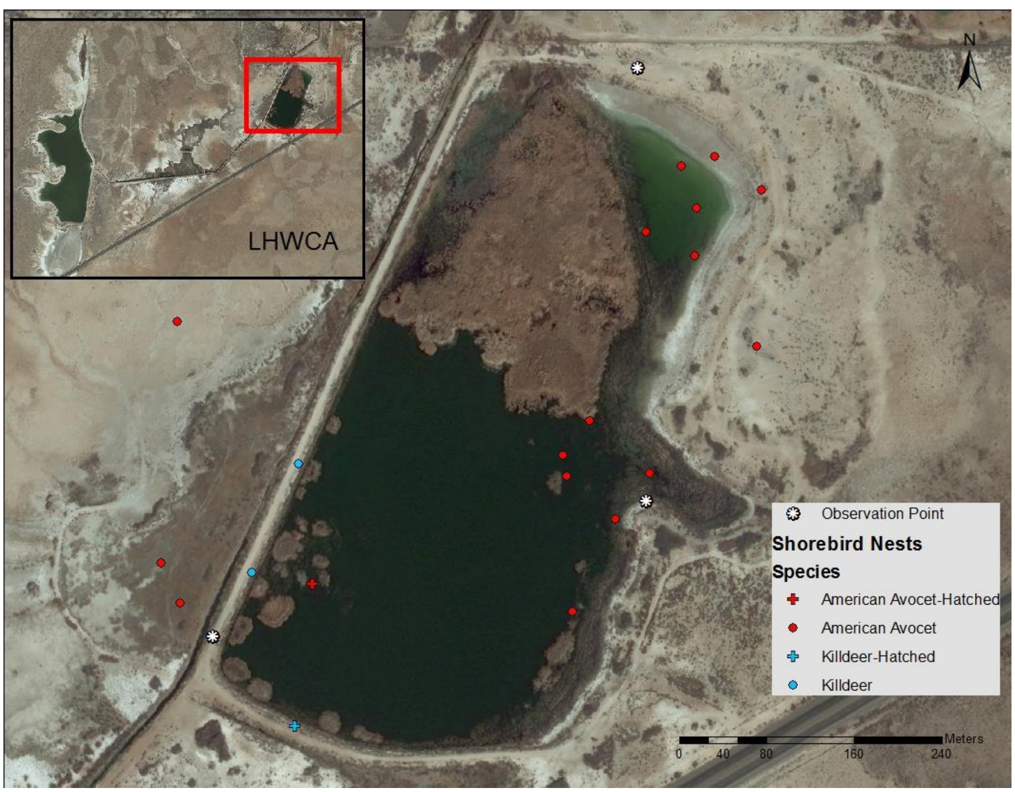


Figure 2.3.4-12. Shorebird nests at LHWCA, Lagoon G, 2016. (Petersen et al. 2017)

In 2016, depredation by coyotes and raccoons was apparently the leading cause of nest failure. The camera trap trained on American Avocet nest 32 on Pond 1 documented nest depredation by a coyote (Figure 2.3.4-13. Coyote depredating American Avocet nest 32.) Flooding was another cause of nest failure. Low-lying nests are susceptible to flooding during heavy rains, especially those built late in the breeding season during the monsoons (Petersen et al 2017). Disturbance was a third cause of nest failure at the LHWCA (Petersen et al. 2017). Birds disturbed by utility terrain vehicles (UTVs) or people walking nearby leave their eggs vulnerable to heat and may subsequently abandon them, after which they are easily depredated by coyotes or raccoons.

Petersen et al. (2017) believes nesting success data for four years of nest monitoring indicate that the wetlands provide more suitable nesting habitat for Snowy Plover and Killdeer than for American Avocet and Black-necked Stilt.

Figure 2.3.4-13. Coyote depredating American Avocet nest 32. from Petersen et al. 2017.

Breeding Raptors

The raptor species known to breed on HAFB are the Swainson's hawk, great horned owl, burrowing owl, American kestrel, Harris's hawk, and barn owl (Natural Heritage New Mexico 2017). It is also possible that red-tailed hawks also breed on base, but no known nests were observed during the surveys. Most stick nests were observed on power poles in the central portion of the base, with some of the nests known to be used by Swainson's hawks.

AMPHIBIANS & REPTILES

Texas Horned Lizard (*Phrynosoma cornutum*)

Texas Horned lizards, also known as “horned toads,” are small, flat-bodied brownish or grayish lizard that lives in hot arid and semiarid sandy habitats in the western United States and Mexico in open areas with sparse plant cover (see Figure 2.3.4-14. Texas Horned Lizard). They are commonly found in loose sand or loamy soils because they dig in soils for nesting, cooling, and hibernation. They bury themselves in the fall for hibernation and emerge in the spring when the temperatures are sufficiently warm. The first few hours of the day are spent basking, usually flattened against a rock or on sloped soil, until their body temperature is raised sufficiently for foraging. They feed primarily on ants. After feeding, when ground temperatures become too hot, they partially conceal themselves in the shade and then bury themselves in the sand in the evening. They readily flee if disturbed while feeding, but are easily caught if dug in for the night. Primary modes of protection are camouflage, running quickly in short bursts, puffing up its body and spines, and shooting blood from its eyes. Mating occurs in late spring, with egg-laying occurring a few weeks later.

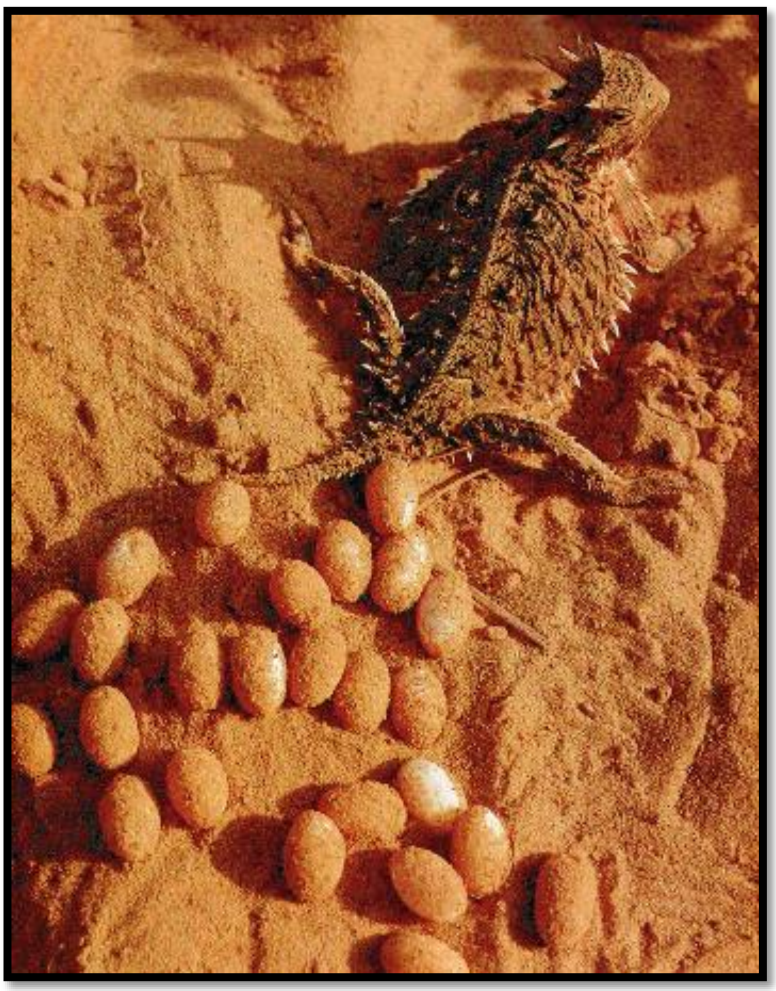


Figure 2.3.4-14. Texas Horned Lizard *(Photo by Wyman Meinzer)*

In the past, the Texas Horned Lizard was a focus of herpetofauna research on HAFB because it is a SOC due to population declines in Texas. An initial Texas Horned Lizard survey was conducted on the main base and the BWWSA as part of the HAFB Sensitive Species Management Plan (Mehlop et al. 1998). Survey results indicate the lizard appears to be abundant on HAFB (Mehlhop et al. 1998) and was found within the major plant community types on both the main base and BWWSA.

Texas horned lizard was the most abundant reptile found on Camera Pad Road and had low densities along Range Road 9 and Vandergrift Road, while Boles Acres Road had the highest lizard density, indicating high abundance in the BWWSA (Mehlhop et al. 1998). The silty loams and sparsely vegetated shrublands of the lower alluvial fans provide good burrowing habitat and provide an adequate food supply of harvester ants (Pogonomyrmex spp.) (Johnson et al. 1997a, Mehlhop et al. 1998). Lizard activity on HAFB is greatest in late May and early June, coincident with the mating season. In the summer of 1995, lizard activity peaked from 0730 to 1115 hours and again from 1725 to 2000 hours, when ground surface temperatures ranged from 78°F to 100°F (Mehlhop et al. 1998). The preferred diet of the Texas horned lizard on HAFB is harvester ants (Pogonomyrmex spp.); however, it appeared that honeypot ants (Myrmecocystus spp.) were more common throughout the base. On Boles Wells Wellsfield, harvester ant nests appeared to be abundant along roadsides (Mehlhop et al. 1998).

Desert Massasauga (*Sistrurus tergeminus*)

The Desert Massasauga (*Sistrurus tergeminus*) was recorded during the Hobert et al. 2016 survey of herpetofauna along the dune edge west of the HSTT. This species is considered a NM SGCN (2016). The species was petitioned for listing under the ESA in 2010, a positive 90-day finding was issued in 2012 and it is scheduled for a status assessment in 2019. More research is needed in the future to determine population density, range, and habitat. This recently acquired survey data will be used to inform future survey efforts. See section 7.4. for information on management of this species.

FISH

White Sands Pupfish

The White Sands pupfish (*Cyprinodon tularosa*) (Figure 2.3.4-15. White Sands pupfish (*Cyprinodon tularosa*)) is endemic to the Tularosa Basin. It is considered threatened under the NM Wildlife Conservation Act and a SGCN (NMDGF 2016a). It is currently managed under the jurisdiction of NMDGF. The species was petitioned for listing under the ESA in 2007 and a positive 90-day finding was issued in 2009. The species is currently under review and scheduled to begin a species status assessment by the USFWS. A cooperative agreement (originally signed in 1994 and updated in 2006) exists between WSMR, HAFB, WSNM, NMDGF, and USFWS to manage this species. A Conservation Plan was completed in 2015 (WSMR & HAFB 2015) to guide conservation of this species on WSMR and HAFB. See Section 7.4 for more information on species management.

Figure 2.3.4-15. White Sands pupfish (*Cyprinodon tularosa*)

Four extant populations of pupfish are protected within the basin: three are on White Sands Missile Range (WSMR) and one on Holloman Air Force Base (HAFB). The two native populations of pupfish occur entirely on WSMR in Salt Creek and Malpais Spring (WSMR & HAFB 2015). The two translocated populations were introduced in 1970: the Mound Springs populations on WSMR and the Lost River population on HAFB (Pittenger and Springer 1996, Pittenger & Springer 1999, Mehlhop et al. 1998, WSMR & HAFB 2015). The refuge populations were established and are maintained as a hedge against catastrophic events. Figure 2.3.4-16. Pupfish Protected Habitat Zones, shows the general location of pupfish habitat on HAFB.

Pupfish prefer habitat with clear, shallow, alkaline springs and streams. In the Lost River, nonnative salt cedar lines the banks of much the dune segment of Lost River, with inland saltgrass (*Distichlis spicata*) as a common ground cover. Pickleweed (*Allenrolfea occidentalis*) is common in the ephemerally wetted flats. Algae and pondweed (*Potamogeton sp.*) are common aquatic species, especially in the more lentic sites, and provide forage for the pupfish (Pittenger 1994; Pittenger 1998; G. Harper and E. Muldavin 1998).

The Lost River is considered to be a natural refuge for the Salt Creek population. Lost River is a perennial relatively stable aquatic habitat and is similar to Salt Creek in terms of salinity, water temperatures, and physical habitat characteristics (Blue Earth 2010). On HAFB, the Lost River pupfish population is distributed in three stream segments or reaches that are connected only intermittently during periods of high precipitation: 1) Upper Reach, 2) Middle Reach, and 3) Lower Reach. See Figure 2.3.4-17. Expansion and contraction of Lost River surface waters October 2010-September 2011 and Figure 2.3.4-18. Lost River Reaches and Surface Water Descriptions from Guy et al. 2012.

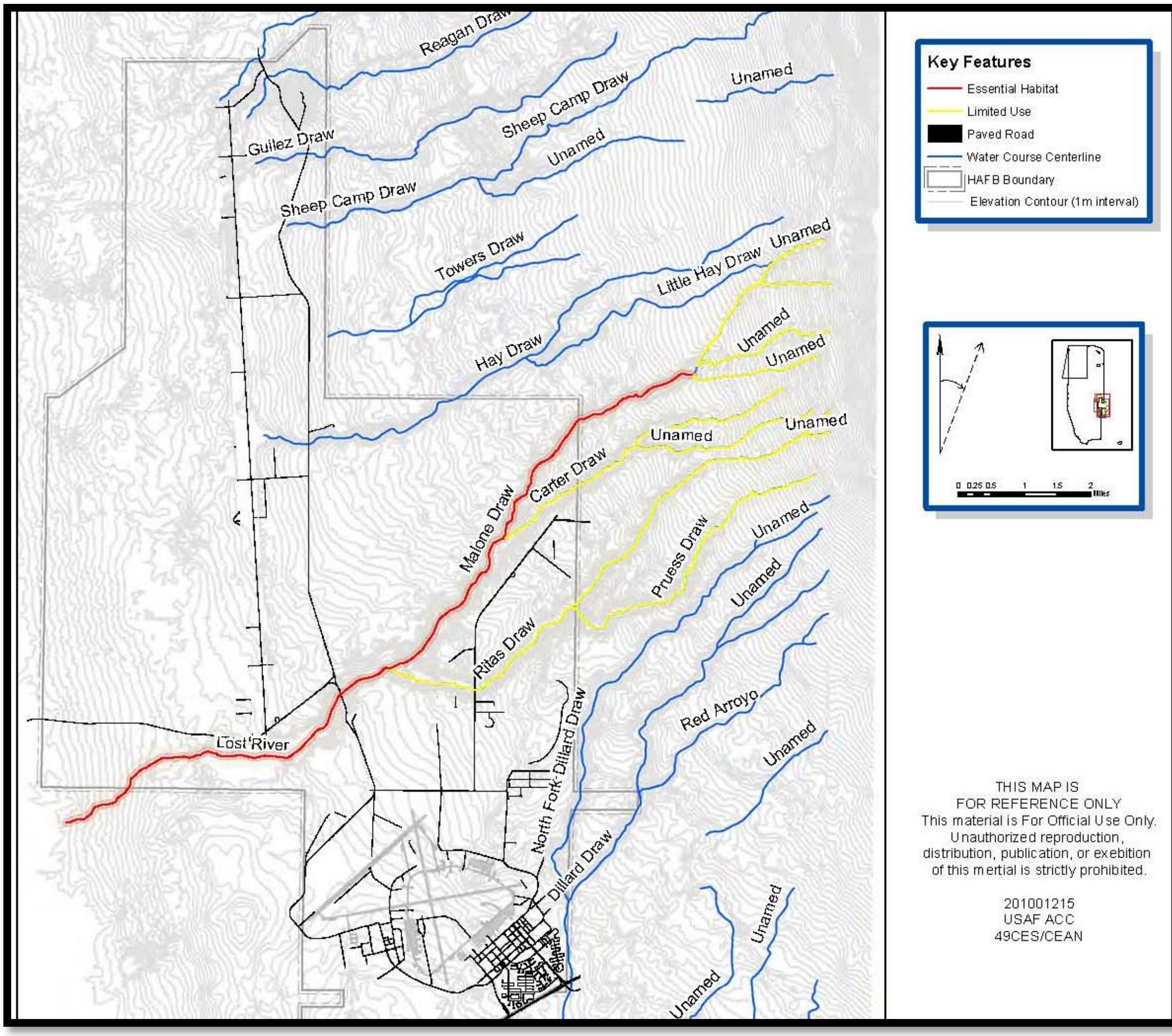
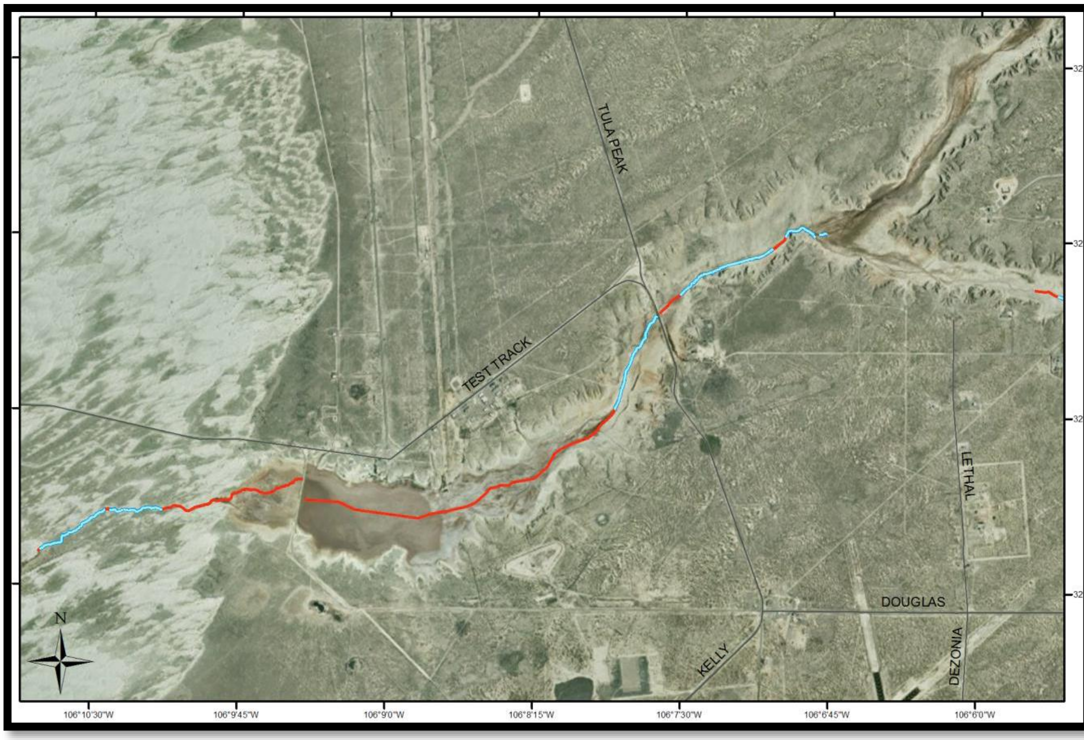


Figure 2.3.4-16. Pupfish Protected Habitat Zones.



2.3.4-17. Expansion and Contraction of Lost River surface waters October 2010-September 2011.

Blue: perennial water. **Red:** intermittent water.

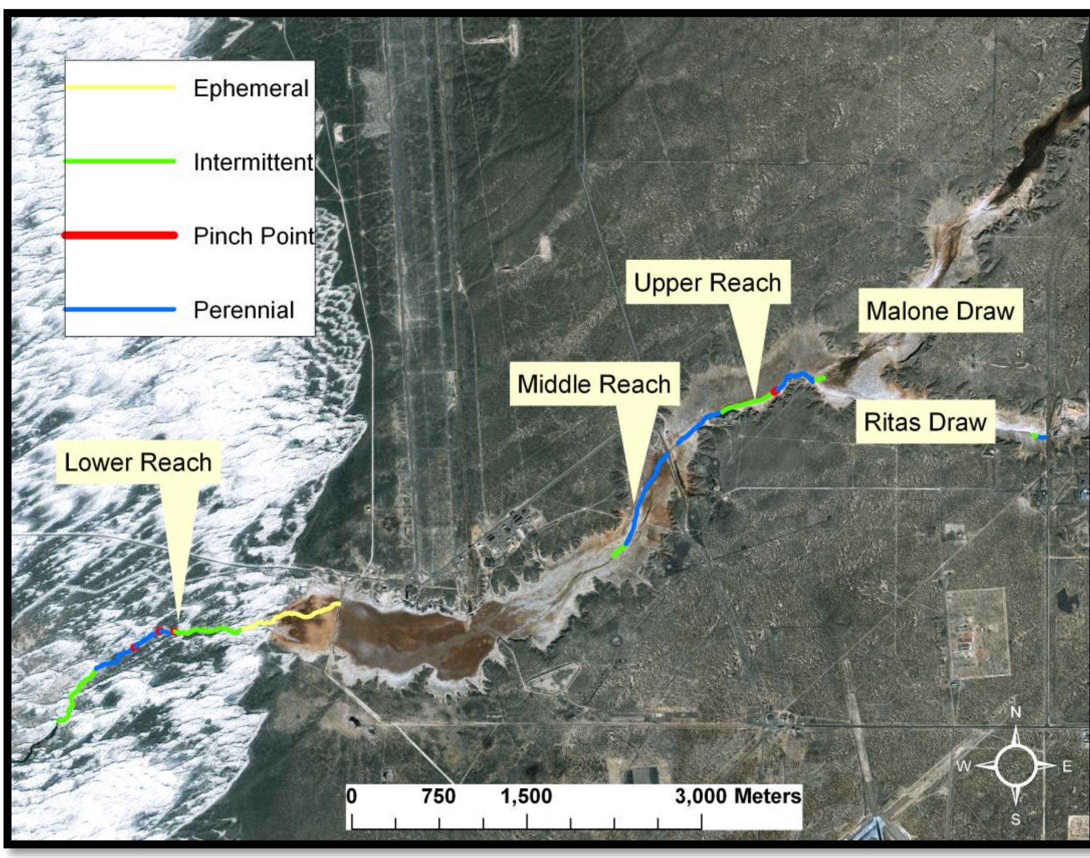


Figure 2.3.4-18. Lost River Reaches and Surface Water Descriptions

Upper Reach or the Malone-Ritas Draw Segment (Figure 2.3.4-18)

The portion of Lost River from the confluence of Malone and Ritas to the east side of Range Road 9/Kelly Road (Pittenger and Springer 1996; Guy et al. 2012). During the 2010-2011 survey (Guy et al. 2012), this reach consisted of two segments of relatively shallow (max. 40 cm) perennial waters. Connecting the two perennial segments is intermittent water with a pinch point just prior to the eastern perennial portion. At this eastern portion is the confluence of Malone Draw (to the north) and Ritas Draw (to the south). The reaches riparian vegetation is dominated by iodinebush (*Allenrolfea occidenta*lis) and saltgrass (*Distichlis spicata*) near the confluence.

Middle Reach or the Trench Segment (Figure 2.3.4-18)

This portion of the Lost River starts at the culvert on the west side of Range Road 9/Kelly Road and continues west until it enters the playa (Lost River Basin) south of the High Speed Test Track (Pittenger and Springer 1996; Guy et al. 2012). This portion of the Lost River was the least variable system with the longest continuous portion of perennial waters available during the 2010-2011 survey (Guy et al. 2012). This portion of the Lost River is deeper and wider for longer stretches than either of the other two reaches. The river channel is greater than 2 m in some portions and water depth range from 3 cm to 110 cm (Guy et al. 2012). There are no obvious pinch points within the Middle Reach. Salt cedar (*Tamarix* spp.) and saltgrass were found along the river within this reach but iodinebush was the dominant species. Given the steep banks, less vegetation occurs in this reach than in the Lower Reach.

Lower Reach or the Dune Segment (Figure 2.3.4-18)

Begins downstream from the playa (Lost River Basin) and continues west to the boundary between HAFB and White Sands National Monument (WSNM) (Pittenger and Springer 1996). During the 2010-2011 survey (Guy et al. 2012), this reach consisted of perennial water with three pinch points, two segments of intermittent water, and ephemeral waters associated with the playa. Vegetation is more diverse in this reach and notably, salt cedar presence (both dead standing and live) is most dense in this reach, making some portions inaccessible (Guy et al. 2012). Saltgrass and other facultative wetland flora were also abundant along this reach. The western most segments of the Lower Reach are well within the gypsum dune fields and the Lost River periodically expands during wet periods onto adjacent WSNM (Pittenger and Springer 1996; Mehlhop et al. 1998; WSMR & HAFB 2015).

Experimental Populations

Populations at the HAFB golf course ponds, Camera Pad Road Pond, and Bradford Spring on HAFB were established in December 2006 by Dr. Craig Stockwell, NDS University using fish from a terminated common-garden experiment. Founding population sizes ranged from 500-6,774, all of Salt Creek lineage (C. Stockwell, DSU pers. comm. 6 April 2010; in Blue Earth 2010 & WSMR HAFB 2015). These sites are considered low habitat quality for sustainable pupfish populations (Blue Earth 2010). On 28 May 2014, pupfish were observed at Bradford Spring but Camera Pad Road pond was found to be dry and the population there was extirpated (WSMR & HAFB 2015). The long-term status of these populations at Bradford Springs and those translocated to the golf course ponds is unknown.

Previous Research & Monitoring Efforts

Monitoring population trends, developing monitoring protocols and genetic research has been the focus of management activities. The following is a list of previous research and management activities:

- A Cooperative Agreement for Protection and Maintenance of White Sands pupfish was signed in mid-1994 by HAFB, WSMR, WSNM, USFWS, and NMDGF, revised in 1998 and most recently renewed in May 2006 (Appendix Memoranda of Agreement and Cooperative Agreements)
- Monitoring the population status of the pupfish at each of the sites over time (J. S. Pittenger, New Mexico Department of Game and Fish, Santa Fe; Pittenger and Springer 1996)
- The genetic relationships of populations of White Sands pupfish. (C. A. Stockwell, North Dakota State University; Stockwell et al. 1998, Jones et al. 1998)
- The relationship between salinity and genetic variation in White Sands pupfish (C. A. Stockwell, North Dakota State University; Stockwell and Mulvey 1998, Miller, K., M.S. Thesis 2001)
- Habitat relationships and pupfish morphology (C. A. Stockwell, North Dakota State University; advised thesis by Schaeffer 1999)
- The costs of parasitism for White Sands pupfish (Cyprinodon tularosa) infected by white grubs (Diplostomatibae). Collyer, M.L. 2000. M.S. Thesis, North Dakota State University, Fargo, North Dakota
- Direct, indirect, and potential effects of salinity on the White Sands pupfish (*Cyprinodon tularosa*) (D.L. Rogowski, North Dakota State University 2004)
- Collyer, M.L., J.M. Novak, and C.A. Stockwell. 2005. Morphological divergence of native and recently established populations of White Sands pupfish (*Cyprinodon tularosa*). Copeia 2005(1):1-11.
- Collyer, M.L., C.A. Stockwell, D.C. Adams, and M.H. Reiser. 2007. Phenotypic plasticity and contemporary evolution in introduced populations: evidence from translocated populations of White Sands Pupfish (*Cyprinodon tularosa*). Ecological Research 22: 902-910
- Blue Earth Ecological Consultants, Inc. 2009. Monitoring and Maintenance Plan for White Sands Pupfish (*Cyprinodon tularosa*). Prepared for the New Mexico Department of Game and Fish, Santa Fe, New Mexico. 51 pp
- Caldwell, J. 2014 White Sands Pupfish Status Report, 2013. Fisheries Management Division, New Mexico Department of Game and Fish, Santa Fe, New Mexico
- White Sands Missile Range and Holloman Air Force Base (WSMR & HAFB). 2015. White Sands pupfish conservation plan. Prepared for White Sands Missile Range and Holloman Air Force Base by Blue Earth Ecological Consultants, Inc., Santa Fe, New Mexico. 121 pp.
- Caldwell, J. 2016 White Sands Pupfish Status Report, 2015. Fisheries Management Division, New Mexico Department of Game and Fish, Santa Fe, New Mexico
- Heilveil, J.S. & Stockwell, C.A. Environ Biol Fish (2017) 100:631. https://doi.org/10.1007/s10641-017-0591-4
- Pittenger, J. Recommendations for Revising White Sands Pupfish Monitoring. 2017. Blue Earth Ecological Consultants

Recent genetics studies conducted on native fish populations compared to translocated fish populations suggest that the Lost River populations is diverging from the source population (Salt Creek). The population is experiencing founder effects as well as fragmentation in response to local ecological conditions (Heilveil et al. 2017). Translocation of fish from Salt Creek to Lost River should continue on an annual basis and possibly in increased numbers (USDOI 2015). Pittenger (2017), has recommended changes to monitoring protocols for Salt Creek and Malpais (Pittenger 2009). New monitoring protocols need to be developed for HAFB in cooperation with White Sands Pupfish Conservation Team to address threats to the translocated population in the Lost River. See Section 7.4 for more information.

INVERTEBRATES

No known federally or state listed invertebrate species documented on HAFB.

2.3.5 Wetlands and Floodplains

History of Constructed Wetlands – Lake Holloman Wetland Complex (LHWC)

The Lake Holloman Wetland Complex (LHWC) area is located in the southernmost part of HAFB. This area comprises approximately 1,341 acres north of U.S. Highway 70 and 110 acres south of the highway. Wetland elevations range from 4,016 feet to 4,052 feet. The area is a remnant of a naturally-occurring playa environment created by depositional processes. Lake Holloman and Stinky Playa, both modified from former large alkali playa lakes, are the dominant physical features within the unit (Figure 2.3.5-1. Aerial View of Lake Holloman Wetlands Complex (LHWC)).

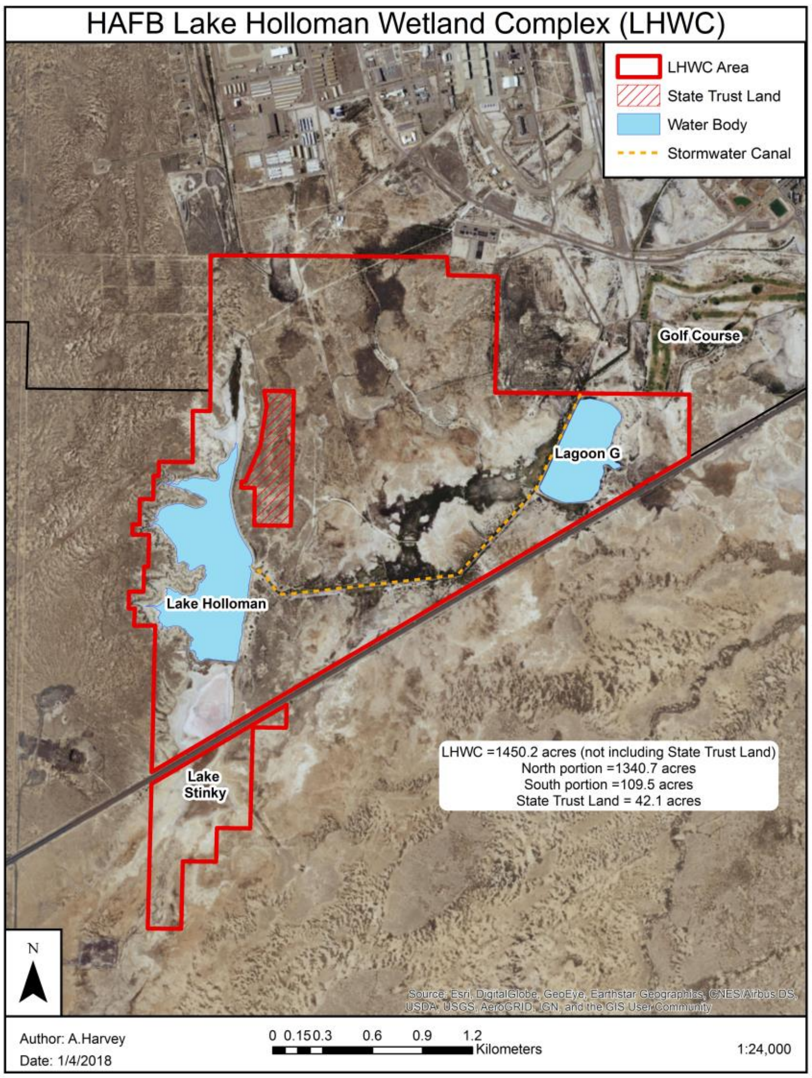


Figure 2.3.5-1. Aerial View of Lake Holloman Wetlands Complex (LHWC)

Lake Holloman was formed in the late 1960s by the construction of a non-engineered dam to store domestic storm water drainage and wastewater discharge. A sewage lagoon system consisting of seven aeration/evaporation ponds held treated wastewater from the base. Discharge from the last sewage lagoon (Pond G) flowed via an open ditch to Lake Holloman.

Wastewater effluent is a valuable resource in the arid southwest. Allocation of this resource on HAFB is governed mainly by the Wastewater Treatment Plant Environmental Assessment (WTP EA, USAF 1995) and detailed management incorporated into the HAFB INRMP. Creating constructed wetlands was selected as the disposal method that would prevent flooding the most effectively as compared with the alternatives considered and was predicted to increase biodiversity compared to existing conditions at the time (HAFB 2004).

The WTP EA states that the proposed action would “permit Base personnel to gain a degree of control over lake levels in both Lake Holloman and Stinky playa. This would facilitate the development of wildlife management plans for both lakes…During periods when the Lake Holloman water level is high, some flow may be permitted to discharge into adjacent Stinky playa for purposes of wetland and wildlife management.” The WTP EA considered an alternative that would use the effluent for irrigating base grass areas, including the golf course; however, the alternative description states that, during the summer months when both irrigation demand and net evaporation would both peak, “lake management requirements would take precedence over landscaped irrigation. As a result, implementation of this alternative would not adversely affect hydrologic flow in the Lake Holloman system” (USAF 1995).

The selected alternative, which created an enhanced wetland system while closing the existing lagoon system, provided for the following effluent flow from the wastewater treatment plant:

- 1.0 million gallons per day to Lagoon G, of which 0.17 million gallons per day would infiltrate into groundwater and 0.18 million gallons per day would evaporate, leaving 0.65 million gallons per day, of which
- 0.5 million gallons per day would further flow into 170 acres of constructed wetlands, all of which would evaporate, and
- the remaining 0.5 million gallons per day would flow directly into Lake Holloman, of which 0.65 million gallons per day would evaporate and 0.62 million gallons per day would infiltrate to groundwater, which supports Lake Holloman (the simultaneous flow of effluent into Lake Holloman and Lagoon G is no longer possible with the upgrade of the pump and pipeline distribution system).

This alternative was intended to preserve the overall hydrologic flow in the Lake Holloman system. Net discharge to Lake Holloman would be similar to the previous conditions and overflow into Stinky playa would occur at the same frequency and at the same level of magnitude as in the past. However, the pipeline and pump capacity could only deliver 250,000 gallons per day to Lagoon G until 2006, when the infrastructure was replaced to provide the total amount to Lagoon G. The WTP EA states: “The development of wetlands in this area would enhance wildlife development in the area and would generally be beneficial to the functioning of the Holloman ecosystem…net discharge to Lake Holloman would continue at existing levels. The hydrology and water quality of Lake Holloman would continue at existing levels. Since Lagoon G would continue to discharge to Lake Holloman, its role as a refuge for the mosquito fish population would not be affected. As a result, the biology of Lake Holloman would be unaffected by implementation of this alternative. In addition, overflow to Stinky playa would remain unchanged over existing conditions. As a result, no impact to biota of Stinky playa would be expected." The Finding of No Significant Impact (FONSI), signed 17 April 1995, states that the water flow would "allow for effluent evaporation needs and promote wildlife habitat in the area."

The WTP EA identifies that the high nutrient levels of Lake Holloman fostered growth of abundant algae and bacteria, providing for abundant insect life, in addition to the mosquito fish, which further attracted numerous shorebirds and waterfowl that feed on the insects and fish to the lake. Lagoon G had better water quality and provided a "significant wildlife habitat and resource." Letters to HAFB in response to the WTP EA from the BLM, Mesilla Valley Audubon Society, USFWS, and the New Mexico Audubon Council all recognized the ecological role that the lake and lagoon plays in providing for waterfowl and shorebird habitat, particularly during spring and fall migration and wintering. The Audubon Council identifies "Lake Holloman and the surrounding area is the most important wetland in Otero County" for diving and dabbling ducks, wading birds, and shorebirds, such as the snowy plover.

The closure of the original wastewater treatment plant and its associated lagoons based on the Federal Facilities Compliance Agreement (FFCA) with US EPA Region 6 and the State of NMED (Verification of completion of closure: sewage lagoons A through G, 30 June 2000) required that the closed lagoons be capped with soil and fenced to eliminate the exposure pathways. The closure are must also be designated as "restricted open space" which means that this area cannot be used for a less restrictive land use unless the potential risks associated with the new land use are re-evaluated and submitted and found acceptable by NMED, as long as the soil cap cover, drainage system, and fence be maintained. The closure of Lagoon G involved no further action in order to:

> *"maintain the crucial wildlife environments that have been created at this pond. The Pond G closure meets human health criteria for the protection of current workers, hunters, and trespassers."*

The final closure plan from NMED (May 1997) further defines "restricted" as:

> *"the US Air Force/Holloman Air Force Base may not use these sites for purposes which would require more restrictive human health risk levels."*

The plan does permit HAFB to discharge sludge to the sludge-drying beds and "discharge treated effluent to the golf course to be used as irrigation water."

The continued use of this area for wildlife, especially water-dependent birds, was supported by the BLM, Las Cruces District Office, Mesilla Valley Audubon Society, USFWS Ecological Services, and the New Mexico Audubon Council (USAF 1995).

Based on the WTP EA, a new wastewater treatment plant was constructed in 1996. It included advanced secondary treatment processes, eliminating the need for the sewage lagoons. Closure through capping of lagoons A through F was completed in August 1999. Pond G was not filled or capped because it was unlined and provided wildlife habitat. To maintain clay hydration and provide added value as wildlife habitat, Lagoon G is required to receive water at all times per the FFCA.

In 1996, in cooperation with the USFWS and based on the WTP EA, HAFB began construction on a system of berms, ditches, and control structures to modify the existing playa system into a constructed wetland. The primary purpose of the new wetland was to provide for disposal of treated sewage effluent from the new wastewater treatment plant. The new wetland roughly encompasses the area between Lagoon G and Lake Holloman (Figure 2.3.5-1. Aerial View of Lake Holloman Wetlands Complex (LHWC)). Prior to the establishment of the constructed wetlands, surface water within this management unit covered 222 acres, including the old lagoons. With the constructed wetlands, surface water can potentially reach 347 acres. The constructed wetlands became operational on 21 November 1997.

Infrastructure Available for Management of Water Levels

The main pipeline from the Wastewater Treatment Plant to the north end of Lake Holloman is a 24-inch gravity line that has the capacity to deliver a maximum of 4.5 million gallons per day from the plant. Three routes, delineated in Figure 2.3.5-2. Routes of water movement and control structures associated with the Lake Holloman Wetlands Complex, carry storm water runoff or treated wastewater effluent through the constructed wetlands: a gravity pipeline to pond 2, a 10-inch forced pipeline to Lagoon G, and the storm water canal. The 10-inch forced pipeline branches from the main line after it leaves the treatment plant and delivers effluent to Lagoon G. A control structure at the southwest corner of Lagoon G provides outflow to the storm water canal immediately to the west of Lagoon G. Three control structures for the constructed wetlands occur between Lagoon G and Lake Holloman along the canal.

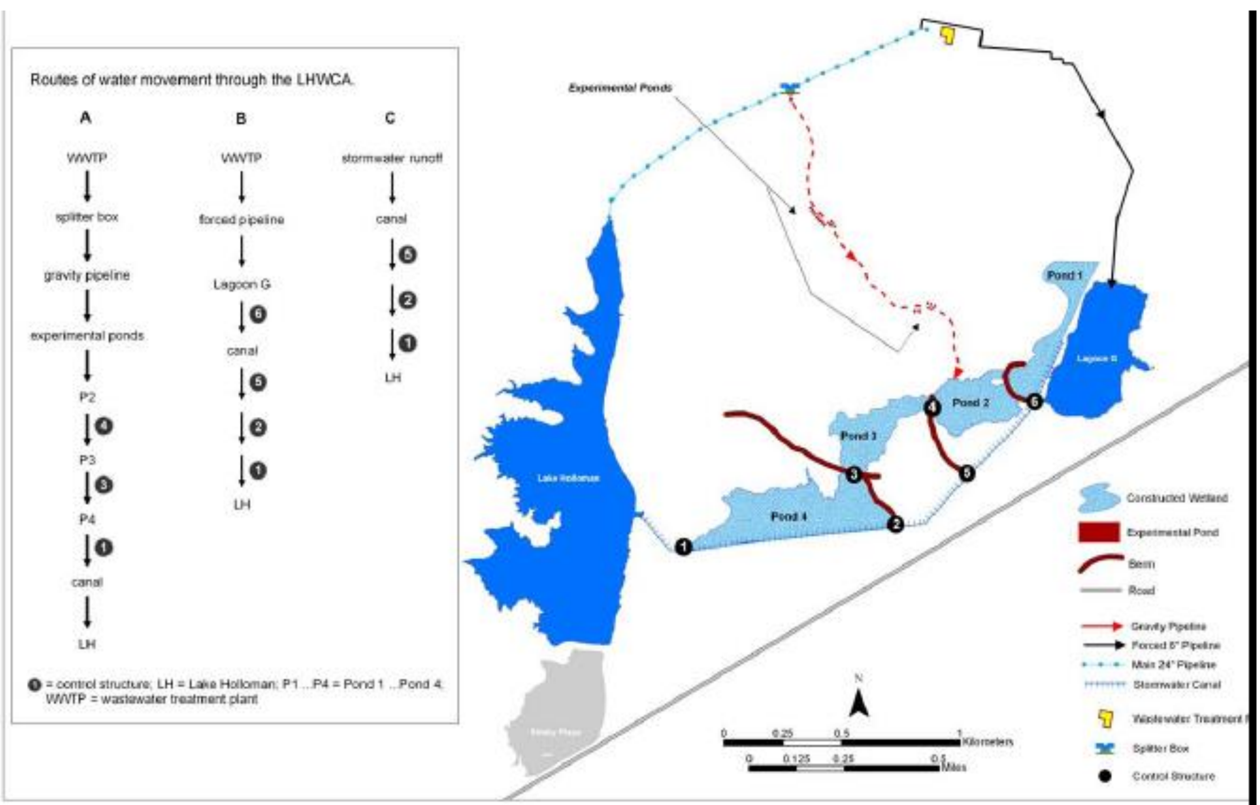


Figure 2.3.5-2. Routes of Water Movement and Control Structures Associated with the Lake Holloman Wetlands Complex

A splitter box, approximately 0.4 miles west of the wastewater treatment plant, allows water to be diverted from the main Lake Holloman line to the constructed wetlands, although this auxiliary line is not frequently used. The splitter box is a gravity-flow manhole with screw-actuated sluice gates set in troughs for two-outlet flow, although this auxiliary line is not frequently used. The constructed wetland complex began operation in November 1997 with the completion of an open-water ditch from the splitter box to Pond 2 of the constructed wetlands. The ditch has been replaced by a gravity pipeline that carries water to Pond 2 (route A, Figure 2.3.5-2. Routes of Water Movement and Control Structures Associated with the Lake Holloman Wetlands Complex).

In 1999, 18 experimental ponds 25 x 50 feet in size were constructed adjacent to the pipeline, between the splitter box and Pond 2. These ponds received water from the pipeline and were used for research on White Sands pupfish between 2001 and 2006, when all surplus fish were translocated to isolated wetlands on the main base. These ponds are no longer used and are being allowed to fall into disrepair, with an ultimate goal of closing the ponds fully by filling them.

Storm water from the main flight line and housing areas flows via open channels that converge northwest of the golf course and run south to the northwest corner of Lagoon G, where the channel connects to the storm water canal. The west berm of Lagoon G forms the east wall of the storm water canal. The canal continues to the southwest and then turns west to Lake Holloman. The three control structures on the canal can be used to divert water to the constructed wetlands (H. Reiser and C. Webb, 49 CES/CEIE, pers. comm.).

Water in the constructed wetlands is impounded in four ponds, contained by a system of earthen berms and connected by control structures for identification and locations of physical features). The five control structures within the constructed wetlands have a half-culvert, drop-inlet design with a vertical riser that accommodates manually-placed wooden stoplogs. Pond water level is designed to be regulated by the height of the stacked stoplogs, and a pond can be drained by removal of stoplogs at the outlet control structure. In addition to closing or opening a control structure, the height of the stoplogs can be used to regulate flow between adjacent ponds. Water flows by gravity from the splitter box through the control structures to Lake Holloman. This path of water movement is shown as route A (Figure Routes of water movement and control structures associated with the Lake Holloman Wetlands Complex) and serves to fill Ponds 2, 3, and 4. Water can also be diverted to Ponds 3 and 4 by closing the lower control structures on the canal. Pond 1 has no water outlet structure but drainage can be regulated to a limited extent by adjusting the height of the stoplogs at control structure 5 (Figure Routes of water movement and control structures associated with the Lake Holloman Wetlands Complex) (Johnson and Freehling 2005).

According to the 1995 WTP EA, the wastewater treatment plant discharges approximately 1 million gallons per day (approximately 370 million gallons per year), and 10% to 20% of the discharge infiltrates into the groundwater, leaving approximately 296 to 333 million gallons of water per year (HAFB 2004). Given an annual net evaporation rate (lake evaporation in inches minus precipitation in inches) of 59 inches per year (considering an average of 8 inches precipitation per year), a substantial portion of the effluent is lost through evaporation. Net annual evaporation from Lake Holloman was estimated to be 0.65 million gallons per day or over 237 million gallons per year. Water in the storm water runoff ditch is also subject to both evapotranspiration and infiltration before reaching the wetlands. The net sum of losses throughout the surface water system prior to enhancing the wetlands was estimated to be 1.14

million gallons per day, or 416 million gallons per year. Groundwater mounds indicate that water from Lake Holloman is lost by infiltration to groundwater (USAF 1995).

However, HAFB unpublished data measuring the daily, monthly and annual average discharge of effluent from the wastewater treatment plant between 1997 and 2006 indicates that the average monthly output ranged from 21.3 and 31.15 MG per month and 256 and 374 MG per year, which is substantially less than 416 MG per year necessary to operate the Lake Holloman Public Access Area wetlands system for effluent management and wildlife habitat estimated in the WTP EA. In terms of average daily discharge, the WTP EA estimated a net need of 1.14 MG per day, while the actual average output over 10 years ranges from a low of 0.69 to a high of 1.01 MG per day, again substantially less than estimated (Table 2.3.5-3. Average Effluent Discharge from the Holloman AFB WWTP, 1997-2006).

Table 2.3.5-3. Average Effluent Discharge from the Holloman AFB WWTP, 1997-2016

	Effluent output (Ave.) MG/Mo	Effluent output (Ave.) MG/Yr	Effluent Output (Ave.) MG/Day	Daily Min Effluent Output (Ave.) MG/Day	Daily Max Effluent Output (Ave.) MG/D
1997	25.86	310.3	0.86	0.775	1.11
1998	29.14	349.7	0.94	0.816	1.08
1999	26.51	318.1	0.86	0.73	0.95
2000	29.99	359.9	0.97	0.88	1.07
2001	26.93	323.2	0.87	0.70	1.05
2002	31.15	373.8	1.01	0.86	1.37
2003	26.81	321.7	0.87	0.70	1.05
2004	30.87	370.4	0.97	0.83	1.15
2005	21.58	258.9	0.70	0.63	0.87
2006	21.31	255.7	0.69	0.55	0.95
2007	20.70	248.4	0.68	0.54	0.95
2008	21.38	256.5	0.70	0.51	1.06
2009	18.77	225.2	0.62	0.44	0.85
2010	22.01	264.2	0.72	0.57	0.96
2011	20.35	244.2	0.67	0.56	0.84
2012	18.61	223.3	0.61	0.50	0.76
2013	21.45	257.5	0.71	0.55	1.02
2014	19.43	233.1	0.64	0.51	0.93
2015	21.55	258.6	0.71	0.60	0.94
2016	17.86	214.3	0.59	0.48	0.75

In addition to receiving treated wastewater, the constructed wetlands serve as a buffer area for receipt of runoff in the event of large storm events. The limited capacity of the storm water ditch could be exceeded by a large thunderstorm. The increased water-holding capacity of the constructed wetlands and their location upstream of Lake Holloman allows storm water pulses to be channeled into the constructed wetlands ponds.

The primary reason that HAFB chose a wetland for wastewater and storm water management was that a wetland could also provide quality wildlife habitat, particularly for migrating and breeding wetland birds. The constructed wetlands add 100 to 125 acres of mudflat, shallow water, and playa habitat to the previously-existing mudflat, playa, and deep-water habitats at the Lake Holloman area, creating one of two of the largest wetlands in the Tularosa Basin (USAF 1995). In a time of declining wetlands and multiple water quality issues (Helmers 1993), HAFB, in the midst of a desert ecosystem, proactively enhanced a desert playa ecosystem to continue to provide breeding and migrating bird habitat (Davis et al. 1994).

The Lake Holloman area has been officially recognized as a state Watchable Wildlife viewing area since 1996. Because of the constructed wetlands project, HAFB was recognized by the Southwest Environmental Center in 1996 for their outstanding service to the environment in New Mexico and awarded the 1996 Conservation Award from the Mesilla Valley Audubon Society. HAFB received the 2000 US PIF Stewardship award for the 300-acre constructed wetlands complex. The award states: “Instead of constructing a conventional [wastewater] treatment system, they were able to provide valuable habitat for PIF priority species, western snowy plover and American avocet, as well as increase nesting habitat for snowy egrets, green herons, and black-necked stilts. Research projects by staff at NMSU and others are underway at the wetland sites. Cooperative public education projects by both the WSNM and the World Wildlife Fund have been spawned. The Mesilla Valley Audubon Society and the Otero County Bird Club have helped with assistance in bird monitoring. Duck hunters have been active in clean-up of the area. The project received several other notable awards for environmental enhancements.” In June 2009, the 49th Fighter Wing was notified by the NM state office of the National Audubon Society that because HAFB included areas that are essential to birds for breeding, wintering and migrating, the National Audubon Society, in partnership with Bird Life International, designated Holloman Wetlands as an Important Bird Area (IBA).

Hydrology and Watershed Features

HAFB lies within the Tularosa Basin, a closed basin with no surface water drainage outlet. Ground water is unrestricted within the unconsolidated Bolson deposits beneath the base. Summer monsoons, large storm events, and snowmelt from the Sacramento and San Andres Mountains provide most of the groundwater recharge. Streamflow and rainfall percolate through the coarse, loosely-consolidated alluvial fans near the base of the mountains, eventually reaching the Bolson aquifer. Streamflow is greatest during the summer monsoons, but most recharge occurs in the winter (Wilkins 1986). Regional groundwater flows mostly to Lake Lucero, approximately 20 miles southwest of the main base and the lowest point in the basin. Groundwater discharge occurs through evapotranspiration, via springs or seeps along steep-sided arroyos, or into playa lakes such as Lake Lucero.

Local groundwater flow is seasonally variable and is affected by the relationship between the groundwater table elevation and the elevation of the bottom of the local arroyo channels. In the southwestern portion of the base, depth to ground water was two feet below ground level near the sewage lagoons and 13 feet below ground level near Lake Holloman and Stinky Playa (EBASCO and Radian 1996). With an average hydraulic gradient of 0.3, groundwater flows consistently from northeast to southwest. However, surface water in the unlined lakes causes groundwater mounding. Immediately to the east of Lake Holloman and Stinky Playa, groundwater flows toward the southeast if the Lake Holloman surface water elevation is higher than the water table, a condition that occurs most of the time (EBASCO and Radian 1995).

Groundwater mounds indicate that water from Lake Holloman is lost by infiltration to groundwater (USAF 1995).

HAFB is crossed by several southwest-trending arroyos that transport surface water drainage flows in the undeveloped parts of the base. All arroyos except Lost River terminate in the gypsum dune fields at the western boundary of the base. Lost River continues into the larger dunes of WSNM, where it ends. During peak water levels, the terminus of the Lost River may extend into the WSMR. Most of the runoff from the developed areas of the base flows through a drainage ditch to Lake Holloman. In the past, when the local groundwater table was high, the ditch flowed most of the year. Other base drainage ditches flows east or southeast to Dillard Draw or to undrained depressions.

Soils and Vegetation

Summary of Soils and Vegetation Types

Yesum-Holloman soils create an uneven mosaic of moderately to highly alkaline soils with flat to moderately undulating surfaces. The Yesum Series are deep, well-drained soils derived from wind-deposited sediments, high in gypsum. Surfaces are nearly level with slightly undulating areas caused by changing wind deposition patterns. The Holloman Series are shallow, well-drained, and moderately alkaline. This moderately permeable soil is formed from loamy and sandy alluvium deposited over gypsum beds in old lake depressions. The underlying gypsum layers range from soft to hard and are 10 to 51 cm (4 to 20 in) below the sandy loam (Section 2.2.3). The Gypsum Land soils in the area are partially stabilized and hummocky, derived from wind-blown gypsum crystals of relict lakebeds (HAFB 2002).

Fluctuating water levels, topographic variation, and proximity to military facilities result in a diverse mix of natural and introduced vegetation types at the constructed wetlands. The dominant vegetation communities surrounding the constructed wetlands are shrublands, which covered about 52% of the study area in 2000 (Freehling et al. 2002). These included Salt cedar/Alkali Sacaton, Emergent Salt cedar, Pickleweed, Pickleweed/ Fourwing Saltbush, Fourwing Saltbush/Alkali Sacaton, and Fourwing Saltbush Sparse Shrublands plant associations. Three predominantly grassland types covered about 12% of the study area: Alkali Sacaton, Gyp Dropseed, and Alkali Sacaton/Pickleweed Grasslands plant associations. Wetland vegetation types include vegetation growing in standing water most of the time. These types covered about 11% of the area: Inland Saltgrass and Inland Saltgrass/Prairie Bulrush Grasslands, and Salt cedar/Inland Saltgrass and Salt cedar Dead Shrublands plant associations. The remaining 25% of the study area contained Barren/Alkali Playa, Development/Ground disturbance, and Water (Freehling et al. 2002).

Native Wetland Plants

Alkali bulrush (*Scirpus maritimus*) and inland saltgrass (*Distichlis spicata*) are two conspicuous members of the native wetland flora at the constructed wetlands. In the historic wetland area that is now Pond 1, saltgrass continues to be the dominant plant species and bulrush has low coverage. Alkali bulrush is, at present, the dominant plant in Pond 2 and is becoming established in Ponds 3 and 4. Bulrush is an issue because it creates unsuitable habitat for shorebird foraging and nesting. Alkali bulrush, five-horn smotherweed, and salt cedar are primary species of concern for vegetation control. The less-abundant cattail (*Typhus* spp.) has become established in Lagoon G. Since the creation of the first LHWCA operational plan (Johnson and Freehling 2005), cattail has increased in Lagoon G (Johnson et al. 2011).

Knowledge of the salinity requirements of these native species is useful to understand the rationale of control practices suggested for use at the wetlands complex. Alkali bulrush becomes dominant at sediment salinity levels of 10-20 mmhos and can tolerate soil salinity up to 18 mmhos for growth. Saltgrass has a higher salinity tolerance (>20 mmhos) and is common in areas that dry periodically, with a resulting high salinity in the upper sediment layers. Cattail is the least tolerant of salinity (<10 mmhos; Great Basin marshes: Smith and Kadlec 1986, Kadlec and Smith 1989). The Mead series soils of the constructed wetlands are characterized by salinities >16 mmhos/cm (Derr 1981), creating conditions that favor spread and dominance by alkali bulrush if inundated. In areas of drawdown, sediment salinities can increase rapidly as cycles of flooding and drying cause salts to return to the surface by capillary action, restoring conditions that promote bulrush establishment (Kadlec and Smith 1989). Thus, flooding and drawdown regimes designed to control salt cedar can assist the proliferation of bulrush and cattails.

<u>Non-Native Wetland Plants</u>

Salt cedar (*Tamarix ramosissima/T. chinensis*) is considered the second worst plant invader in the U.S. (Stein and Flack 1996). It is an invasive large woody species from Eurasia in the tamarisk family that requires high levels of water (phreatophyte) for establishment and survival. Nearly a dozen species were brought to North America from southern Europe or Asia in the 1800s for shade and erosion control. Several species escaped cultivation and have taken over riparian and wetland areas throughout the western U.S. On HAFB, it was planted as a windbreak in Carter Draw and other former ranch sites, and the military planted the species in one area of the High Speed Test Track for dune stabilization over 30 years ago. The species has dispersed aggressively into the drainage bottoms and lowland depressions at the southern end of the base, including the Lake Holloman wetland complex, Dillard Draw near the residential area, and drainage ditches near the flight line and golf course (HAFB 2006). They are relatively long-lived trees that can survive in arid conditions where groundwater is inaccessible by most other species of plants. Mature plants are tolerant of brief periods of inundation, as well as drought, high soil salinity, and nutrient stress. Flowers develop continuously under favorable environmental conditions but require insect pollination to set seed. In the southwestern U.S., salt cedar produces large quantities of minute, wind- or water-dispersed seeds throughout the growing season in the Southwest (Warren and Turner 1975, Shafroth et al. 1998). Seeds survive for only a few weeks during the summer and the few seeds surviving over winter do not form a persistent seed bank. Seeds are viable for four to five weeks under ideal conditions during summer and germinate within 24 hours following contact with water. There are no dormancy or after-ripening requirements. Optimal substrate for germination is saturated, fine-grained sediment. Conditions conducive for first-year survival are saturated soil during the first few weeks, a high water table, and open sunny ground with little competition from other plants. In the initial stages of establishment, roots grow slowly for the first four weeks and seedlings will not survive more than one day of soil drying. Seedlings are vulnerable to inundation in the four to six weeks after germination. Mature plants will re-sprout from roots if top growth is damaged or removed by cutting, fire, flood, or herbicide treatment. Also, adventitious roots develop from submerged or buried stems or stem fragments (Brock 1994, Di Tomaso 1998).

Five-horn smotherweed (*Bassia hyssopifolia*) is native to Europe and Asia, first appearing in North America near Fallon, Nevada in 1915, possibly introduced as a seed contaminant, and has spread rapidly throughout western North America (Collins and Blackwell 1979). As an annual, it reproduces only by seed and will not re-sprout from root fragments. Five-horn smotherweed has high salinity tolerance and is adapted to fine and medium-textured soils (USDA NRCS 2003). The seeds cannot survive freshwater inundation for extended periods (Bruns 1965). Five-horn smotherweed has become invasive at Lagoon G and Ponds 3 and 4 in areas that were formerly inundated on a regular basis (J. Dye, 49 CES/CEIEN pers. comm.).

Vegetation at Lagoon G: The following vegetation information is from Smith and Johnson (2005). A photo taken in the 1970s shows that the area which is now Lagoon G was originally a natural playa, with no salt cedar present. In the 1990s, the edges and area surrounding Lagoon G were clear (H. Reiser, former 49 CES/CEIEN, pers. comm.), but those areas are now covered in vegetation. The desired condition for Lagoon G is an open playa with saltgrass around the edges, providing mudflat habitat and deeper water in the middle of the pond. In addition, sufficient water should be stored in Lagoon G to provide water to the constructed wetland ponds for vegetation and wildlife habitat management. Before the completion of the constructed wetlands, Lagoon G received approximately 900,000 gallons of water per day (H. Reiser, pers. comm.). Drought conditions combined with low volumes of treated effluent (200,000 gallons per day) for several years resulted in encroachment of vegetation in Lagoon G. The influx of 1 million gallons of reclaimed water per day treated, in combination with precipitation runoff from the surrounding areas, moistened the soil sufficiently to encourage wetland plants but did not provide enough water for restricting vegetation to saltgrass around the edges of the open playa. At the north end of Lagoon G, five-horn smotherweed, alkali bulrush, salt cedar, and cattail are currently well established. Large salt cedar trees against the fence on the northern boundary of the lagoon create a security issue. In 2001, HAFB, with assistance from the USFWS, treated these trees and younger salt cedar in the northeast part of the lagoon with foliar applications of herbicide. The wet soils in the latter area restricted access to some salt cedar patches, but the treatment was successful where it occurred. Otherwise, no vegetation control measures have been taken in Lagoon G until the aerial treatment in September 2006. A stand of four- to five-year-old salt cedar trees has invaded the southeastern part of Lagoon G. The peninsula where numerous stilts and avocets nested in 2002 became covered with salt cedar, and bulrush invaded areas that were bare in early 2003.

Vegetation at Pond 1: The south end of Pond 1 has historically been a natural saltgrass marsh, but vegetation there had been dying since 2002 due to drought conditions, and a ring of salt cedar has grown up around the pond. However, conditions have improved in recent years, and vegetation has returned. A berm around the pond has existed since at least the 1950s. When wet, Pond 1 is a saltgrass meadow interspersed with open pools of water, the highest-quality nesting habitat for stilts. The desired condition of Pond 1 is native saltgrass without the salt cedar on the perimeter.

Vegetation at Pond 2: When the constructed wetlands complex is fully functional, Pond 2 provides shallow water and mudflat habitat for foraging shorebirds and their invertebrate prey. The basin of Pond 2 currently contains salt cedar, with saltgrass and bulrush infestations since the pond has been dry.

Vegetation at Pond 3: Pond 3 potentially includes several habitat types for wetland birds. The west side contains saltgrass, which, when wet, can provide nesting habitat for stilts. The center of the pond provides shallow water, and the edges, when drawn down, can provide mudflat foraging habitat. The ideal condition of this pond includes this diversity of habitats during shorebird breeding and migration. Currently, the pond contains significant amounts of salt cedar, bulrush, five-horn smotherweed, and saltgrass.

Vegetation at Pond 4: Pond 4 potentially contains deep water, shallow water, and mudflat habitats. The desired condition for this pond includes water levels that maintain shallow water and mudflat habitat during breeding and migration. Nearby upland habitat is used for nesting. Salt cedar, five-horn smotherweed, and bulrush have encroached in this pond.

Vegetation at Lake Holloman: Lake Holloman contains primarily deep-water habitats, with mudflat around the edges and extending onto several peninsulas. Deep water provides foraging habitat for ducks and phalaropes. Avocets, stilts, and plovers nest in the mudflat habitats. Wet soils are created at the north end of the lake where the pipeline brings in water from the splitter box. Salt cedar, cattail, and bulrush have established in this wet area. Salt cedar control efforts have been underway, using cut-stump and aerial application herbicide methods with imazapyr and/or triclopyr since the fall of 2006.

Vegetation in the Stormwater Canal: The storm water canal receives runoff from the Cantonment area of the base. Water can also be released into the canal from Lagoon G through Control Structure 6, provided that adequate surface water is available within Lagoon G. Flow in this canal should be unimpeded, primarily for reasons of storm water management. Salt cedar grows on the edges of the canal, but because water is normally present, salt cedar and other inundation-intolerant plants do not typically establish inside the canal. Bulrush has been present in parts of the canal in the past.

Wetland Birds

Since surveys began in 1994, at least 73 species of wetland birds have been detected at the Lake Holloman wetlands complex area, making wetland complex very important in the Tularosa Basin. Several of these species are known to nest in the LHWC. See Sections 2.3.3; 2.3.4; 7.1.; and 7.4 for more information on wetland species.

Ecological Value of Wetlands

The quantity and quality of riparian and geographically isolated wetland habitats essential for the survival of many of New Mexico's SGCN have been significantly diminished, which is critical because water availability in the Chihuahuan semi-desert grasslands is extremely limited. Water is found in ephemeral or intermittent pools or streams, or is stored in playas and arroyos, such as the Lost River and Dillard Draw drainages and the Lake Holloman complex on HAFB. Riparian and wetland systems in desert ecosystems, despite a popular perception of fragility, are often quite resilient and can regain their equilibrium within a few years once stressors are relieved. One of the primary concerns with the function and condition of riparian and geographically isolated wetlands habitats on HAFB is invasive species such as salt cedar, which degrades native wildlife habitat by competing with and replacing native plant species and consuming limited sources of moisture, and significantly alters riparian diversity, ecosystem processes and landscape structures and dynamics. Invasion by salt cedar has been exacerbated by a reduction in flood flows caused by extended drought conditions, the lowering of water tables and periodic decreased effluent flows into the constructed wetlands.

Floodplain management: the floodplain for the Lost River drainage and Malone and Ritas Draws is protected as Essential Fish Habitat for the White Sands pupfish (see Section 7.4 Management of Threatened and Endangered Species, Species of concern and Habitats). These drainages and other floodplains are protected by E.O. 11988 “Protection of Floodplains” and HAFB policy to avoid roads within floodplains and remove the majority of activities from within floodplains, such as the former CATMS range. Off-road driving is not allowed at any time in floodplains on HAFB.

2.3.6 Other Natural Resource Information

Air Quality

Air emissions at the base occur due to training exercises, aircraft refueling and maintenance, rocket firing activities, jet engine testing, fuel storing and distribution, aerospace ground equipment operations, corrosion control activities, emissions from aircraft and motor vehicle operations, boilers, emergency generators, and grounds maintenance equipment. HAFB and the surrounding area are currently in compliance with the New Mexico State Implementation Plan (SIP) and its requirements for National Ambient Air Quality Standards (NAAQS, Clean Air Act) for all "Criteria Air Pollutants" (carbon monoxide, lead, nitrogen oxides, PM-10 particulate matter, sulfur oxides, and volatile organic compounds). See Table 2.3.6-1. Limit Comparison Report. This places HAFB within an "Attainment Area", requiring no detailed analysis for new projects (HAFB 2002).

Table 2.3.6-1. Limit Comparison Report

Source Category: HAFB				
Pollutant	**Emissions (Tons)**	**Limit**	**Units**	**Compliant**
Nitrogen Oxide (NOX)	3.441	205	tons per Year (tpy)	Yes
Carbon Monoxide (CO)	1.920	84.1	tons per Year (tpy)	Yes
Particulate Matter	0.218	178.9	tons per Year (tpy)	Yes
Particulate Matter – 10 *	0.216	178	tons per Year (tpy)	Yes
Particulate Matter – 5 *	0.215	178.8	tons per Year (tpy)	Yes
Sulfur Oxide (SOX)	0.579	20.7	tons per Year (tpy)	Yes
Volatile Organic Compound (VOC)	10.119	249.9	tons per Year (tpy)	Yes

Comparison report from 1 January through 31 December 2016. * Number refers to size in micrometers.

2.4 Mission Impacts on Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

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2.4.2 Land Use

The Holloman AFB General Plan (2004) outlines the general land use patterns of the base and economic impact on the local community. The primary land use patterns on HAFB are shown on Figure 2.4.2-1. General Land Use Areas on Main Base Holloman AFB. There are five main land use areas: 1) Cantonment, 2) Dunelands and HSTT; 3) Northern grass-shrubland; 4) Lake Holloman Wetland Complex/public access; and 5) BWWSA.

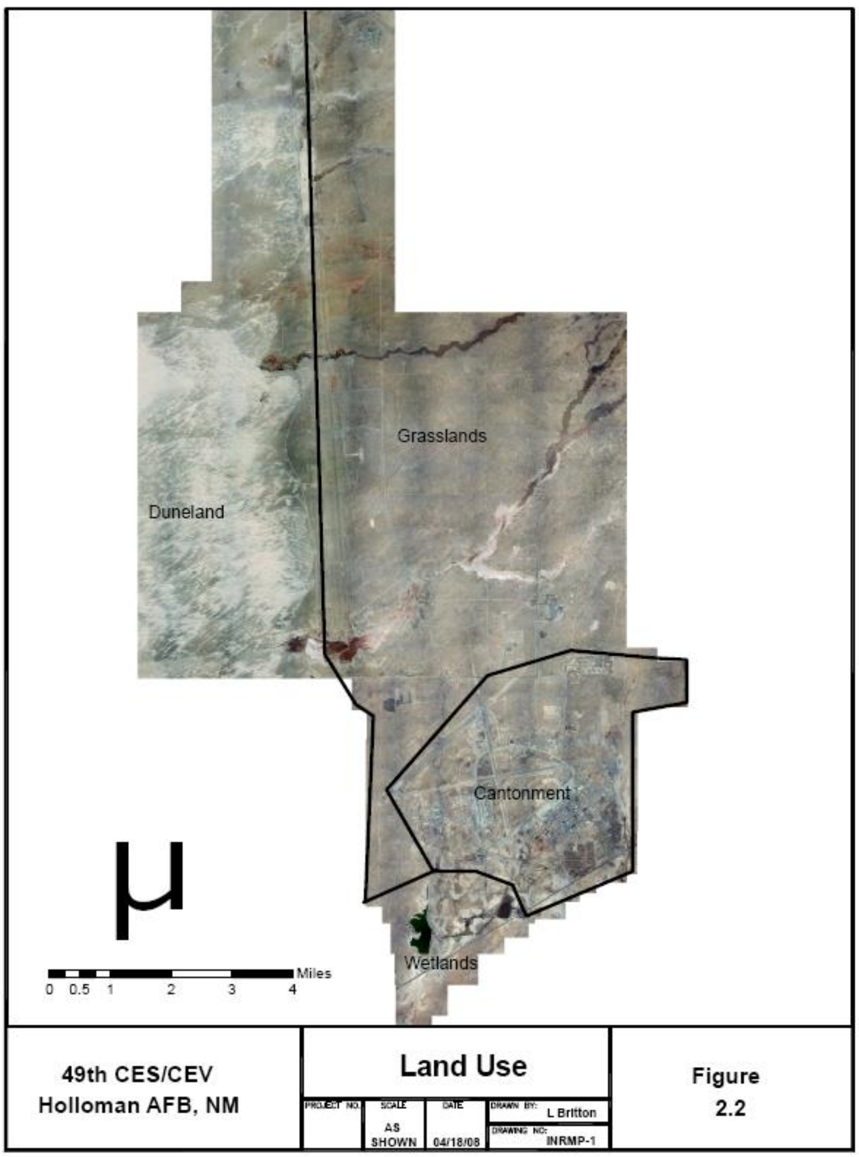

Figure 2.4.2-1. General Land Use Areas on Main Base Holloman AFB

1) Cantonment: comprises approximately 8,000 acres within the southern portion of the base. The landscape has been highly modified to accommodate the majority of functions conducted by the military, including base housing and personnel support facilities. Within this upland ecosystem, topography is relatively level with elevations ranging from 4,042 feet in the far northeast corner to 4,127 feet west of the airfield. Although the natural landscape has been fragmented by broad road networks and permanent structures, nearly 60% is covered in native vegetation.
2) Dunelands and HSTT: comprise approximately 23,000 acres and extend roughly from the test track facilities to the HAFB western boundary. The striking natural features of this management unit are the constantly transforming white gypsum sand dunes that progressively grade eastward into the alluvial flat shrublands with gypsiferous soils. The HSTT area is second only to the Cantonment in development and ground disturbance for military purposes. The test track lies perpendicular to the east-west draws and in some cases, particularly within Hay Draw, Guilez, and Allen draws, alters the natural flow of these systems. Due to the nature of the testing Land Use involved with the HSTT, materials ejected from the track can impact any location. Areas receiving the greatest impact and use are at the northern end of the track and the southern end near the north bank of Lost River.
3) Northern grass-shrubland: North of Douglas Road is approximately 19,000 acres in size. From this nearly level and moderately undulating topography, Tularosa (Tula) Peak rises abruptly 984 feet above the surrounding basin floor. Broad, deeply incised drainages move alluviated materials from upland reaches westward into the dunes. This area is a complex of upland and arroyo riparian ecosystems, creating a morphologically and biologically diverse ecological unit. The airfield is located within this area and, because of the protected zones and the distance from the Cantonment, this area has little development other than the airfield. Because of its undeveloped nature and lack of historical grazing, this area holds the greatest potential for natural resource recovery and conservation. Fragmentation by roads previously used for military purposes, but now primarily used for non- military access, may be the principal threat to conserving the ecosystems contained within this area.
4) Lake Holloman Wetland Complex/public access: comprises approximately 1,341 acres north of US Highways 70 and 110 acres located south of the highway in the southernmost part of the base, directly south of the Cantonment. Prominent physical features within the unit are Lake Holloman and Stinky Playa, both former large alkali playa lakes. East of the playa lakes is a series of shallow depressions, lagoons, and intermittent drainages that were formerly part of the historic reaches of Dillard Draw (Geo-Marine 1996). Historic connections between the upper alluvial system and the basin lowland ecosystem, including Lake Holloman and Stinky Playa, have been interrupted by road development and military construction. In 1997, in cooperation with the USFWS, HAFB built a system of berms, ditches, and control structures to create a wetland roughly encompassing the area between Lagoon G and Lake Holloman. Prior to the establishment of the constructed wetland, surface water comprised 222 acres and included the group of lagoons north of Lagoon G. With the constructed wetland, surface water may reach 347 acres. This area serves as the water containment for treated sewage effluent from the HAFB wastewater treatment plant. By law, the area is open to the public.
5) BWWSA: approximately 7,000 acres total, with acres under the jurisdiction of either the Air Force or the BLM and lies within the alluvial fans of the Sacramento Mountains south of Alamogordo. The BWWSA is made up of five parts unofficially referred to as the Boles, Douglas, San Andres, Frenchy, and Escondido Wellfields. The primary purpose of the BWWSA and the Bonito Lake Water System is to provide continuous sources of potable water for the base. The BWWSA begins five miles south of Alamogordo, adjacent to the western foothills (bajada) of the Sacramento Mountains. USAF has jurisdiction over approximately 7,000 acres on Boles, Douglas and San

Andres Wellfields, which includes fee purchase and condemnation tracts. In addition to these parcels, HAFB has sub-surface interests to protect and develop the underground water supply on 4,187 acres of public land withdrawn under Public Land Orders 3434 and 4627. Management for Frenchy and Escondido Wellfields lie with the BLM. North/northeast of Holloman AFB is the 115 acre Bonito Lake Water System Annex, with an additional 77 acres of easement and 78 acres of general use permits and licenses. Lands to the east of the BWWSA area are under the jurisdiction of the BLM on the north and the Lincoln National Forest on the south. The southern tip of the annex area borders McGregor Range, Fort Bliss, U.S. Army. Separating the north and south wellfield areas is Oliver Lee State Park. To the west of the BWWSA is a mosaic of private lands, BLM lands, and land held by WSNM. The Old El Paso Highway provides north-south public access through the southern part of the BWWSA area (Douglas and San Andres Wellfields areas). US Highway 54 intersects the extreme northwestern corner of the BWWSA area. These lands lie within the alluvial fan of the Sacramento Mountains and are heavily dissected by ephemeral drainages, creating a rolling topography. No military activities occur on the BWWSA, including law enforcement.

2.4.3 Current Major Impacts

Mission impact on natural resources is relatively low. BASH related incidents are a concern as well as potable water use. Due to the characteristics of HAFB's soil, mission activities could also have an impact on soil stability and erosion.

Soil Disturbance Study on HAFB Main Base

HAFB (49 CES/CEIE) implemented a long-term soil disturbance research project in 1997 to determine the impacts of military training and other activities on gypsiferous soil types. The objectives of the study were to:

- Identify gypsic soils which are most suitable for military training exercises based on the resistance of critical ecosystem functions to disturbance by typical training activities
- Evaluate the impact of different disturbance types associated with military training activities on the resistance and resilience of a suite of vegetation, microbiotic crust, hydrology and water erosion and wind erosion indicators
- Develop a preliminary conceptual model to predict the resistance of different gypsic soils to disturbance by military exercises (Herrick and Belnap 2004)

Plots were established on three different soil types to study the effects of different types of disturbance on soil crust communities, erosion rates, and recovery rates. Two of the study plots are located in the grasslands north of Douglas Road. One, called the Transition site, was located in an area with gypsum intergrading with silty, material covered with patchy dense perennial grasses with interspersed shrubs with limited man-caused disturbance. The second, called the Outcrop site, was located on partially indurated gypsum, exposed and near the surface, with dispersed sub-shrubs and perennial grasses and forbs. This site had evidence of relatively recent military training, including foxholes and communication wire. The third site, called the Dune Margin site, was located in almost 100% gypsum soil along the eastern border of WSMR, less than 600 feet downwind of an active dune. The area was characterized by highly dispersed low shrubs with little evidence of man-caused disturbance.

The two grassland plots differed by soil types and vegetation communities. The Outcrop site had shallow soils with high gypsum content on vegetation mapping units dominated by fourwing saltbush/gyp dropseed or gyp dropseed grasslands. The Transition site was on deep soils with low gypsum content dominated by fourwing saltbush/alkali sacaton plant communities. The plot within the dunelands was located just west of the HSTT on deep soils with high gypsum content dominated by fourwing saltbush/gyp dropseed plant communities.

Each plot was disturbed using horses, military vehicles, and booted military personnel on foot to determine how different types of military disturbances affect the degree of soil erosion impacts to the soil crust community, and recovery rates. Three phases were conducted, all in the months of October-November – Phase I was in 2001, Phase II in 2003, and Phase III in 2007. Data were collected on plant cover; microbiotic crust indicators (lichen and cyanobacteria cover, chlorophyll content, and nitrogen fixation); hydrology and water erosion indicators, including infiltration; soil stability; surface roughness; and wind erosion.

Phase I found that cryptogam cover pre- and post-treatment was highest at the Dune Margin site, lowest at the Transition site, and intermediate at the Outcrop site, with treatment effects similar on all sites. Treatments involving vehicles and horses decreased the cryptogam cover between 70% and 85%, while walking decreased cover by 48% to 59%. The study found that subsequent mortality combined with limited cryptogam recovery resulted in significantly reduced nitrogen fixation potential at all sites one year after disturbance. In addition, the impact one year later at the Transition site was much greater, with potential nitrogen fixation reduced over 90% by all three treatments. Substantially higher wind erosion was found at the Dune Margin site, probably due to the increased exposure to blowing dune sand upwind.

Overall, the treatments generally reduced soil stability, and all treatments except for the human trampling at the Dune Margins recovered within one year, indicating that the large aggregate soil structure is relatively resistant to acute disturbances. However, gypsic soil smaller aggregates were significantly impacted by the treatments at the Dune Margin and Outcrop sites, possibly due to the relatively higher dominance of lichens at the two gypsic sites. The treatments significantly reduced surface infiltration rates at all sites, while only the vehicle disturbance significantly increased compaction and only at the Dune Margin site. Crust strength was significantly affected by treatments at all sites, with complete recovery at all sites. Crust recovery indicators showed that higher surface roughness reduced wind speed at the soil surface. Horse and walking increased surface roughness while vehicles reduced it. These effects persisted throughout the year and were greatest at the Dune site. All treatments decreased plant cover, with vehicle disturbance having the greatest impact because of its damage to shrubs in particular.

The study continued in Phase II with a second disturbance on half of the original treatment plots conducted in 2000. During Phase III, conducted in October to November 2003, monitoring from the 1997 treatments and 2000 retreatments was completed. All three types of treatments (horse and human trampling and vehicle tracking) significantly reduced vegetative cover, especially shrub cover. Both Phases II and III found that all three treatments significantly reduced vegetative cover at both the Dune Margin and Transition sites, with minimal impact at the Outcrop site, primarily due to loss of shrub cover. It took four years for canopy cover to recover at the Dune site, four times longer than at the Transition site. The rapid recovery at the Transition site was due to grass regrowth. Shrub recovery was slow at all sites, particularly in the vehicle plots four years post-treatment. Vegetation at the Dune site was both less resistant and less resilient than at the other sites, probably due to having more shrub than grass cover. Vehicle tracks had the most negative and persistent impacts, especially on shrubs. Although the Dune and Outcrop sites showed 40% reduction in lichen cover one year after treatment, both sites showed strong recovery trends, with over 70% recovery in lichen cover. However, nitrogen fixation reduction was more dramatic, with potential nitrogen fixation dropping to near zero one-year post-disturbance and a slower recovery rate, despite the relatively rapid recovery of the crusts themselves.

All three treatments significantly reduced vegetative cover relative to the control, primarily due to loss of shrub cover; grass was relatively unaffected. Canopy cover recovered much faster at the Transition site due to grass growth than at the Dune Margin site; canopy cover continued to decline through time at the Outcrop site. Shrub recovery was slow, particularly at the Dune Margin and Transition sites, and particularly in the track plots. By 2007, few treatments resulted in significant vegetation differences from the control and recovery had occurred for most sites and treatments by 2001.

Transition and Outcrop sites supported much higher grass cover, which was more resistant and resilient to disturbance than shrub cover. Fourwing saltbush is brittle and susceptible to trampling; grass may have also outcompeted shrubs, although this hypothesis was not tested. Plots doubly disturbed in a phase generally recovered to similar cover as the single disturbance plots within one to three years of treatment. By 2007, some double disturbance plots even recovered to levels above the single disturbance plots, although patterns were not consistent.

Lichen cover one year after disturbance was reduced by 45% in all treatments at all sites, with lichen resistance to disturbance low. Although the second disturbance had a negative effect on most indicators at most sites, infantry seemed to have caused little to no additional degradation. By 2007, lichen cover had improved at all sites and had recovered to control levels in infantry plots. Both resistance and resilience tended to be lowest under the horse treatment, followed by the track treatment. Response of chlorophyll content was similar across sites and treatments, with a fairly dramatic reduction following disturbance, then a near-complete recovery by 2007. As connection with deeper soil through soil pore continuity can allow soil crusts to remain moist, loss of the continuity makes crusts more susceptible to drought.

In general, treatments reduced water infiltration and slightly reduced soil stability. Treatment effects lasted longer at the Dune Margin and Outcrop sites than at the Transition site. The horse and infantry treatments appear to have increased infiltration capacity at the Transition site immediately post-disturbance (not statistically significant); this site had had much less lichen than the others. Infiltration recovered by 1998. The track treatment tended to compact rather than disturb the crust. After the first severe storm, the physical crust re-forms. Generally, soil stability recovered over 10 years at all sites, although a general decline occurred between 2001 and 2003, matching that observed in vegetation. Field soil stability was minimally impacted by double disturbance, although the horse treatment generally reduced stability and increased soil roughness more than the other treatments.

At both the Dune Margin and Outcrop sites, all three treatments increased sediment trapped by wind following disturbance at least twice that prior to disturbance. Subsequent crust re-formation was apparently actually increasing treatment values to exceed control values, especially in the track treatment at the Dune Margin and Outcrop sites. While this is positive for wind erosion resistance, it has potentially negative effects for seedling emergence and water infiltration. Wind erosion was clearly inherently more severe at the Dune Margin site. The transition site appears to be more resistant to wind erosion due to higher vegetative cover and finer soil texture. Double disturbance was similar to single disturbance treatments. The Dune Margin and Outcrop sites have naturally high resistance to water erosion, with low slopes, high infiltration capacities, and high microbiotic crust cover. Lichens and cyanobacteria showed minimal reductions following disturbance and recovered fairly quickly.

The Transition site showed significant evidence of overland flow. The greatest threat to hydrologic function at all three sites is vehicle traffic. Just two passes of a small jeep with extremely low tire inflation on dry soil reduced equilibrium infiltration rates by 40% to 50%. Recovery was relatively rapid at the Outcrop and Transition sites, particularly when compared with the Dune Margin site where infiltration rates were still 40% below control levels four years after the first disturbance. Vehicle traffic apparently has a significant long-term effect on soil structure at the Dune Margin site. Relatively slow recovery of nitrogen fixation suggests the loss of integrity of the microbiotic crust community despite relatively rapid recovery of crust cover and stimulation of cyanobacterial cover.

The Dune Margin site was the most sensitive to disturbance and was generally the slowest to recover, with low vegetative cover (mostly brittle saltbush) and gypsic soils having low strength and susceptibility to compaction. Both the Transition and Outcrop sites are more resistance to degradation, with relatively high cover of resistant plant species and possibly higher water-holding capacity. It is possible that one of the reasons that the Outcrop site was more resistant to degradation is that it had already been degraded from military activities while the Dune Margin site was in relatively pristine condition.

In conclusion, off-road vehicle traffic was the greatest threat to all three sites. Intensive horse trampling and human trampling can negatively affect soil stability, hydrologic function, and biotic integrity. However, the magnitude and persistence is generally much less. Assuming that the primary objective is to sustain the capacity of the land to support military training and other land use values, recovery time is minimized by selecting site/training combinations that cause relatively little degradation (high resistance) or which result in rapid recovery (high resilience). The key variable is the number of years required for recovery. Military planners should control the types of activities, where they occur, and when they occur, which are interrelated. The Outcrop site represents the most suitable soil for both single and repeated disturbance. However, vehicle disturbance is the most destructive and generally require the longest recovery time at all sites. Focus training on soils and plant communities similar to those at the Outcrop and Transition sites, avoiding the dune margins. Limit traffic to existing roadways, as even light vehicle traffic can cause damage requiring at least 5 years recovery. The knowledge generated by this study was used to develop assessment and monitoring protocols (Pellant et al. 2005, Herrick et al. 2005), and a user-friendly database and field entry system (Herrick et al. 2007). All three tools are widely used throughout the US and a number of other countries.

2.4.4 Potential Future Impacts

Future impacts to land use would be expected on HAFB with the exit of the German Air Force and the addition of new F-16s; however, the impacts cannot be identified until any facility construction is completed, training missions are finalized, and funding is appropriated. This process is expected to occur over the 5-year interval of this INRMP. Future impacts will be identified in yearly review to this plan.

2.4.5 Natural Resources Needed to Support the Military Mission

Properties of the land and other natural resources which restrict military training are often termed Environmental Constraints. Constraints may be direct from the resources themselves or indirect from laws, regulations, and policies that protect resources. The only constraint on HAFB is the consistent cost of bird strikes.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The AF environmental program adheres to the Environmental Management System (EMS) framework and it's Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, U.S. Department of Defense Instruction (DoDI) 4715.17, *Environmental Management Systems*, AFI 32-7001, *Environmental Management*, and international standard, ISO 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 that are necessary to implement and support the natural resources program are listed in the table below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Installation Commander	The Wing Commander (WG/CC) is responsible for ensuring that installation and tenant units comply with laws and requirements associated with the management of natural resources. Also, approves the INRMP and any necessary revisions, provides appropriate funding and staffing to ensure implementation of the INRMP, controls access to and use of installation natural resources, and signs cooperative agreements between the installation and other entities pursuant to the Sikes Act.
AFCEC Natural Resources Media Manager/Subject Matter Expert (SME)/ Subject Matter Specialist (SMS)	Provides natural resources management support to Air Force headquarters, major commands, and installations. Subject Matter Experts utilize their knowledge in natural resources policy, ecosystem management, and land use planning principles to help conserve and enhance the natural infrastructure that is necessary to sustain Air Force operations.
Installation Natural Resources Manager/POC	Ensures studies are done in a timely manner, and in conformance with protocol. Verifies that current data in INRMP, surveys and integrated plans is correct and complete.
Installation Security Forces	Involved with reporting of and security at hazardous materials spills. Serve as Conservation Law Enforcement Officers (CLEO)
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	Serve as the EMS conduit between installation environmental function and their unit. Attend CFT and other working group meetings as requested. Advise the work area supervisor on any EMS and environmental policies. Manage and monitor the EMS

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
	requirements for the unit. (T-1). Provide any information required for installation environmental and sustainability performance measures. Participate and support EMS and compliance assessments. (T-1). Assist with developing corrective actions to address identified findings.
Installation Wildland Fire Program Manager	Coordinates and manages controlled burn prescriptions and planning. Maintains installation Wildfire Management Plan. Obtains all necessary permits. Advises and coordinates with contracted firefighters. Administers fire ecology studies and reports as warranted.
Pest Manager	Sustain Government property, preventing pests from causing damage. Control of noxious vegetation, and nuisance wildlife (Prairie dogs on airfield). Removal of road kill on base, and removal of hazardous (poisonous) wildlife.
Range Operating Agency	Not applicable
Conservation Law Enforcement Officer (CLEO)	Not applicable
NEPA/Environmental Impact Analysis Process (EIAP) Manager	The NEPA Manager oversees and executes all installation activities pertaining to the Environmental Impact Analysis Process to ensure environmental considerations are factored into proposed activities.
National Oceanic and Atmospheric Administration (NOAA)/ National Marine Fisheries Service (NMFS)	Not applicable
US Forest Service	Not applicable
US Fish and Wildlife Service	HAFB collaborates with both the USFWS & NMDGF to ensure accuracy of natural resources data presented in the INRMP. Provides guidance for natural resource management goals and objectives. Reviews and concurs with the effectiveness and implementation of the INRMP during annual reviews and 5-year updates.
Base Civil Engineer	Is responsible for the preparation, maintenance, and day-to-day implementation of the INRMP, and is the focal point for all plan actions and issues. The BCE also establishes mechanisms to review and analyze the impacts using the Environmental Impact Analysis Process (EIAP) for all proposed actions of the INRMP, and makes recommendations based on the analysis to the Installation Management Flight for approval or disapproval.

5.0 TRAINING

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

Installation Supplement – Training

Holloman AFB training is according to AFI 32-7064:

- *NRMs at Category I installations must take the course, DoD Natural Resources Compliance, endorsed by the DoD Interservice Environmental Education Review Board and offered for all DoD Components by the Naval School, Civil Engineer Corps Officers School (CECOS). See http://www.netc.navy.mil/centers/csfe/cecos/ for CECOS course schedules and registration information. Other applicable environmental management courses are offered by the Air Force Institute of Technology (http://www.afit.edu), the National Conservation Training Center managed by the USFWS (http://www.training.fws.gov), and the Bureau of Land Management Training Center (http://training.fws.gov).*
- *Natural resource management personnel shall be encouraged to attain professional registration, certification, or licensing for their related fields, and may be allowed to attend appropriate national, regional, and state conferences and training courses*
- *All individuals who will be enforcing fish, wildlife and natural resources laws on AF lands must receive specialized, professional training on the enforcement of fish, wildlife and natural resources in compliance with the Sikes Act. This training may be obtained by successfully completing the Land Management Police Training course at the Federal Law Enforcement Training Center (http://www.fletc.gov/).*
- *Individuals participating in the capture and handling of sick, injured, or nuisance wildlife should receive appropriate training, to include training that is mandatory to attain any required permits*
- *Personnel supporting the BASH program should receive flight line drivers training, training in identification of bird species occurring on airfields, and specialized training in the use of firearms and pyrotechnics as appropriate for their expected level of involvement*
- *The DoD supported publication Conserving Biodiversity on Military Lands -- A Handbook for Natural Resources Managers (http://dodbiodiversity.org) provides guidance, case studies and other information regarding the management of natural resources on DoD installations*

Natural resources management training is provided to ensure that base personnel, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Below are key NR management-related training requirements and programs:

- Personnel involved with pesticide use in support of the BASH program shall receive pesticide use training and certification to comply with federal and state laws or regulations
- Use of all-terrain vehicles ATV’s requires training to comply with federal and DoD instructions
- Use of utility terrain vehicles UTVs requires familiarization of vehicle performance and safety

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

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

Physical records are filed in accordance with the most recent Air Force Records Information Management System (AFRIMS) file system and categories prescribed by AFRIMS. Electronic records are being saved in AFRIMS and in the Air Force-Wide Environmental Management System (eDASH). Additionally, some electronic files are saved to the Squadron's SharePoint site.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC 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.

An annual report of depredation activities is submitted to the USFWS Migratory Bird Office. The report details species taken, location, month taken, the amount (number), and final disposition of the birds. Updates to the INRMP are ongoing. Reporting of changes is done annually for concurrence by the USFWS, and the NMDGF.

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 applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

Installation Supplement –Natural Resources Program Management

The Natural Resources Program Manager (NRM):

- Prepares, maintains, and implements the INRMP as required by the Sikes Act
- Provides natural resources policy guidance, technical support, and advice, identifies policy deficiencies and coordinates corrections as necessary, and performs planning, programming, budgeting, and execution of natural resource requirements
- Assesses natural resource impacts from mission activity and proposes remedial actions
- Shall locate, identify, and evaluate natural resource assets, participate in ESOHCAMP and EMS audits/inspections, and maintain good relations with NR stakeholders (regulators)
- Performs information and records management, and provides training as needed
- Serves as a key member of the BASH working group, the Wildland Fire working group, and the IPMP development team

7.1 Fish and Wildlife Management

Applicability Statement

This section applies to AF installations that manage fish and wildlife on AF property. This section IS applicable to Holloman AFB.

Program Overview/Current Management Practices

Holloman AFB follows AFI 32-7064 and guidance from USFWS and NMDGF to promote fish and wildlife management activities, to include:

BIRDS

A high number of bird species of conservation concern occur in HAFB constructed wetlands, grassland and shrubland habitats (Table 2.3.3-7. HAFB Birds of Conservation Concern). HAFB supports robust survey, monitoring, and research efforts in all of these habitats with a focus on species of concern (see Section 7.4 Management of Threatened and Endangered Species, Species of Concern and Habitats).

INVERTEBRATES

Potential Threats

Ongoing drought and limited water delivery to the constructed wetland ponds could limit invertebrate diversity in the LHWC. Fluctuations in water levels at Lake Holloman and lack of semi-permanent water in the former constructed wetland ponds have consequences on the long-term survival and recovery of macroinvertebrates whose eggs hatch when rehydrated; e.g., midges (Chironomidae) and crustaceans (Triops) (Smith et al. 2016b). Additionally, Smith et al. (2016b) suggest "at Lagoon G, spread of cattails and other emergents into open water, decrease in moist-soil habitats, and recent salt cedar control efforts have changed the proportion and quality of habitats available for aquatic macroinvertebrates". An increase in emergent vegetation is beneficial for dragonflies and damselflies (Smith et al. 2016b). Both groups use wetland plants for perching sites and refugia. Damselflies oviposit primarily on wetland and aquatic plants and search for prey on emergent vegetation.

Management

Further evaluation is needed of Smith et al.'s (2016) management recommendations to maintain patches of emergent vegetation interspersed with open water and moist-soil flats of Lagoon G to create a mosaic of habitats for odonate larvae and adults and other macroinvertebrates. Suggested conservation activities include mechanical removal as the most practical method to maintain areas of open water in Lagoon G and to eliminate cattail obstruction of the control structure outlet.

Treatment and removal of salt cedar is a management tool for enhancing habitat quality in general basewide, but it also has the potential to increase abundance and diversity of dragonflies (Anisoptera) (Smith et al. 2016b). A negative association between dense tree cover and odonate abundance has been documented in arid zones (Samways and Sharratt 2009). In particular, invasive trees are detrimental to dragonflies through the negative physiological effect of shade and indirectly by shading of perch and oviposition sites for some species (Remsburg et al. 2008).

Macroinvertebrate production in mud flats and salt flats was an original management goal for the LHCW. Successful implementation was achieved with the water delivery system and 27 control structures (Freehling et al. 1999). According to Smith et al. (2016b), the creation and maintenance of moist-soil habitat is necessary for adequate shorebird use of the wetlands and present-day reduction in coverage of wet mud flats and salt flats, restricted to Lagoon G and limited areas adjacent to the canal, makes moist-soil enhancement an important component of resource management.

Continued monitoring of the diversity of LHWC invertebrates are important as indicators of habitat health as well as potential threats to bird populations. Recent dragonfly surveys were completed by TAMU in 2017 (Demere et al. 2017) at the LHWC. Preliminary results indicate that dragonfly diversity has increased by adding the Widow Skimmer (*Libellula luctuosa*) to recorded dragonfly species. Results will be incorporated into the INRMP when finalized. Coordination of water management for diverse needs - vegetation management, mosquito control, duck hunting, and golf course management - should be undertaken to insure that moist-soil habitat can be maintained for macroinvertebrates during shorebird migration and nesting.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

Outdoor recreation at HAFB applies to Team Holloman members. HAFB IS required to implement this element.

Program Overview/Current Management Practices

Numerous outdoor recreation facilities at HAFB are available to military and government personnel and their families. Most of these facilities are within the Cantonment area, while others, such as the shooting range, are north of Douglas Road (see Figure 7.2-1. Outdoor Recreational Sites on Holloman AFB). Developed outdoor recreational activities that affect natural resources include: sport centers, the golf course, parks and jogging paths, the FamCamp, sports range, and horseback riding (HAFB 2004). Hunting, fishing, birdwatching, off-road vehicle activities and other natural-resource based dispersed recreational activities are described in this section.

Sports Centers

The sports centers on HAFB include the Youth Center, a soccer field, six ball fields, two tennis courts, a football and track field, and facilities associated with the swimming pool. The Youth Center provides aftercare programs and a place to meet friends for children from kindergarten high school. The Outdoor Recreation Facility rents recreational equipment and leads outdoor recreation tours and trips. Pending improvements include expansion of softball fields and construction of a BMX track and additional parking for the recreational areas. All the expansions are proposed within the footprint of the existing recreational area. Youth Sports 4-Plex has been proposed for location adjacent to the golf course. The Youth Sports 4-Plex would include a bicycle and jogging trail network connecting the facility to the housing area. This would provide the opportunity for safe and non-motorized recreational activities. The Fitness Center Sports Complex includes multipurpose facilities of sports fields connected by existing bicycle and jogging trails.

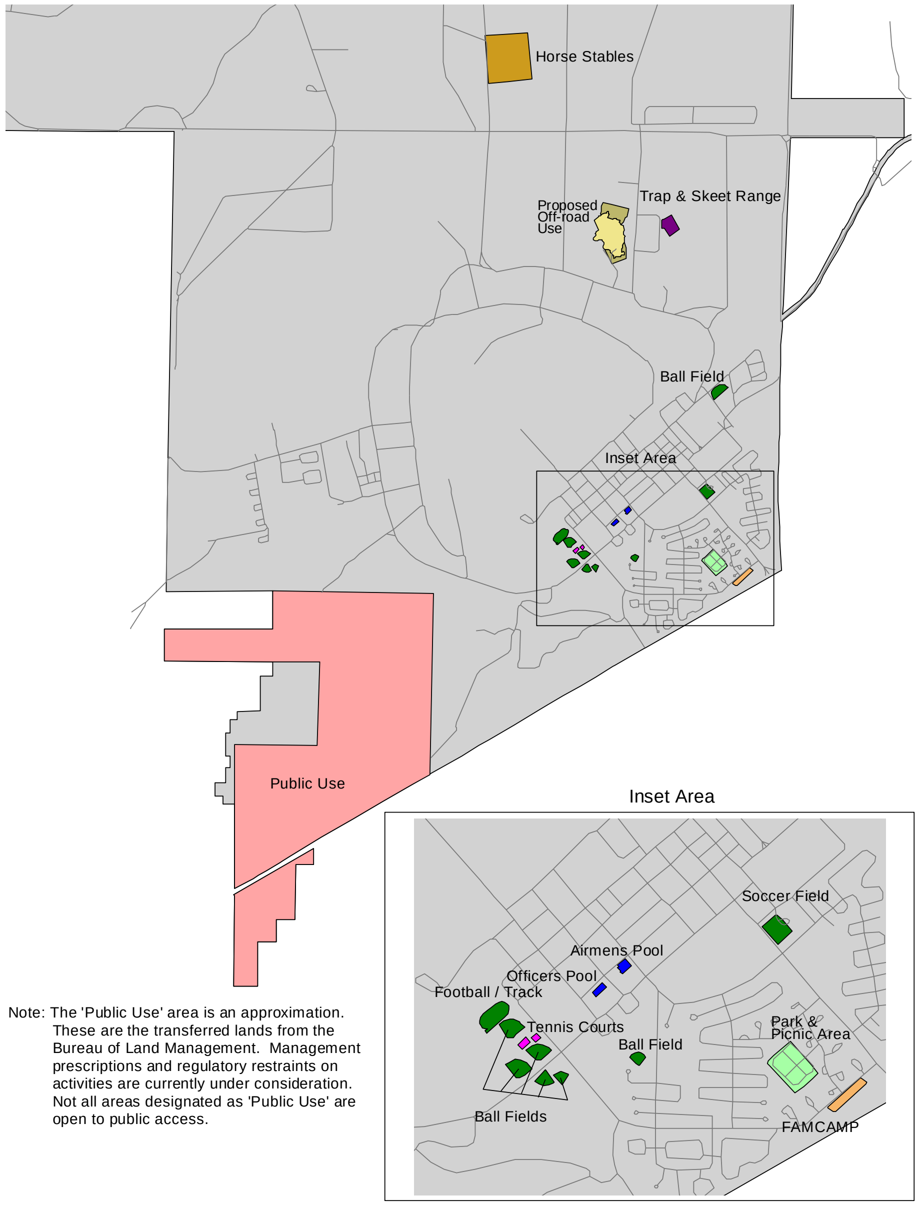

Figure 7.2-1. Outdoor Recreational Sites on Holloman AFB

Apache Mesa Golf Course

The Apache Mesa Golf Course (Figure 7.2-2. Apache Mesa Golf Course Holloman AFB, NM**)** is a significant portion of the HAFB morale program and adds a sense of community to this remote location. It is also a considerable luxury that imposes an impact on water resources in this xeric environment. The golf course currently has nine holes and is one of the single largest users of effluent water on the base. See Section 7.5 Water Resource Protection and Section 15.0 Associated Plans, Tab 3. Golf Environmental Management Plan, for more information on golf course management practices.

Figure 7.2-2. Apache Mesa Golf Course Holloman AFB, NM

Air Force Golf Course Environmental Management Program (GEM):

The Apache Mesa Golf Course Environmental Management (GEM) Plan was developed in October 2010 as a proactive AFCEC initiative to foster a better understanding of the environmental challenges facing our golf courses worldwide (Chapter 15.0 Associated Plans Tab 3). Armed with the support and approval of the Air Force Services Agency golf program, AFCEC's goal is to facilitate the creation of an environmentally friendly golf course facility while supporting the installation mission. Air Force Installation (AFI) 32-7064, Section 11, requires a GEM Plan as part of the INRMP.

> "*In concert with the mission of the United States Air Force, we pledge to employ only those management practices that minimize or eliminate the potential for negative impacts to the environment and the surrounding community, ensure compliance with all appropriate regulations, and to constantly re-evaluate our processes to achieve the highest standards of environmental excellence".*

The GEM Initiative

The goal of the GEM initiative is to facilitate the creation of an environmentally friendly approach to golf course management while protecting and promoting the great game of golf. AFCEE is dedicated to helping to identify ways that more rounds can be played on better-conditioned courses while minimizing or eliminating negative impacts to the environment. The comprehensive GEM planning process is the vehicle to document our successes while communicating directly with our customers, commanders, and local community.

The following environmental challenges were identified during the GEM process:

- Airfield safety
- Bird/wildlife Aircraft Strike Hazard (BASH)
- Water use
- Water quality
- Migratory birds
- Human health and safety
- Nuisance wildlife

FamCamp RV Park

The FamCamp is situated partially within a floodplain containing barren alkaline playas. It is sparsely vegetated with grasses and shrubs characteristic of the Lake Holloman Wetlands. FamCamp is located west of the main entrance and north of Hwy 70 (see Figure Outdoor recreational sites on Holloman AFB). The camp provides full hookups for twelve recreational camping vehicles. Stays are limited to 30 days on a space-available basis. The camp has expanded to 30 spaces and added additional amenities to the camp. These include providing full service utility sites, a playground, landscaping, and a pet exercise area. The extension of the FamCamp has been designed and an Environmental Assessment (EA) has been completed. The project was issued a Finding of No Practical Alternative (FONPA) compliant with EO 11988 (Protection of Floodplains). The EA included removal of nonnative plants (such as salt cedar) and landscaping with salt-tolerant plants that are native to dry areas yet viable in floodplains.

Apache Sports Range

The Apache Sports Range offers skeet and trap shooting, sporting clay and archery. The soil within the shooting range becomes contaminated over time with an accumulation of lead shot. The lead is reclaimed every three years by a commercial contractor. The method for removing the lead is by scraping the topsoil and recycling lead and brass.

Swimming Pools

HAFB has two swimming pools; an Olympic outdoor pool and play water park, which is open from Memorial Day through September. The other is an indoor swimming pool at the Domenici Fitness and Sports Center.

Horseback Riding

The Flying “H” Equestrian Facility is no longer operational due to safety concerns and facilities requiring extensive maintenance.

Parks and Jogging Paths within the Cantonment Area

The parks and jogging paths within HAFB provide unique services for the base community. Heritage Park is home to a display of aircraft previously assigned to the installation located south of Building 29 on the main entrance road to the base. A downsized-display of aircraft currently assigned to the 49th Wing can be viewed in front of Wing Headquarters, Building 29. A Veteran’s Memorial area honoring POWs and

MIAs from previous wars is at the northern end of the park. The main features of the memorial are a memorial stone wall and an eternal flame.

Steinhoff Park was originally the site of the base commander's home until 1981. It now serves as a multi-use base community park. The hodge-podge landscaping (including one palm tree) at the park is representative of some of the original landscaping found around the commander's home. The total area of the park, including a 0.5 acre parking area is about approximately two acres. This park has two covered pavilions, volleyball courts, horseshoe pits, and barbecue grills. A number of squadron functions, such as going-away parties and potlucks, occur at this park.

Thrasher Park serves as the base community's principal recreational park. This facility is approximately 7.7 acres in size. Originally, Thrasher Park was a mobile home park until 1989. Park facilities now include a soccer field, volleyball courts, a playground area, one covered pavilion, barbecue grills, picnic tables, and restrooms. Several mobile basketball hoops are located in a blocked off street on the west side of the park. This park will be reconstructed as a result of Military Family Housing privatization.

HAFB has two major jogging paths located on the base. The main path runs from base housing west past the golf course and basketball fields out toward the West Area. This path is approximately two miles long. It receives heavy use from joggers, walkers, and parents pushing baby strollers. The second jogging path is approximately 1 mile long and is located adjacent to Sabre Road on the east end of the airfield. This route is primarily used by joggers. There are proposals to extend this jogging path around the entire perimeter of the airfield

Waterfowl and Upland Game Bird Hunting

Waterfowl hunting is currently allowed for the general public at Lake Holloman in accordance with, Federal (Public Law 103-337) and state waterfowl hunting regulations. Lagoon G is open for waterfowl hunting to military personnel only and their guests, and only on alternate weekends from late October of the current year to late January of the following year (Figure 7.2-3. Special Waterfowl Hunt Zones for Lake Holloman and Lagoon G). Alternating weekends are used to provide refugia for waterfowl at one of the two hunted areas on any given weekend.

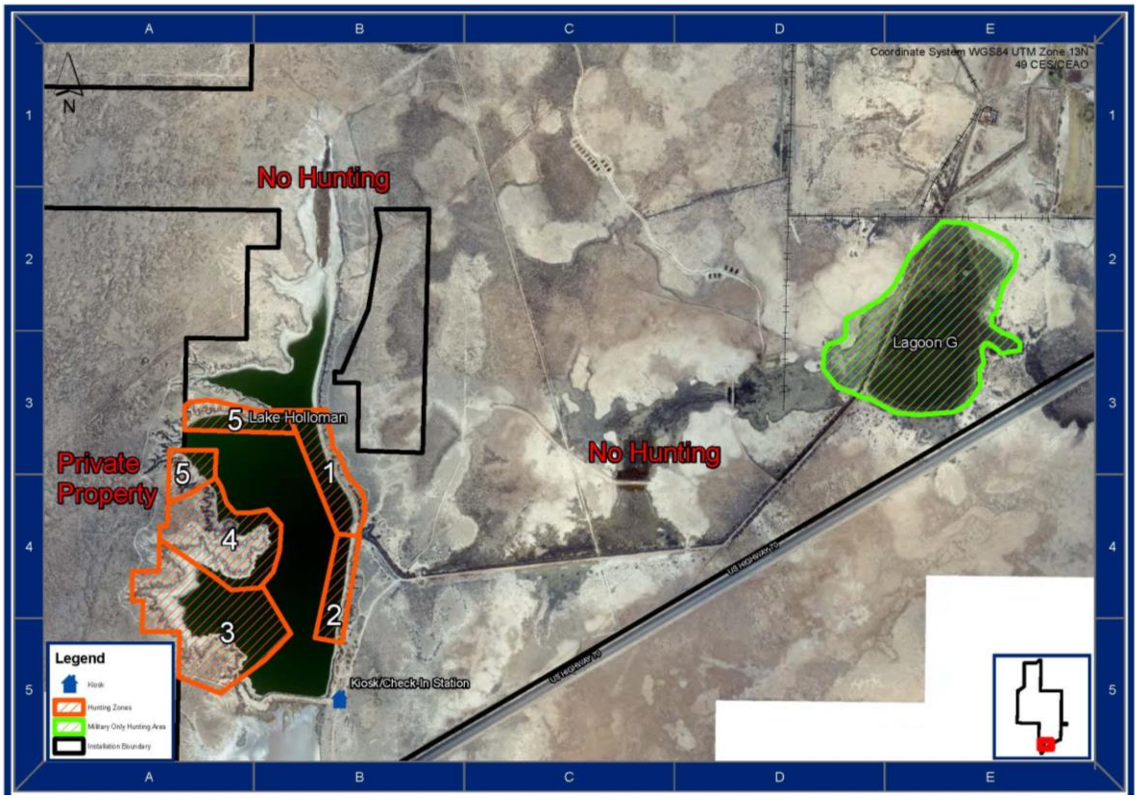

Figure 7.2-3. Special Waterfowl Hunt Zones for Lake Holloman and Lagoon G

Certain duck species, such as canvasbacks and pintails, may be regulated through seasonal closures set by Federal regulation. Hunters are encouraged to avoid taking fulvous and black-bellied whistling (tree) ducks (*Dendrocygna bicolor* and *D. autumnalis*), wood ducks (*Aix sponsa*), long-tailed ducks (*Clangula hyemalis*), white-winged and surf scoters (*Melanitta fusca* and *M. perspicillata*), common goldeneye (*Bucephala clangula*), and all species of merganser (*Mergus* spp.) in the Lake Holloman hunting area and report any sightings of these species to 49 CES/CEIE due to their rarity. It is not legal to take sandhill cranes. Upland areas in the Public Access Area are closed to all types of upland game and big game hunting. The Lake Holloman Wetland Complex is a Class III area that contains valuable ecological features, because of the high biodiversity and density of birds in the primarily arid Tularosa Basin, per AFI 32-7064. For purposes of waterfowl hunting and birdwatching, Lake Holloman is designated as an “Open Area” with use open to all participants, while Lagoon G is a “Restricted Area” with access and use restrictions defined by the commander based on mission safety and security considerations.

All waterfowl hunters must have a valid New Mexico State hunting license with a permit number for the mandatory Federal Migratory Bird hunting and Conservation Stamp and proof of completion of an approved hunter education course. Military hunters must complete a safety course given by 49 CES/CEIE Natural Resources personnel before hunting at Lagoon G. All discharged shotgun shells and other litter must be picked up and packed out. Retrieval of downed birds is required, with a fine of $200.00 plus $50.00 or more per bird for wanton waste of migratory birds. HAFB reserves the right to close the Lake Holloman area to hunting whenever security is a concern or law enforcement support is unavailable.

BWWSA is designated as an "Off-Limit Area" per AFI 32-7064. However, some illegal hunting has been reported in the past. The Douglas Wellfield was completely fenced in 1997, which significantly reduced or eliminated these illegal activities. Although the question of hunting in this area has been discussed, overriding security issues and lack of enforcement capability preclude serious consideration of hunting at BWWSA.

Birdwatching

Currently, bird-watching is the most popular activity provided for the general public at the Lake Holloman Wetlands Complex because of the high biodiversity and density of birds in the primarily arid Tularosa Basin.

HAFB is an active participant in the National Watchable Wildlife Program, a nationwide cooperative effort to combine wildlife conservation with America's growing interest in wildlife-related outdoor recreation, primarily because of the birdwatching opportunities in the public access area of the Lake Holloman complex. The ultimate goal of the program is to help maintain viable populations of all native animal species by creating well-informed public support for conservation. Defenders of Wildlife initiated the idea and have been instrumental in developing the program. The following organizations have a memorandum of understanding to support Watchable Wildlife sites: BLM, USFWS, National Park Service, Bureau of Reclamation, U.S. Forest Service, Army (two offices), Navy, Air Force, International Association of Fish and Wildlife Agencies, Defenders of Wildlife, Izaak Walton League, National Audubon Society, and National Wildlife Federation.

The Lake Holloman wetlands complex is one of two largest areas of permanent wetlands in the Tularosa Basin, providing important habitat for the wildlife on HAFB including migrating shorebirds, waders, and waterfowl. Since 1996, the area was recognized as a New Mexico 'Watchable Wildlife' viewing area. HAFB was also recognized by the Southwest Environmental Center in 1996 for its outstanding service to the New Mexico environment because of the project to enhance the entire playa wetland system. HAFB received the 2000 PIF Stewardship Award in the group category for the contribution that the constructed wetlands make toward providing critical shorebird and waterfowl habitat. In June 2009, the 49th Fighter Wing was notified by the NM state office of the National Audubon Society that because HAFB included areas that are essential to birds for breeding, wintering and migrating, the National Audubon Society, in partnership with Bird Life International, designated Holloman Wetlands as an Important Bird Area (IBA).

The Lake Holloman area met the following site-selection criteria:

- The site is important to species of high conservation priority in New Mexico, such as the snowy plover and American avocet
- The area contains rare and unique habitats, such as non-riparian wetlands and Chihuahuan Desert Grasslands
- The site regularly holds significant numbers of waterfowl, shorebirds, long-legged wading birds and single-species concentrations, including eared grebe, northern shoveler, ruddy duck, killdeer, black-necked stilt, American avocet, and Wilson's phalarope

The Bureau of Land Management transferred the land where Lake Holloman is located to HAFB under Public Law 103-337, Section 2845 (effective June 12, 1996). This law ensures the public has access to these public lands for uses consistent with the public uses on adjacent lands. The BLM does not allow locked gates on lands adjacent to Lake Holloman and Lake Stinky, so consistent with that management, the transferred lands should not have locked gates either. The public has input in determining how access should be handled. In addition, pets must be on a leash no longer than six feet or under control of a person, with the further restriction that dogs are not allowed west of the parking lot gate (to lake dam, west side of lake and Stinky Playa) from 1 April to 1 September (49 WG/JA letter, 28 Dec 2016).

Fishing, Boating

<u>Fishing</u>

No game fish populations occupy or are stocked in waters on HAFB and fishing is not allowed.

<u>Boating</u>

Boating is currently not allowed on any part of the Lake Holloman Wetland Complex and no infrastructure to support boating and/or related recreational activities is under consideration. Signage is in place at the kiosk/parking area to also inform users that the water in Lake Holloman ~~is under testing and thus far~~ has been deemed unsafe for primary contact (i.e. swimming or drinking).

Primitive Camping

Primitive camping is currently allowed for the general public along the southeastern portion of Lake Holloman, but it is not permitted at Lagoon G or within the constructed wetlands. (49 WG/JA letter, 28 Dec 2016). The following are some of the regulations that apply to camping at Lake Holloman, which are posted at the information kiosk and reinforced through various signage:

- Travel and camp on durable surfaces (established roads and camps, rock or gravel, NOT within drainages)
- Observe Camping Stay Limit: from 1 April to 31 August it is 7 days, and from 1 September to March 31, it is 14 days. Camping is for recreational purposes only, personal property may not be left unattended for longer than 24 hours.
- Quiet hours are 2200-0600
- Campfires are currently prohibited, and will be permitted only in metal fire rings and grills within campsites when and if they are installed in this area. No out of state firewood is allowed.
- You must pack out what you bring in, draining of wastewater holding tanks is not allowed
- Pets must be on a leash no longer than 6 feet or under control of a person, with the further restriction that dogs are not allowed west of the parking lot gate (to lake dam, west side of lake, and Stinky Playa) from 1 April to 1 September
- Horses and other pack animals are not permitted in the area
- Drive and park only on road or established campsite

Trapping

Recreational trapping is not allowed by any person at any time on HAFB and therefore the base is designated as a trapping, "Off-Limit Area" per AFI 32-7064. Trapping is permitted on a restricted case-by-case basis in support of natural resource management and safety protocols.

Off-road Vehicle Use and Equestrian Use

Off-road vehicle use (ORV)

Recreational off-road vehicles (ORV) and all-terrain vehicles (ATV) are not permitted to travel off existing roads within the base (Executive Order 11989, U.S. Army Corp of Engineers 1992). Any ORV use must be justified following the criteria established in AFI 32-7064 (10.6): Allow use of ORVs only after thoroughly analyzing the resource base. Evaluate the impact on erodible soils and wildlife. Restrict use of ORVs, including dirt bikes and ATVs, to areas that can sustain their use without damage to natural or cultural resources. Make sure all ORVs are licensed and insured. Close areas damaged from uncontrolled ORV from future use. Undertake rehabilitation projects to restore the damage.

Documented unauthorized recreational ORV use has occurred on the base at least since 1975, mostly in the drainage bottoms of Lost River, Malone Draw, the North Fork of Dillard Draw, and the more remote arroyos in the northern portion of the base. However, this use has been substantially decreased through better enforcement, based on identification of the problems in the 2001 INRMP and following notice from NMDGF requiring HAFB to stop/control ORV usage.

ORV use, such as ATVs and motorbikes are allowed only in designated areas within the Borrow Area at times when it is not in conflict with military mission, especially off-road training on military vehicles, primarily in the afternoons and on weekends. This recreation is managed by Outdoor Recreation (49 SVS/SVRO). Recreational users must be trained, certified and under supervision to use the area, which is fenced and locked when not in use.

Any person with an HAFB identification card providing access to the Base is eligible to use the Borrow Area for motorized recreational use, as long as they have been trained and certified by personnel under the authority of base Safety (49 FW/SEG). Military training always takes precedence over recreational use of the Borrow Area. The southern end of the Borrow Area which encompasses the recreational ORV site is considered a "Restricted Area" for all users per AFI 32-7064, due to the consistent use of that section by resident barn owls.

Mountain biking will not be encouraged on base except during organized mountain biking events sponsored by the 49 SVS/SVRO. The organized events are held approximately twice per year on weekends and will only occur on existing roads in the Dillard Draw area.

7.3 Conservation Law Enforcement

Applicability Statement

This section applies to all AF installations that maintain an INRMP, as all installations are required to provide a method for enforcement of conservation laws. Holloman AFB IS required to implement this element.

Program Overview/Current Management Practices

The 49th Security Forces Squadron (49 SFS) provides law enforcement, security, and operational security for all base activities on base, including fish and wildlife management issues as needed, as well as preparing policy positions on security, protection, and law enforcement programs for the base.

In accordance with the transfer legislation (Public Law 103-337), HAFB continues to allow public access to Lake Holloman and the constructed wetlands. Lagoon G and Pond 1 are generally off-limits for recreational use, as they are located outside of the land transfer and are subject to restricted access like the rest of the main base. During the waterfowl hunting season, information is posted at the information kiosk located at the Lake Holloman public parking area and is made available at Outdoor Recreation (49 SVS/SVRO) on base.

Currently, 49 CES/CEIEN has no certified conservation law enforcement officer. In the past, HAFB has used USFWS personnel to enforce waterfowl hunting at the Lake Holloman area, with spot checks by law enforcement personnel from NMDGF. A temporary measure available during the 1999 to 2000 and 2002 to 2003 seasons was the use of a commissioned law enforcement officer from the USFWS to ensure compliance with the base and state waterfowl hunting regulations during the waterfowl hunt season. This approach may be taken in the future, pending available funds and development of a memorandum of agreement with the USFWS Service for conservation law enforcement. A long-term solution to natural and cultural resources law enforcement protection must be addressed.

Trails, interpretive signage, and observation towers or blinds may be constructed only after taking into consideration legal and ecological management issues that protect wildlife habitat. No recreational use of the dune fields west of the HSTT because of the sensitive ecology, difficulty in enforcement and management, potential security and operational issues with the HSTT, and the availability of quality duneland recreation in the WSNM.

The BWWSA lands are a combination of Air Force-owned and public land withdrawals from the BLM for subsurface water rights. Therefore, 49 SFS has no authority to enforce any activities in the BWWSA because of lack of exclusive jurisdiction over this area. All law enforcement is handled by the Otero County Sheriff’s Department and HAFB will continue to cooperate with the Department.

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

Applicability Statement

This section applies to AF installations that have threatened and endangered species on AF property. This section **IS** applicable to Holloman AFB. Under the Sikes Act and SAIA (1997, 16 U.S.C. 670); the Fish and Wildlife Conservation Act (16 U.S.C 2901-2911); Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds; the Migratory Bird Treaty Act (1918, 16 U.S.C. 703-712); the Endangered Species Act (1973, 16 U.S.C 1531-1544); and several additional DoD and Air Force policies and directives, HAFB has responsibility to conserve natural resources on base, including native migratory birds and their habitats.

Program Overview/Current Management Practices

HAFB is located in the Chihuahuan Desert Ecoregion and the Tularosa Basin Watershed. The base supports important grassland, shrubland, riparian habitats and geographically isolated wetlands locally. Most of the sensitive species on HAFB are birds that are either associated with grassland habitats on main base and BWWSA or with wetland habitats, primarily in the LHWC south of the Cantonment. Threatened and endangered (T&E) species surveys have been conducted every 3 to 5 years and will continue be performed on this schedule. See Section 2.3.4 for more detailed information on the species discussed below. HAFB specific goals and conservation actions for each species or species group is included with its particular subsection.

HAFB manages habitat used by a small number of federal and/or State of NM listed threatened or endangered species including five bird species and one fish species (Table 2.3.4-1. HAFB Threatened & Endangered Species). All of the threatened or endangered birds are considered vagrant except the Peregrine Falcon (*Falco peregrinus*). The White Sands Pupfish (*Cyprinodon tularosa*) is considered threatened under the New Mexico Wildlife Conservation Act and is under review for listing under the Endangered Species Act. The NMDGF is initiating a Species Status Assessment of the pupfish pursuant to the Wildlife Conservation Act, 17-2-37 NMSA 1978 (NMDGF letter dated 14 Feb 18).

Other species of conservation concern occur on HAFB including an additional 76 bird species, 22 of which are considered NMDGF SGCN (see Table 2.3.3-7. HAFB Birds of Conservation Concern). Two bat species (Pale Townsend's Big-eared Bat - *Corynorhinus townsendii* & Spotted Bat - *Euderma maculatum*) and one reptile species (Desert Massasauga - *Sistrurus catenatus*) occur on HAFB and are also considered NMDGF SGCN. The following discussion is organized by class and provides detailed information on the status, threats, and management of these species on HAFB.

Mammals

Bats

<u>Status and Protection</u>
Pale Townsend's Big-eared Bat (*Corynorhinus townsendii*) and Spotted Bat *(Euderma maculatum)* are both listed as NM SGCN (2016). According to the Western Bat Working Group - WBWG (http://wbwg.org/matrices/species-matrix/; accessed 2 Jan 2018, matrix compiled in 1998), Pale Townsend's Big-eared Bat is a high conservation priority and the Spotted Bat is a medium conservation

priority. High priority species are imperiled or are at high risk of imperilment and require high priority for funding, planning, and actions. Medium priority species warrant closer evaluation, more research and conservation actions of both species and threats. Neither of these species are currently federally listed as threatened or endangered.

Potential Threats

Bats require specific conditions for roosting, particularly during gestation, lactation, and for winter torpor, including a cool and stable microclimate and protection from disturbance and predators. Therefore, since bats roost in large colonies, losing a quality nursery or winter roost can cause a potentially large increase in mortality for that colony, and possible extirpation, if another suitable site is not found quickly. Disturbance, especially multiple disturbances, during these critical times can also cause an entire nursery or winter colony to deplete critical energy reserves at a critical time, also potentially resulting in a large increase in mortality for the colony.

Extermination of nursery colonies from buildings is a major cause of population loss for free-tailed and other bats where the species is dependent on buildings due to of lack of natural roosting habitat, such as HAFB. Studies have shown that most individuals that had been excluded from their roosts by building maintenance and repair failed to appear at hibernation sites and were assumed dead. Extermination and exclusion resulted in the loss of at least 52% of the little brown bats in 23 colonies monitored for about a decade (Humphrey 1982). Use of insecticides has also been confirmed as causing population declines in insectivorous species of bats, with lethal concentrations of insecticides found in bodies of juvenile bats, and adult bats found starved from lack of food (Humphrey 1982).

The major threats to bats on Holloman AFB are use of insecticides and disturbances to maternity colonies and over-wintering hibernacula. Direct and indirect exposure to pesticides, such as when bats consume insects containing pesticides, can lead to mortality. Disturbance of bats roosting in buildings, particularly nursery and hibernaculum roosts, may cause females to abandon their young in nursery colonies and expend their energy reserves in both nursery roosts and hibernacula (Humphrey 1982, Mehlhop et al. 1998). Human activity near roosting bats can create enough noise to arouse the bats.

Management

Recognizing the concern for the health of bat populations, the Department of Defense entered into a Memorandum of Understanding with Bat Conservation International (BCI), dated October 2006 (Appendix D. Memoranda of Agreement and Cooperative Agreements), to identify, document, and maintain bat populations and their habitats on DoD installations. The purpose of the MOU is to establish procedures for planning and conducting cooperative efforts for bat conservation, establish policies and procedures for obtaining technical assistance from BCI to maintain or increase the productivity of bats and their habitats on DoD lands, to keep once-common species of bats from being listed as Federally threatened or endangered, and to work to recover presently listed species of bats and prevent species extinctions. DoD and BCI will work cooperatively to identify and evaluate appropriate proposed bat conservation actions to ensure that project plans are consistent with Federal and state management objectives for bats and other legal and statutory requirements, using effective methods for bat management and conservation. BCI can also provide training to DoD personnel in surveying, inventorying, and monitoring bats.

HAFB has erected some bat houses on base in areas where bats are known to forage. The USFWS advises that most bat houses used by bats are occupied within the first 1 to 6 months (during the first summer the bat house is erected). If bats do not roost in erected bat houses by the end of the second summer, move the houses to another location (letter to 49 CES/CEIE dated 10 Oct 08). The USFWS further recommends that HAFB work further with BCI to place bat boxes in according to their thermoregulatory needs, as some species prefer full sun, others partial sun, and others total shade. All houses should face south to southeast to take advantage of the morning sun. In addition, placing boxes at different heights and locations and in different habitats would ensure a diversity of bat species.

Bat houses can be mounted on structures that do not obstruct access to bats, such as on poles, on the sides of buildings, and on the trunks of tall trees. They should be placed at least 15 feet above the ground to increase the chance of attracting bats. It is helpful to place bat houses near water sources that attract insects, and free water can be used for drinking, which is especially important for nursing females. Placement away from buildings with activity or human habitation could encourage bats to roost in more isolated and suitable areas.

Placing bat houses near golf course ponds, wetlands, and open water, all areas of high insect abundance, could help reduce undesirable insect populations without the use of chemicals. This is especially helpful to complement mosquito control using mosquito fish. Bat houses placed near the Lost River drainage in occupied pupfish habitat where mosquito fish cannot be introduced would also complement mosquito control efforts on base.

HAFB personnel may be frightened of bats and often do not realize their beneficial impact on reducing nuisance insects. Calls received by 49 CES/CEOUE for bats are reported to 49 CES/CEIE to determine method of removal, if necessary. Because fear of bats is common, 49 CES/CEIE will continue to develop and distribute educational materials on bat management and protection and appropriate actions to take when a person encounters a bat. Distribution of materials will be via brochures, articles in the base newspaper, and in all “Right Start” and FTAC briefings for personnel. 49 CES/CEIE will also provide recommendations to base units that request installation of bat houses near their facilities through AF Form 332.

Although the potential for Histoplasmosis fungus transmission from bat guano has not been reported west of the Mississippi, some precautions must be taken to remove unwanted bat guano, because the Center for Disease Control reports that there is a potential for rabies transmission from bats and bat guano. Before entering an area where personnel are cleaning up bat guano or where bat guano is present, open windows and doors to properly aerate the area. 49 CES/CEOUE suggests that anyone cleaning guano:

- Must wear, at a minimum, a surgical mask
- Avoid sweeping, dusting or vacuuming, unless using a HEPA filter
- Spray area down with 10% bleach solution
- Wear disposal gloves while cleaning up the area
- Wash hands thoroughly

To exclude unwanted non-maternal bat colonies from buildings, including the Temporary Living Facilities, no chemicals will be used. Using window screening and duct tape, find the entrance/exit that the bats are using, drape three to four feet of screening over the side of the building, including the entrance/exit at the top end of the screening for at least four days. The bats can leave the site, but cannot reenter. Mothballs may act as a repellent to get the bats to leave. After all bats have been determined to leave the building, use expanding foam and screening to fill the hole or crevice. If the bats have been living behind the drywall, it may have to be replaced. The optimal time to exclude bats from a building is from the first week of September to the first week of October, avoiding the critical life cycle periods of pregnancy, gestation, lactation, and hibernation. Bats are often leaving the area at this time, as it is the beginning of fall migration. Bats return to the area beginning in March and, if absolutely necessary for health and safety of personnel or occupants, bats may be excluded March through May. As this action is considered facilities maintenance and not conservation, funding cannot be obtained through 49 CES/CEIE. 49 CES/CEIEN and 49 CES/CEOUE will continue to coordinate on bat management and ensure that appropriate buildings on base are “bat-proofed” with effective exclusionary structures at appropriate times and seasons to minimize impacts on the bat population.

HAFB personnel interested in using or testing sonic bat repellers will coordinate with 49 CES/CEIEN to identify proper placement and timing of the equipment to ensure effectiveness and to minimize harm or mortality to bats. 49 CES/CEIEN will monitor the equipment and its results and document the results and any necessary changes in use, placement, and/or tempo will be coordinated. Any individual who encounters a bat that is behaving abnormally, e.g., not trying to escape, will contact 49 CES/CEOUE for assistance.

<u>Future Research and Studies</u>

Research priorities should first concentrate on determining specific habitat use and identifying roost and hibernacula for foraging bats (Mehlhop et al. 1998; ESI 2011). Due to bat mortality from disturbance during hibernation, determining the location of these sites and subsequently protecting them from disturbance is important to maintaining bat populations. In addition, tracking the distance that bats travel to a local water source would increase understanding of local bat ecology. A monitoring program based on these initial goals will contribute to developing an adaptive management strategy. Monitoring for bats should generally be carried out during the breeding and migration periods, which typically fall within June and July (Mehlhop et al. 1998). A more dispersed mist net survey in spring, summer, and fall would provide a higher resolution of bat diversity.

The Center for Integrated Research on the Environment (CIRE) at the University of Montana has received a notice to proceed on Task Order 13 from USACE to support of the US Air Force Civil Engineer Center (AFCEC). Task Order 13 encompasses a nationwide, 48-installation survey of bat (chiroptera) species at various Air Force properties. The work involves completion of acoustical bat surveys based on the installation location and the protocol guidelines from USFWS field office. To conduct these surveys, five acoustic monitors were deployed in April 2017 for a 90 day research/study at HAFB.

ARTIODACTYLA

Currently no known federally or state listed artiodactyla has been documented on HAFB. The Gemsbok or Oryx is however a management concern. See Sections 7.11 Integrated Pest Management Program and 7.12 Bird/Wildlife Aircraft Strike Hazard (BASH).

BIRDS

HAFB Bird SOC include the federal and state endangered Least Tern (*Sternula antillarum*). Surveys have also recorded state threatened Baird's Sparrow (*Ammodramus bairdii*), Bald Eagle (*Haliaeetus leucocephalus*), Neotropic Cormorant (*Phalacrocorax brasillianus*), and Peregrine Falcon (*Falco peregrinus*). All of these species, except the Peregrine Falcon is considered a vagrant on HAFB.

Other documented SOC include the Bank Swallow (*Riparia riparia*), Bendire's Thrasher (*Toxostoma bendirei*), Western Burrowing Owl (*Athene cunicularia hypugaea*), Cassin's Sparrow (*Peucaea cassinii*), Common Nighthawk (*Chordeiles minor*), Long-billed Curlew (*Numenius americanus*), Loggerhead Shrike (*Lanius ludovicianus*), Chestnut-collard Longspur (*Calcarius ornatus*) and McCown's Longspur (*Rhynchohanes mccownii*), Eared Grebe (Podiceps nigricollis), Golden Eagle (*Aquila chrysaetos*), Sagebrush Sparrow (*Artemisiospiza nevadensis*), Scaled Quail (*Callipepla squamata*), Vesper Sparrow (*Pooecetes gramineus*), Virginia's Warbler (*Oreothlypis virginiae*), and Western Bluebird (*Sialia Mexicana*). See Section 2.3.4 for species descriptions.

Migratory & Breeding Birds

<u>Status and Protection</u>
All native species of birds are protected under the Migratory Bird Treaty Act (MBTA). Species found on HAFB not protected under the MBTA are the house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), and Rock pigeon (common pigeon, *Columbia livia*). DoD Compliance with the MBTA and E.O. 13186 including implementing regulations and incidential take permits, as well as other related Executive Orders and interagency agreements applies to both military readiness actions and non-military readiness actions.

Migratory birds are of great ecological and economic value and are an important international resource. They are a key ecological component of the environment and they also provide immense enjoyment to millions of Americans who study, watch, feed, or hunt them. Recognizing their importance, the United States has been an active participant in the internationally coordinated management and conservation of migratory birds. The MBTA (16 USC 703-712) is the primary legislation in the U.S. established to conserve migratory birds. The USFWS is the federal agency responsible for administering and enforcing the law. Breeding Birds are further protected by nest destruction policy.

<u>Potential Threats</u>
Human disturbance, predation, and changes in breeding habitat.

<u>Management</u>
According to Petersen et al. 2017, it would be difficult to manage for the abundant predators at the LHWC. Excluding or trapping them would be extremely labor-intensive and expensive. Providing more secure nest sites is the most feasible option for American Avocets and Black-necked Stilts, the two nesting species most impacted by predators. Avocets appeared to benefit from nesting on the islands that appeared in Lagoon G in 2002.

Snowy Plover

<u>Potential Threats</u>
Climate change, invasive and problematic species, human intrusions and disturbance. Loss or degradation of breeding alkali flats and playas from flooding, drying, and/or vegetation encroachment, disturbance to nesting birds (NMDGF 2016a). The primary concerns for western snowy plover are either flooding or excessive drying of mudflats from March through June, habitat alterations that change availability of either food or nesting habitat, and disturbance during nesting, including by people and dogs.

<u>Management</u>
Management of the constructed wetland for the snowy plover would include mudflats within close proximity to standing water and dense clumps of inland saltgrass (Mehlhop et al. 1998).

American Avocet

<u>Potential Threats</u>
Human disturbance, predation, and changes in breeding habitat.

<u>Management</u>
It has been suggested that the best option for increasing avocet nest success would be to provide secure islands for nesting in Lagoon G. This might be accomplished by careful drawdown of Lagoon G water levels in April, before they began to nest. Water level should then be constantly maintained to secure the islands from coyotes and raccoons. To ensure sufficient water depth around the islands, it might be useful to dredge around them and pile the soil on top of the islands (Petersen et al. 2017). Evaluation of the feasibility of this management strategy is needed.

Shorebirds

Least Tern (NMDGF 2016a)

<u>Potential Threats</u>
Loss or alteration of riverine habitats from altered flow regimes, channelization, inundation, chemical contamination of prey base, human disturbance of nesting flats (NMDGF 2016a).

<u>Management</u>
Monitoring studies of both aquatic macroinvertebrates and wetland birds have demonstrated that, without shallow water and moist soil habitats, neither shorebirds nor their invertebrate prey will be present at the LHWC (Freehling et al. 2002; Smith et al. 2003; Smith and Johnson 2004, 2005; Johnson et al. 2011; Smith et al. 2016b).

See Johnson et al. 2011 and Freehling and Johnson 2012 for more on suggested water discharge/ flooding timing for the wetlands to be of the most benefit to bird species. The most important periods are fall migration, when stopover migrants need food for their flights from arctic nesting grounds to wintering sites in Central and South America; spring migration, when they return; and summer, for species that nest at HAFB.

Grassland Birds – Neotropical Migrants and Raptors

Status and Protection

None of the grassland birds or neotropical migratory birds confirmed on HAFB are federally listed as endangered or threatened. However there are a few species that are considered threatened or SGCN by the state of NM (NMDGF 2016). All native species are protected under the MBTA and EO 13186. It is also possible that federally endangered or threatened species such as the Aplomado Falcon might occur on HAFB in the future (Envirological Services 2004).

Grassland and riparian habitats have been identified as those most in need of conservation in New Mexico. Chihuahuan Desert Grasslands, as they existed prior to European settlement, may be the most endangered biome in the United States. Overgrazing, fire suppression, and shrub encroachment is a problem in grasslands further north as well as in the Chihuahuan Desert. Shrublands have increased in the state as a result of grassland overgrazing and fire suppression. Grassland bird populations are declining, and their habitat is recognized by many as possibly the most imperiled ecosystem worldwide (Whitford 1997, Department of Interior 1996). Grassland bird populations have shown steeper, more consistent, and more geographically widespread declines than any other guild of North American bird species.

Potential Threats

Invasive species encroachment and drought are major threats to the habitat at Holloman. Electrocutions are also a threat to birds that perch and nest on utility poles.

Management

Additional studies of grassland birds on the main base and the BWWSA are needed to clarify habitat quality, presence and abundance, season of use, importance of HAFB to the species within their range, and potential mission impacts of migratory bird species.

Western Burrowing Owl

Status and Protection

Western Burrowing owls are the most abundant raptor species on base. Burrowing owl (BUOW) [*Athene cunicularia hypogea*]) populations have declined throughout their range. The BUOW is a NM SGCN (NMDGF 2016a), US Fish and Wildlife Service (USFWS) Bird of Conservation Concern (BCC, USFWS 2008), BLM Sensitive Species (Biota Information System of New Mexico [BISON-M] 2015), and DoD Partners in Flight (PIF) Sensitive Species (DoD PIF 2014). Burrowing owls are protected under the MBTA, which prohibits take, import, export or possession of burrowing owls and other migratory birds. Burrowing owl populations on HAFB are considered a high conservation priority because of jeopardized populations elsewhere in its range and because of its own precipitous decline observed on base.

Potential Threats

Population declines throughout the burrowing owls range have been attributed to destruction and fragmentation of their grassland habitat, with fragmentation increasing predation rates, pesticides decreasing their insect prey base, predation, and collisions with vehicles (Mershon and Bailey 2006).

An analysis of actual conditions at HAFB in relation to burrowing owl breeding population status indicate that pesticide use is not a likely mechanism causing population declines because insecticides are used extremely rarely, especially in the area of the HSTT.

Little development has occurred within this area as well, so human encroachment on the habitat is also not a likely factor. It is not known if the burrowing owls in the area of the HSTT are adversely impacted by the tests and associated activities, such as debris searches, camera setup, and the tests themselves, but the owls are returning to the area consistently and some successful burrows are located very close to the track. The authors and surveyors also found that burrowing owls on Kirtland AFB also breed successfully in areas with high human activity and military operations, indicating that military operations apparently do not interfere with burrowing owl presence and successful breeding (Mershon and Bailey 2006).

Borgman et al. (2003) hypothesized that burrowing owls may also be limited by the availability of suitable nesting burrows, which are excavated by badgers, prairie dogs, skunks, foxes, and coyotes and placed artificial burrows in clusters in areas of historical use. Envirological Services biologists reconstructed 33 damaged burrows in the HSTT area that had been placed in 2002 to 2003, resulting in successful use of the artificial burrows in several years since placement, including in 2006. Even if the artificial burrows were not used directly for nesting, the addition of suitable burrows in the vicinity of the nest area provides additional escape opportunities from predators and use as satellite burrows may have improved the suitability of the cluster (Mershon and Bailey 2006).

Low levels of precipitation may also decrease insect prey, and, with decreased precipitation on HAFB from 1999 to 2001, burrowing owl populations may also have decreased. In 2002, annual precipitation increased, which may account for the increased number of young fledged, although these increases occurred mainly in December after the breeding season (Borgman et al. 2003). Although the owls returned to HAFB before the high levels of precipitation occurred, the higher levels of precipitation were certainly a factor in success for foraging and feeding the chicks (Mershon and Bailey 2006).

Although no studies have been done on levels of predation on burrowing owls on HAFB, both Borgman et al. (2003) and Mershon and Bailey (2006) both found low numbers of predators and predation.

Burrowing Owl habitat is at risk of encroachment by invasive plants, particularly African rue (*Peganum harmala*) and Russian thistle (*Salsola kali*), which render burrows unusable. African rue grows in dense stands, reducing the amount of open area preferred by Burrowing Owls, and Russian thistle can physically obstruct burrows (Johnson et al. 2016)

Trapping owls and other human activities directly near active nests can result in nest abandonment. Therefore, where possible, owl nest sites should be avoided during training exercises, vehicle parking, or off-road travel. Any activities that need to occur directly on or adjacent to active burrows should be conducted, whenever possible, outside of the breeding season (mid-March through July). Direct damage or destruction of burrows, whether or not being used at the time, must be avoided, as they might be used by owls in the future. In addition, some owls overwinter at Holloman in nesting burrows, and activities directly adjacent to burrows used by overwintering owls should also be avoided.

As conditions improved, burrowing owls returned to HAFB in the area of the HSTT based on their documented moderate to high fidelity to specific breeding areas and even to particular burrows (Klute et al. 2003, Mershon and Bailey 2006).

Management

At a minimum, surveys of historic nesting burrows should be conducted and all artificial burrows should be monitored at the beginning of the breeding season (late March to late April and one at the end of the season (mid-July to mid-August) to determine use and, if possible, breeding success. A routine maintenance schedule of artificial nesting borrows should be established and maintained to retain suitability. Current artificial burrows are not viable for BUOW nesting. Restoring or installing new artificial burrows may be beneficial (Turner et al. 2017).

Relocations of burrows and translocation of individual owls may be a management solution in high use areas. Operations conducted at the airfield and within the HSTT area should incorporate operational procedures to avoid impacting owl burrows, while ensuring no loss to mission capabilities. Habitat use by overwintering owls should also be considered when planning for owl management.

Other Raptor Species

Status and Protection

None of the owl species on base are protected under the ESA; all are protected under the MBTA and Executive Order 13186 “Protection of Migratory Birds”. The bald and golden eagles are also protected under the Bald Eagle Protection Act. The loggerhead shrike is considered a “Common Bird in Steep Decline” by PIF (2018).

Threats

Barn owls and great horned owls occasionally nest and roost outside buildings, and may roost inside hangars. Owls are not normally considered nuisance pest animals. A permit from the USFWS, under the MBTA, is required to capture or harass any raptors. The USFWS amended the MBTA to simplify the nonlethal removal of trapped migratory birds, except threatened or endangered species, or bald or golden eagles, by the general public from the interior of buildings in which their presence may be a threat to the birds, to public health and safety, or to commercial interests, without requiring a permit per the MBTA. The bird must be captured using a humane method and, in most cases, immediately released to the wild. The regulation does not allow removal of birds or nests from outside of buildings without a permit. Removal of active nests from inside buildings must be conducted by a Federally-permitted migratory bird rehabilitator. Any bird that is exhausted or ill or is injured or orphaned during the removal must be transferred immediately to a Federally-permitted migratory bird rehabilitator.

Management

Keeping hangar bay doors and doors to other storage areas closed will prevent owls from entering hangars; if owls do enter any buildings, do not close the doors over weekends and long holidays so owls can escape. In Bear Base open storage areas, false ceilings that cover exposed potential roosting sites have been installed, and nest boxes have been installed on the outside of two buildings.

Protected species causing problems in operational areas will not be disturbed during the breeding season and will be captured and relocated, if necessary, after the breeding season is completed per MBTA regulations.

Electrocution Risk Management

A survey of all power poles on HAFB was conducted between August 2003 and January 2006 during the day to determine the level of risk to raptor and other perching/roosting birds with large wingspans to electrocution (Envirological Services, Inc. March 2006). The study was prompted by discovery of numerous electrocuted birds across the main base and on the BWWSA prior to 2003. Data collected for each pole included pole topography, pole type, configuration, and presence of apparatus. Data collected regarding use of each pole by birds included presence and amount of whitewash (number of splotches) on the ground and/or pole, prey remains, and castings (such as owl pellets). Incidentally to the survey, presence of raptors and other large wingspread birds and presence of their carcasses were recorded.

Other reports included a Great Horned Owl (11/5/2007) near Bldg. 1090 , a Bobcat (9/29/2009) HSTT, near a Camera Pad Rd transformer, a Golden Eagle (4/19/2010) near RR 9, east side feathers at base of pole, and a Great Horned Owl (8/12/2010) Near Bldg. 851 on the west transformer.

During a power pole survey for the Holloman Air Force Base Avian Protection Plan in August 2012 (Johnson et al. 2013), a survey was performed near many power poles (66% of all the poles on Holloman), and found no signs of electrocuted birds.

The following areas had evidence of use by birds, in descending order:

- The BWWSA, having the most likely habitat for raptors and the least amount of human disturbance, had the highest percentage of poles used by raptors or large birds (155 poles with evidence of bird use out of 185 poles, or 82% of the poles). Nine of the poles had the highest potential for hazard for electrocution; an additional 22 poles had a high potential for hazard for electrocution, for a total of 17% of the poles.
- The shrublands-grass area north of Douglas Road had the next highest use (469 poles with evidence of bird use out of 916 poles, or 51% of the poles). Ten poles had the highest potential for hazard with an additional 78 poles having high hazard for electrocution, for a total of 10% of the poles. This area also had the highest number of poles of concern.
- The HSTT area was next in proportion (105 poles with evidence of bird use out of 221 poles, or 48%). This area had no poles having the highest potential for hazard, and 12 poles of 221 poles having a high potential for hazard, or 5% of the poles.
- The dunelands area had few poles but a relatively high proportion of use (17 poles had evidence of bird use out of 52 poles, or 33%). This area had one pole having the highest potential for hazard, and an additional two poles having a high potential for hazard, or 6% of the poles.
- The Cantonment area had the least use by raptors, primarily because of human activity and lack of habitat (79 poles had evidence of bird use out of 948, or 8%). However, this area had the highest number of carcasses (most likely because the high density of buildings and human activity decreased the opportunities for predators to remove carcasses before discovery, along with a lower density of predators).

Overall, less than 1% of the poles on base had the highest hazard ranking; an additional 5% were ranked as having a high hazard, with the BWWSA, the grass/shrublands north of Douglas Road, and the Test Track areas having both the highest use by birds and the highest hazards.

Electrocution of raptors on HAFB occurs most often on distribution lines of 69,000 volts or less. The occurrence and number of electrocutions are most attributable to configuration of the pole, presence of raptor protection devise, presence of transformers, exposed jumper wires or other equipment and use by raptors and other large birds. Although poles with apparatus make up 32% of the total poles on HAFB, a high proportion of mortalities were recorded at such structures. The presence of apparatus on poles, such as transformers, appears to contribute to raptor electrocutions more than the actual configuration of the pole. In this study, poles with high levels of whitewash and supporting apparatus were all ranked as highest hazard for electrocution.

The Exterior Electric shop (49 CES/CEOA) at HAFB has already completed retrofits on poles as requested by 49 CES/CEIE based on previous electrocutions, and plans to convert all the poles to a vertical configuration to eliminate crossarms that serve as perches in the future. The retrofits started at the La Luz Gate entrance to the base. Additionally, we have removed about 13,952 linear feet of primary and secondary overhead lines and converted to underground applications. Future projects estimate removing 14,330 linear feet of primary and secondary overhead lines and converting to underground application.

Table 7.4-5 below is a list of recent projects that support avian protection.

The 49 CES/CEIE will:

- Coordinate periodic surveys in areas with high electrocution risk for birds
- Using the NEPA process, we will annotate in the Request for Environmental Impact Analysis (AF Form 813) to include any comments concerning reducing raptors and endangered species electrocution risks
- Report all injuries and mortalities to 49 CES/CEIEE, which is responsible for reporting to USFWS and NMDGF
- Ensure that forms are distributed for personnel (e.g. Exterior Electric Shop) to report identified electrocution injuries and mortalities to 49 CES/CEIEE

Table 7.4-5. Recent Projects Supporting Avian Protection

Project # KWRD	Description	Remarks	Status
11-0250	Repair electrical poles and guy wires.	Project will consider wildlife protection with the repairs, including efforts to reduce raptor and endangered species electrocution risk.	Completed 2016
15-0130	Demolish airfield stadium lighting.	Removing about 1775 LF from primary/secondary overhead lines to underground. Positive bird safety.	In progress ECD 2018
16-0018	Repair RPA electrical feed for reliability.	The feeder will be placed underground. Positive bird safety.	In progress. ECP 2018

16-0076	Repair Heritage Park feeder.	Place electrical feeder underground. Positive bird safety.	In progress. ECP 2018
16-0107	Repair electrical primary distribution system.	Project will upgrade overhead distribution lines in various sections of the main base. Reduce raptors and endangered species electrocution risks.	Projected. Awaiting funds
17-0002	Repair clinic and Idaho Avenue feeder.	New underground electrical lines. Reduce raptors and endangered species electrocution risks.	Projected. Awaiting funds

AMPHIBIANS & REPTILES

Texas Horned Lizard (*Phrynosoma cornutum*)

Status and Protection

The Texas horned lizard has declined in about 30% of its range and has disappeared from about 50% of its range. The Texas horned lizard, formerly a Category 2 species for federal listing as endangered or threatened, was reclassified 28 February 1996 as a SOC (Department of Interior 1996). The species is protected in several states, including Texas and California.

Potential Threats

The primary threats against Texas horned lizards are habitat destruction and loss of ant habitat from development. Additional potential threats to the Texas horned lizard are insecticides and the imported red fire ant (*Solenopsis invicta*), both of which destroy the necessary ant prey by direct mortality and competition. Insecticides may also directly kill Texas horned lizards. Fire ants are spreading westward, but have not yet attained a high density in arid lands. Fire ants could swarm and sting the lizard to death or limit the potential prey of the lizard (Mehlhop et al. 1998). On HAFB, the arid climate and xeric vegetation communities probably will not support this ant in significant numbers (Mehlhop et al. 1998, Drees and Reinert 2002). Thus, HAFB provides suitable habitat for *P. cornutum* over the long term.

Management

Studies of Texas horned lizard and other related species is scheduled for 2018.

Desert Massasauga (Sistrurus tergeminus)

The Desert Massasauga (*Sistrurus terge*minus) was recorded during the Hobert et al. 2016 survey of herpetofauna along the dune edge west of the HSTT. This species is considered a NM SGCN (2016) and more research is needed in the future to determine population density, range, and habitat. This recently acquired survey data will be used to inform future survey efforts.

FISH

White Sands Pupfish

Status and Protection

The White Sands pupfish is considered threatened by the New Mexico Wildlife Conservation Act and a SGCN. It is currently managed under the jurisdiction of NMDGF. The species was petitioned for listing under the Endangered Species Act (ESA) in 2007 and a positive 90-day finding was issued in 2009. The species is currently under review and scheduled to begin a species status assessment by the USFWS.

A Cooperative Agreement for the Protection and Maintenance of White Sands pupfish was signed in 1994 by HAFB, WSMR, WSNM, USFWS, and NMDGF, revised in 1998, and most recently renewed in May 2006. A White Sands Pupfish Conservation Plan was completed in 2015 to guide conservation of this species on WSMR and HAFB (WSMR & HAFB 2015).

Potential Threats

Potential threats to the population of pupfish within HAFB may exist due to changes in the physical or biological environment:

- Dewatering of the pupfish habitat is a possibility because intensive groundwater pumping for agricultural uses nearby could potentially lower the water table, thereby affecting surface water availability within Malone Draw and Lost River (Pittenger and Springer 1996). Changes in weather and climate patterns may also effect availability of suitable habitat (WSMR & HAFB 2015).
- Dune encroachments into pupfish habitat in the lower Lost River drainage adjacent to the HSTT may pose a threat to habitat quality. Recent visual analysis of time series imagery (Guy et al. 2012) indicate that the dunes have not moved or changed significantly over the last 70 years.
- Salt cedar, a nonnative plant rapidly decreases water availability within desert arroyo-riparian ecosystems, because of excessive evapotranspiration rates. The spread and increase of this species may pose a long-term threat to the stability of pupfish habitat (Mehlhop et al. 1998).
- A break in the sewer line that crosses Lost River (south of the Test Track) could release raw sewage into Essential Habitat
- A limited threat of lead contamination from spent munitions at the currently closed Small Arms Firing Range in Ritas Draw could leach into pupfish Essential habitat
- Unauthorized off-road vehicle use, particularly in the reach between the Malone-Ritas Draw confluence and Range Road 9 has been a chronic threat to that segment of the population (Pittenger 1996). This segment of the population is limited by low availability of water and the impact of vehicles could be substantial (Mehlhop et al. 1998). The Programmatic Environmental Assessment for Ground-Based Training on Holloman Air Force Base, officially closed all White Sand pupfish areas to mission-related vehicle training. Additional mitigations include the use of signage, physically patrolling the area, using surveillance cameras, and briefing new environmental coordinators (Figure 7.4-1 No Off-Road Driving Sign).
- Illegal collection of fish could imperil the populations, with the greatest impact occurring at the Malone-Ritas Draw segment (above Range Road 9, Pittenger and Springer 1996, Mehlhop et al. 1998)

Figure 7.4-1 No Off-Road Driving Sign

<u>Management</u>

The Cooperative Agreement (2006) sets the framework for HAFB actions for management of the White Sands pupfish. HAFB, along with the other signatory parties, agrees to cooperate in the management, protection, and conservation of present and future populations of White Sands pupfish and their habitats. As a signatory to the Cooperative Agreement, HAFB agrees to:

- Continue participation on the White Sands Pupfish Conservation Team to review activities that might affect the pupfish or its habitat, make recommendations and provide advice and information to the Team, and meet at least annually to discuss pertinent concerns either in person or via teleconference
- Maintain the Cooperative Agreement for Protection and Maintenance of the White Sands Pupfish and any subsequent approved recovery plans
- Provide logistical and financial resources necessary to carry out the responsibilities identified in the Cooperative Agreement, such as providing personnel and equipment to monitor habitats and populations of pupfish and the exchange of manpower, equipment, and funds to carry out other activities under the Agreement
- Participate in professional meetings to apprise the scientific community of the status, biology, and ecology of White Sands pupfish
- Protect, manage, and enhance habitats of White Sands pupfish within Essential Habitat and Limited Use Areas on HAFB, in coordination with signatory agencies
- Restrict all non-emergency activities, including vehicular traffic, except on existing roads, with the exception of natural and cultural resources management, conservation and research (to include, but not limited to pupfish monitoring, research and conservation activities), within Essential Habitat, with consultation of HAFB Natural Resource Managers (49 CES/CEIE). In the case of emergency activities that may affect habitats of White Sands pupfish, such as chemical spills, debris recovery from military activities, or carrion removal, notify and confer with NMDGF and USFWS, as appropriate.
- Prohibit the transport and introduction of any live nonnative aquatic organisms to aquatic habitats on HAFB. In aquatic habitats within HAFB not currently inhabited by White Sands pupfish, confer with and obtain consent of the USFWS and NMDGF prior to any establishment of nonnative aquatic organisms.

- Cooperate with the signatory agencies in the inventory and removal of specifically identified populations of nonnative fauna within HAFB to prevent the potential contamination of habitats or populations of White Sands pupfish
- Coordinate and monitor all unclassified activities proposed for implementation within Essential Habitat and Limited Use Areas with the signatory agencies to prevent negative impacts to White Sands pupfish or its habitat and review current project activities to ensure that no potential negative impacts to the species or its habitat are impending
- Evaluate and monitor all classified project activities that may affect the White Sands Pupfish or its habitat and ensure that no negative impacts to the species or its habitat will occur
- Implement, review, and update as necessary, incident response programs for accidental chemical spills, impacts from airborne debris, vehicle accidents, etc. and coordinate the resolution of any unforeseen perturbation to the White Sands pupfish or its habitats with signatory agencies immediately upon detection or advisement of such event(s)
- Develop a public information program to educate the base community about White Sands pupfish and affiliated restrictions and procedures with the Cooperative Agreement (2006)
- Ensure that members of the Conservation Team have proper permits for entry into HAFB, as pre-scheduled with the Natural Resources Manager (49 CES/CEIE) prior to entry; HAFB Security will be notified of all monitoring activities (575-572-7171)
- Provide the Conservation Team with optics permits
- Coordinate with NMDGF concerning suspected violations of the New Mexico Wildlife Conservation Act

Description of White Sands Pupfish Habitat Per the Cooperative Agreement (2006)

Essential Habitat
is aquatic habitat that is occupied by White Sands pupfish on a perennial or intermittent basis. On HAFB this includes all stream channels of Malone Draw and Lost River on HAFB, WSNM, and WSMR, and a corridor 200 meters (660 feet) wide, extending 100 meters (330 feet) from either side of the center of the stream channel. It also includes any other areas where White Sands pupfish are found or transplanted by mutual agreement of all signatories as well as a 100 meter (330 foot) buffer around said habitat as demonstrated in the previous delineations, with the exception of the experimental ponds on HAFB and any future exceptions under mutual agreement with NMDGF, USFWS, HAFB, WSNM, and WSMR and the party or parties seeking such exceptions (see Figure 1. Pupfish Protected Habitat Zones).

Limited Use Areas
are lands adjacent to existing habitat where activities must be managed to ensure that degradation of Essential Habitat does not occur through direct or indirect effects, such as contaminant runoff or excessive soil erosion. All reasonable precautions shall be taken in coordination with USFWS and NMDGF, as appropriate, to avoid or minimize degradation of Essential Habitat due to activities on Limited Use Areas (see Figure 1. Pupfish Protected Habitat Zones).

Areas of Concern
consists of all watersheds within the topographic drainage of Malone Draw-Lost River. All activities within these areas will be considered for their cumulative impacts on White Sands pupfish habitats.

White Sands Pupfish Conservation Plan (2015) and Monitoring Protocol (Pittenger 2017)

Species management is further directed by the White Sands Conservation Plan which identifies actions and monitoring protocols that can be implemented on WSMR and HAFB to improve the security of the species (WSMR & HAFB 2015). The conservation plan was initially prepared in 1994 (Pittenger 1994) and was recently updated (WSMR & HAFB 2015) but recommendations for revising monitoring protocol (Pittenger 2017) will require updates to the plan. The overall conservation goal is to maintain a viable and genetically appropriate population of the White Sands pupfish in Malone Draw and Lost River as a replicate of the natural population in Salt Creek.

Translocation Activities

- Translocation began in 1970 (Pittenger and Springer 1996, Pittenger & Springer 1999, Mehlhop et al. 1998, WSMR & HAFB 2015)
- The Lost River pupfish population is derived from Salt Creek on WSMR
- Genetic integrity of the Lost River population is maintained by regular infusions of fish from the Salt Creek parent population (e.g. Caldwell 2014)
- The pupfish population in the Lost River on HAFB is supplemented once a year with 10 pupfish of each sex in the Upper Reach and 10 pupfish of each sex in the Lower Reach from Salt Creek (Guy et al. 2012)
- Documentation of previous translocations are lacking. Previous translocations occurred in the winter (November/December). Future translocations may take place in the spring instead of the winter to coincide with yearly monitoring efforts (pers. Comm 18 December 2017, Joanna Hatt, NMDGF).
- Most recent translocation 18 December 2017 deposited pupfish from Salt Creek in two locations on Lost River
    - Upper Lost River UTM WGS84 coords: 13 N 395696E; 3640840N
    - Lower Lost River UTM WGS84 coords: 13N 390283E; 3638630N

HAFB Monitoring Protocol

A monitoring protocol for the White Sands Pupfish on HAFB is being developed in cooperation with the White Sands Pupfish Conservation team including USFWS, NMDGF, WSNM, and WSMR. HAFB's White Sands Pupfish monitoring protocol will follow the provisions of the Cooperative Agreement (2006), Conservation Plan (2015) and recommended monitoring protocol revisions (Pittenger 2017). The general goals of the monitoring protocol are:

1. Provide a conservation benefit to the species through proactive management.

2. Maintain a viable translocated pupfish population in Lost River and potentially other locations such as Bradford Spring.

    a. The White Sands Pupfish Conservation Team has recognized the need to create additional populations of the pupfish in order to secure the population; however, the Team is concerned that mosquito fish in the constructed wetlands on HAFB may outcompete the native pupfish. Mosquito fish are highly aggressive and bear their young live (avoiding the egg stage with its high predation rate), mosquito fish may prey on the eggs or young of any White Sands pupfish populations introduced to the Lake Holloman area. Therefore, pupfish will not be introduced into any areas with mosquito fish, including the constructed wetlands.

3. Monitor translocated pupfish populations and essential habitat on HAFB using similar protocols to WSMR for continuity and comparability.
    a. Propose annual or every other year inventory of Lost River pupfish populations.
        i. On WSMR, pupfish populations are monitored annually, on a rotating basis between Salt Creek and Malpais Spring (P. Morrow, WSMR, pers. comm. 2017) per recent recommendations by Pittenger (2017).
    b. Measure habitat and sampling covariates within the Lost River concurrently with fish sampling to enhance modeling (Pittenger 2017).
4. Protect, manage and enhance pupfish habitat (i.e., within those areas deemed essential to the conservation of the species). Including evaluating options to address habitat fragmentation caused by culvert erosion.
    a. Ensure that no filling of jurisdictional or non-jurisdictional wetlands is considered except when required for mission related purposes, and then will be conducted only with a permit consistent with section 404 of the clean water act, federal policy of "no net loss" of wetlands and only with an approved AF Form 332 with concurrence of 49 CES/CEAN
    b. Options include: replacing or repairing the culvert; hand transporting fish populations annually east of the culvert; maintaining the population only west of the culvert; evaluating the suitability of Bradford spring to house a second population.

Proposed Monitoring Activities

<u>Expansion and Contraction of Surface Water</u> - Define and monitor the extent and seasonal range of surface water throughout the Lost River on HAFB.

- Complete surface water inventory similar to work completed by Guy et al. 2012
- Explore using an unmanned aerial vehicle (UAV) to collect similar data in the future

<u>Population Monitoring</u> – Determine occupancy, abundance and trends of the Lost River refuge population following the conservation plan (WSMR & HAFB 2015) and monitoring recommendation from Pittenger (2017). In the minimum a presence/absence survey should be conducted.

- Conduct an annual inventory
- Distribution of sample units
    - Established sample sites will be documented and monumented for future inventory efforts
    - Points will be randomly selected along each perennial segment of the three reaches
    - A minimum distance of 20 m between adjacent sample points
- Minnow traps will be set and collected within a six hour daytime period (e.g. 0800 to 1400)

<u>Measure Habitat Covariates</u> – collect habitat data concurrent with population inventory (Pittenger 2017).

- Site covariates (e.g. water depth, water temperature, aquatic and emergent wetland vegetation cover, substrate composition, flow velocity, canopy cover)
- Sampling covariates (e.g. sample date, weather conditions, and surveyor)

Genetic Sampling – Evaluate the genetic integrity of the Lost River/Salt Creek refuge population.

- Collect genetic samples from Lost River populations
- Collect genetic samples from experimental populations as necessary
- Compare refuge population to parent population

Translocation - Continue annual infusion of fish from Salt Creek.

- Replenish fish once each year from Salt Creek to Lost River
- Deposit fish at the two established locations (Upper Reach and Lower Reach)
  - Upper Lost River UTM WGS84 coords: 13 N 395696E 3640840N
  - Lower Lost River UTM WGS84 coords: 13N 390283E 3638630N
- At least 25 pupfish of each sex (50 total) will be deposited at each location for a total of 100 fish each year (USDOI 2015)

Salt Cedar Encroachment – Monitor and control salt cedar in essential pupfish habitat on HAFB (Lost River and Malone Draw).

- Four permanent photo points were established along the Lower Reach of the Lost River on 20 October 2011 (Guy et al. 2012). Each photo point was georeferenced and a photo was taken facing northeast (see Table 7.4-2 and Figure 7.4-3).
- Photographs in these locations should be repeated every three years

Table 7.4-2. Lost River – Lower Reach Salt cedar Photo points

Photo point ID	UTM Coordinates (WGS84; X, Y)
PH1	389840, 3638366
PH2	390014, 3638491
PH3	390274, 3638622
PH4	390430, 3638612

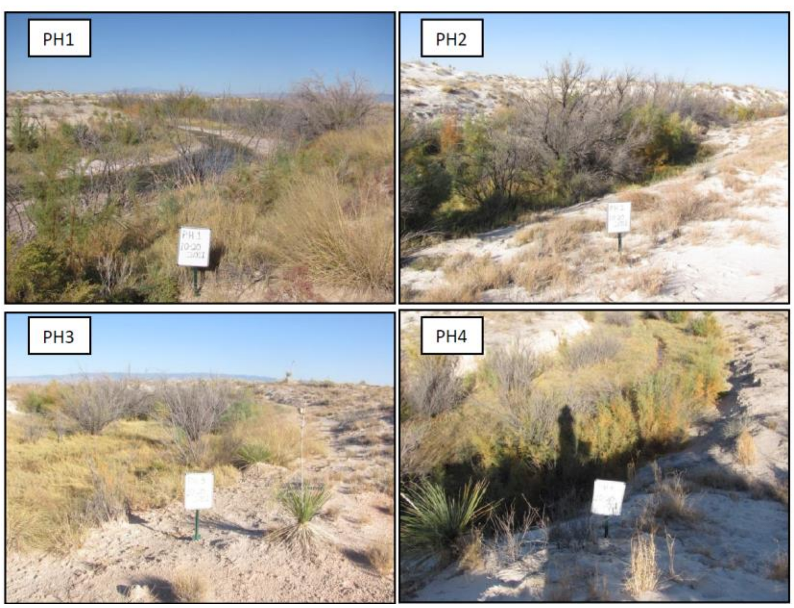

Figure 7.4-3. Lost River Lower Reach Photo points established on October 20, 2011. From Guy et al. 2012 Figure 3-11.

INVERTEBRATES

Status and Protection

No known federally or state listed invertebrate species documented on HAFB.

LICHEN

Figure 7.4-4. *Acarospora clauzadeana*, the Gypsophyllous Lichen that Occurs on HAFB

Status and Protection

Lichens represent a symbiotic relationship between fungi and algae (Ladyman and Muldavin 1996). *Acarospora clauzadeana* is a lichen that grows on gypsic soils that occurs in the southwestern U.S and Mexico (Figure 7.4-4. *Acarospora clauzadeana*, the Gypsophyllous Lichen that Occurs on HAFB). It is rare and currently under consideration by The World Conservation Union, Species Survival Commission (IUCN) for rare and endangered listing. The lichen has NHNM rankings of G1 and S1. In New Mexico, this lichen is known only from HAFB and at Bottomless Lakes, where this lichen appears "sporadically" on gypsum outcrops on Comanche Hill (Weber and Nash 1992). It is also known from Spain and Mexico. It is not known how the species dispersed among the widely separated locations nor if it has colonized certain sites only relatively recently. It is possible that it was once more common than it is now and relic sites are being observed (NatureServe 2007). This lichen is restricted to gypsum "tiaras", which are vertical, concave, gypsum surfaces on the leeward side of small shrubs typically having a northwest aspect. These microhabitat distributions and their minute size make locating the lichen very difficult (Weber and Nash 1992). The lichens appear to occur on the knolls of drainages, associated with gypsum formations and gypseous soils. Acarospora clauzadeana was the subject of brief searches by NMNHP on gypsum outcrops along river drainages within the main base (1994-95). Previous studies indicate that this lichen occurs on miniature "sandcastle" formations of weathered crystalline gypsum (Weber and Nash 1992). Exposed gypsum layers usually occur along the edge of drainages, such as Malone, Hay, Carter, Dillard and Sheep Camp draws on HAFB. Eight populations were found, seven of which are located within these draws. Precise field measurements using a GPS were not used to attain these locations; therefore, vegetation community or other environmental indicator associations have not been modeled or determined to date.

Potential Threats

Lichens are easily disturbed by foot traffic. This is somewhat advantageous during high precipitation events where the lichen fragment and can start new colonies. However, if fragmentation occurs during dry periods, it may lead to destruction of lichens (Harper and Marble 1988). Lichen is also highly susceptible to fire. The soil surfaces on knolls of drainages are normally stabilized and protected if foot and automobile traffic are limited to maintained roads. Two of the lichen colonies are protected by the 200-meter buffer established around White Sands pupfish Essential Habitats on HAFB. Protection of other sites does not warrant any action at this time, because lichen sites on H AFB do not fall within military training sites identified in the Appendix Programmatic Environmental Assessment for Ground-Based Training on Holloman Air Force Base or other ground-disturbing activity areas. Although the soils are inherently erodible, any accelerated erosion could be a threat.

7.5 Water Resource Protection

Applicability Statement

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

Program Overview/Current Management Practices

Water Conservation, Landscaping, and Golf Course Management

Located in a dry desert environment, within the Chihuahuan Desert Eco-region, HAFB receives about 8 inches of precipitation per year. The dry early-summer months of May and June are typically the hottest, with the majority of precipitation occurring between July and October. Precipitation events during the rainy season typically occur as afternoon or early evening thunderstorms. In addition to the harsh desert climate, the soils on HAFB have a high gypsum and salt content typically considered very unproductive. The natural vegetation endemic to this area can tolerate these highly alkaline soils and seasonal monsoon thunderstorms. Therefore, water conservation is a critical consideration on HAFB.

New Mexico State Policies and Guidance on Water Conservation

The New Mexico Office of the State Engineer, Water Use and Conservation Bureau, published a document called "A Water Conservation Guide for Commercial, Institutional, and Industrial Users" (July 1999), because "the importance of water to the State of New Mexico cannot be overstated. The quality of life for New Mexico's population and the future growth of the state depends on water." The state defines water conservation and water waste as any action that:

- Reduces the amount of water withdrawn from water supply sources
- Reduces consumptive use
- Reduces the loss or waste of water
- Improves the efficiency of water use
- Increases recycling and reuse of water and prevents the pollution of water

"Conversely, water waste is the excessive use of potable water that is unproductive or does not reasonably sustain economic benefits where there is a shortage of potable water. Drought combined with population growth places a burden on once-adequate water supplies. That is why water conservation is an important consideration as New Mexico begins a new millennium."

New Mexico recognizes that water management must be part of an integrated approach that examines how changes in water use will impact all other areas of operation. In the case of HAFB, this involves the use of water for recreation, landscaping, wildlife, mission operations, and for the HSTT (Appendix C. Programmatic Environmental Assessment/Finding of No Significant Impact for Management of the High Speed Test Track on Holloman Air Force Base), as well the increasing population of Alamogordo. For water management to succeed, both using the most efficient and effective technology and changing the behaviors and attitudes of users must be accomplished. An effective water management plan must examine how much water is being used and by whom, questioning if the process would be compromised with less water. The quality of the water must also be matched to the application without jeopardizing other uses of either potable or non-potable water.

HAFB is a participant in the Alamogordo Chamber of Commerce Water Committee, whose members cooperatively plan for the use of local water resources across organizational lines. The base also has representatives on the Brackish Water National Desalination Research Facility Executive Committee, which works toward addressing the major technical, environmental, and economic issues that prevent wider use of desalination to supplement increasingly limited sustainable fresh water supplies.

Holloman AFB Water Supply

Potable Water Availability and Use

HAFB lies within the ground flow gradient from the Sacramento foothills to the lowest point within the basin, Lake Lucero, to the southwest of the main base. Groundwater recharge in this area of the Tularosa Basin occurs mainly from rainfall and snowmelt in the Sacramento Mountains, where intermittent streamflow infiltrates into the coarse, loosely consolidated alluvial fan material. Although streamflow is greatest during the summer monsoons, most recharge occurs in the winter months (Wilkins 1986). Before development of the Tularosa Basin, recharge for the Tularosa Basin is estimated to be greater than 100,000 acre-feet per year, with the greatest portion accumulating at the base of the Sacramento Mountains (Meinzer and Hare 1915). Since 1911, when development began in the Tularosa Basin, population growth, and concurrent development have stressed water resources in this closed basin (Huff 2005).

Median annual precipitation in Alamogordo is 11 inches based on 96 years of data collected between 1909 and 1999. Lake evaporation is approximately 75 inches per year (Huff 2005). Most of the average annual precipitation on the main base falls during convectional thunderstorms during the summer monsoon season from July through October. Winters are usually dry (USAF 1995).

Southeast of the contiguous portion of the base, the USAF has jurisdiction or property interests in 2,694 acres called the BWWSA. This includes Boles, Douglas, San Andres, Frenchy, and Escondido well fields, and sub-surface interests to protect and develop the underground water supply on 4,187 acres of public land withdrawn under Public Land Orders 3434 and 4667. Land surface management for these public lands lies with the BLM. The total acreage of the BWWSA, including land under the jurisdiction of the BLM, is about 12,000 acres.

The BWWSA well fields receive groundwater recharge from rainfall and snowfall in six canyons in the Sacramento Mountains: Lead Canyon, Muleshoe Canyon, San Andres Canyon, Dog Canyon, Deadman Canyon, and Escondido Canyon. Recharge near HAFB has been estimated to be approximately 5% of total precipitation in the sub-basins, which varies between an average of 15.6 and 20.8 inches per year. It is unlikely that rainfall falling on the basin floor contributes meaningful amounts to groundwater recharge because of the small precipitation rates and large evaporation rates (Huff 2005). Depth to groundwater is approximately 270 feet; however, the last well was drilled to a depth of 1,300 feet. The depths of the wells are considered sufficient to prevent contamination by sewage effluent from adjacent residential communities (HAFB 2002).

Natural discharges of groundwater in the basin-fill aquifer include evapotranspiration (approximately 88%), inter-basin groundwater flow into the main Hueco Bolson aquifer (approximately 9%), and flows in streams on the basin floor (approximately 3%). The maximum evapotranspiration rate has been estimated at 4 feet per year, and the evapotranspiration extinction rate depth (the maximum extent of which evaporation occurs) was estimated at 15 feet near HAFB (Huff 2005). Depletion of water is that part of withdrawal or diversion that has evaporated, transpired, been incorporated into plants or other products, or been otherwise consumed and is therefore not available for groundwater recharge. Huff (2005) assumes that a 55 percent depletion rate is representative of precipitation in the Tularosa Basin. Burns and Hart (1988, cited in Huff 1996) simulated that ground-water water-level declines in the portion of the Tularosa Basin, including the BWWSA well fields, as ranging from 26 to 60 feet from 1982 levels by the year 2001. Huff (1996) found that groundwater withdrawals regularly equaled or exceeded estimated groundwater recharge in the Boles, San Andres, Douglas, Escondido, and Frenchy well fields from the mid-1980s through the mid-1990s. Data from HAFB identify the volume of water produced by the BWWSA in 2015 and 2016 (Table 7.5-1. Water production for the BWWSA (City) 2015/2016 for HAFB (million gallons) [1, 2]).

The total water consumption over the past 40 years has consistently decreased. Table 7.5-2. Total Water Produced CY2006 to CY 2016 on HAFB (Million Gallons)[1] show data from the last five years. Groundwater at the margins of the basin within the alluvial fans of the Sacramento Mountains grade from freshwater (containing less than 1,000 milligrams per liter [mg/L] total dissolved solids [TDS]) to highly alkaline sources near the center of the basin with more than 100,000 mg/L TDS (USAF 1995, Geo-Marine 1996). Approximately 2 percent of the saturated deposits of the basin-fill aquifer contains water having dissolved solids less than 35 mg/liter (McLean 1970, cited in Huff 2005). Although concentrations of dissolved nitrates have the most consistent increases and current concentrations of dissolved nitrate are greater than historical concentrations in seven of ten wells, current concentrations are less than the maximum contaminant level of 10 mg/liter for drinking water established by the US Environmental Protection Agency (Huff 1995). Groundwater under the main base, which may occur at depth as shallow as three feet below the surface at some points, is too salty for consumption and is not considered legally potable.

Table 7.5.1. Water production for the BWWSA (City) 2015/2016 for HAFB (Million Gallons) [1, 2]

Months	San Andres		Boles		Douglas		Escondido		Frenchy		Bonito	Total	
	Y2015	Y2016	Y2015	Y2016	Y2015	Y2016	Y2015	Y2016	Y2015	Y2016	2015/2016	Y2016	Y2015
Jan	1.02	4.69	2.58	6.19	0.00	0.00	0.00	8.66	22.39	4.97	0.00	25.99	24.51
Feb	1.77	2.10	2.26	3.72	0.00	0.00	0.00	0.32	18.44	13.46	0.00	22.46	19.59
Mar	5.85	7.25	5.66	5.62	0.00	0.00	1.27	0.00	13.75	11.79	0.00	26.53	24.66
Apr	3.68	11.61	4.72	4.42	0.00	0.00	6.31	0.00	13.60	8.50	0.00	28.31	24.52
May	6.74	12.60	11.07	4.08	0.00	0.00	4.74	0.00	14.57	10.90	0.00	37.11	27.57
Jun	6.02	13.73	10.33	3.59	0.00	0.00	5.53	0.00	13.12	13.63	0.00	35.00	30.95
Jul	4.48	14.76	7.54	4.76	0.00	0.00	9.99	0.00	12.04	14.46	0.00	34.04	33.97
Aug	10.98	15.84	2.02	5.24	0.00	0.00	12.34	0.00	4.88	11.39	0.00	30.22	32.48
Sep	7.22	18.46	5.37	3.01	0.00	1.39	14.55	0.00	7.75	3.54	0.00	34.89	26.39
Oct	1.50	12.37	2.70	3.41	0.00	1.75	16.48	0.00	9.51	12.68	0.00	30.19	30.21
Nov	0.61	10.57	6.53	0.60	0.00	1.77	7.34	0.00	8.25	12.17	0.00	22.74	25.12
Dec	2.29	4.67	7.65	20.02	0.00	0.85	7.77	0.00	5.81	2.87	0.00	23.52	28.40
TOTAL	**52.15**	**128.65**	**68.42**	**64.64**	**0.00**	**5.76**	**86.32**	**8.98**	**144.11**	**120.34**	**0.00**	**351.01**	**328.37**

1 HAFB water production data for year 2015 and 2016.
2 Bonito Lake no longer a drinking water source due the Little Bear Fire

Table 7.5-2 Total Water Produced CY2006 to CY 2016 on HAFB (Million Gallons)[1]

Year	February[2] (low month)	July[2] (high month)	Year Total	Monthly Average	Daily Average
2006	32.0	50.8	474.3	39.5	1.3
2007	30.6	34.9	418.9	34.9	1.2
2008	37.9	40.9	498.0	41.5	1.4
2009	34.1	53.8	451.7	37.6	1.3
2010	31.4	49.7	523.8	43.7	1.5
2011	42.6	49.7	482.4	40.2	1.3
2012	25.4	43.7	447.6	37.3	1.2
2013	33.4	31.4	409.5	34.1	1.1
2014	24.8	41.6	393.2	32.8	1.1
2015	22.5	34.1	351.1	29.3	1.0
2016	19.6	34.0	328.4	27.4	0.9

1 February and July are almost always the low and the high water use months for the year.

HAFB used to rely on surface water from Bonito Lake (40 percent) and groundwater (60 percent) for potable water. The water from the lake was transported through a 90-mile pipeline mostly owned by the base. The lake is owned and operated by the City of Alamogordo and it was used as a primary source of drinking water. Bonito Lake is a reservoir located in the Sierra Blanca Mountains northwest of Ruidoso, New Mexico. However, in 2012 the Little Bear Fire caused flooding and sedimentation at Bonito Lake and the surrounding area. Therefore, the surface water source is expected to be unavailable until 2019. In the meantime, Holloman AFB will rely on various wells (BWWSA) located 12 to 35 miles southeast of the base near the foothills of the Sacramento Mountains.

Groundwater extracted from the well fields is transported via pipelines of two ground level storage tank located in Boles and San Andres well field, with a total capacity of 0.9 MG. These water storage tanks are continually being filled to prevent water deficits from occurring on-base. The water is treated at the Civil Engineering Water Treatment Plant and its stores in two main storage tank (1.0 MG and 1.5 MG). The water is then distributed out to the water system to include two elevated tanks (Eagle Tower with a capacity of 0.3 MG and North Area Tower with a capacity of 0.25 MG, having a total capacity of 0.55 MG (2015 Annual Drinking Water Quality Report for Holloman AFB Public Water System ID: NM3562719).

Ten years ago, average daily demand on-base was approximately 2.1 million gallons per day (MGD). The average for 2015 was 1.0 MGD. This very significant reduction in water consumption is the result of converting the Golf Course to irrigation with treated effluent, and aggressive campaign to find and fix and replacement of 5 miles of old cast iron water mains. However, replacement and repair of leaks in water lines is ongoing thus the base water consumption is continuing to drop. Additionally, HAFB has reduced water consumption by replacing turf areas with xeriscaping and Astroturf. This large-scale conversion of traditional landscaping to xeriscaping base wide, with plans adapted to arid conditions, had contributed substantially to the decrease in water consumption on HAFB since 2003 (Figure 7.5-3. Total Annual Potable Water Production, 1976-2016).

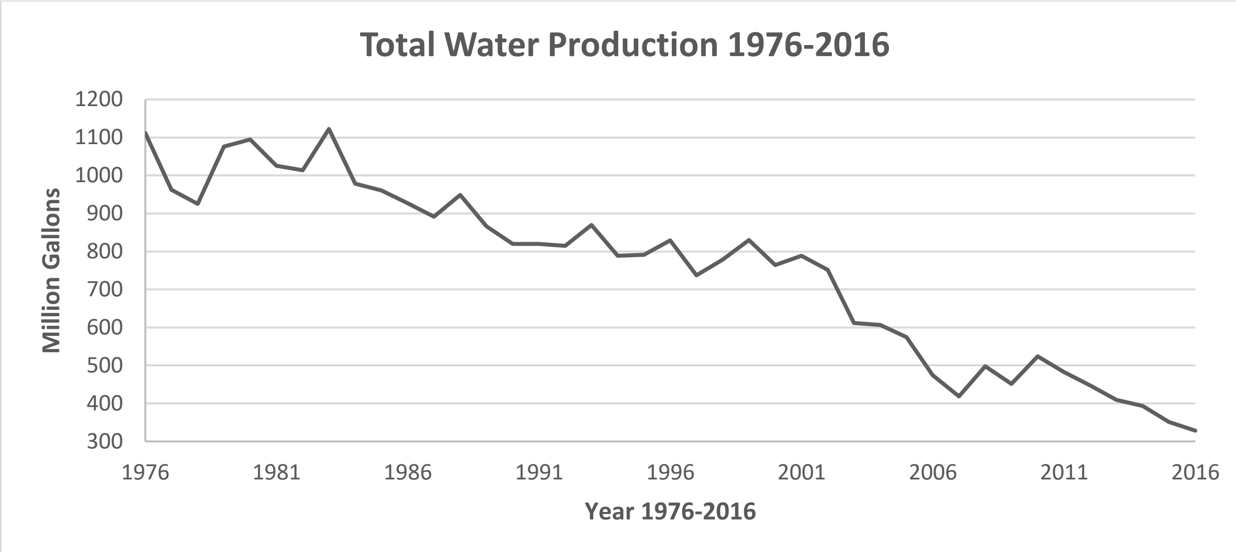

Figure 7.5-3. Total Annual Potable Water Production, 1976-2016

Non-Potable Water Availability and Use

The Holloman AFB Wastewater Treatment Plant (WWTP) has a design capacity of 1.5 Million Gallons per Day (MGD) of residential and industrial sewage from HAFB, with an average daily flow of less than 1.0 Million-Gallons per Day. The facility consist of a complete mixed, extended aeration activated sludge treatment with a parallel secondary treatment system (two aeration basins and two clarifiers), capable of treating an instantaneous peak flow of 4.5 Million Gallons per Day. Currently, the plant processes an average of 0.6 MGD.

The treated effluent flows by gravity to a splitter box that allows the effluent to be discharged to Lake Holloman and/or Lagoon G. Lake Holloman is located directly south of the Cantonment. In 1997, in cooperation with the USFWS, Holloman built a system of berms, ditches, and control structures to create a wetland roughly encompassing the area between Lagoon G and Lake Holloman. As mention before this area serves as the water containment for treated sewage effluent from HAFB WWTP.

The installation is also authorized by the State of NM to discharge treated effluent waters for irrigation purposes under Permit No. DP-1127, which was issued by the NMED, Groundwater Quality Bureau (GWQB). This permit allows the base to discharge wastewater such that the effluent may move directly or indirectly into groundwater. This permit regulates discharges from the WWTP to receiving waters as well as for irrigation of the golf course, dust suppression, and construction purposes for areas within the base.

The golf course used to account for 16 to 20 percent of potable water consumption at the base, the addition of a 400,000-gallon tank for storage of treated effluent water to irrigate the golf course did successfully eliminate the use of potable water to irrigate the golf course. All decisions regarding diversion and use of effluent for golf course irrigation must be made within the context of law, regulation, Executive Orders, mission, the Environmental Assessment for the Wastewater Treatment Plant, Holloman Air Force Base, New Mexico, pertinent Memoranda of Agreement and Understanding with which HAFB participates (Appendix D), and this INRMP.

Landscaping/Xeriscaping and Water Conservation in Arid Environments

The most positive landscape trend on the base is clearly the use of native or desert adapted plant material requiring minimum water combined with gray rock/multi-colored rock with boulders and rock mulch ground covers. This practice, referred to as xeriscape, reduces the need for irrigation and maintenance. The use of xeriscaping base wide has substantially reduced the potable water used on base by over 637 million gallons per year from a high of 1,111 million gallons in 1976 to a low of 474 million gallons per year, a reduction of approximately 57% in 30 years (Holloman AFB 2018 - Design Compatibility Standards). See Section 7.7 Grounds Maintenance for more information on HAFB landscaping plans.

Apache Mesa Golf Course Water Use

Water is our most precious resource. Unfortunately, golf courses need a reliable quantity as well as quality of water to provide recreational service to the installation. HAFB's Apache Mesa Golf Course is irrigated using effluent. HAFB has completed an environmental assessment (EA) and signed finding of no significant impacts (FONSI) which evaluates the effectiveness and impacts associated with irrigating the Apache Mesa Golf Course with effluent from the Wastewater Treatment Plant (WTP). The proposed action involved diverting 70 to 130 million gallons/year of the 255 million gallons per year discharged from the WTP to the golf course. HAFB constructed a water tank near the course to ensure water supplies match up with demand. In 2011, HAFB ceased using potable water to irrigate the golf course. This project alone reduced the consumption of potable water on base by 20% or 70 million gallons per year. See Section 7.2, Outdoor Recreation and Public Access to Natural Resources and Section 15.0 Associated Plans, Tab 3. Golf Environmental Management Plan, for more information on golf course management practices

Military Family Housing

As part of the nationwide policy to privatize military family housing, HAFB, along with 25 other Air Force installations, recently issued a 50-year contract to Soaring Heights to manage all the existing military family housing on base. Other than measures stipulated in the contract for privatization, HAFB has no direct authority over day-to-day management of and policies for military family housing.

The civilian and military make up approximately 10,600 people on base per day, using approximately 50 gallons per person per day, or 964,600 gallons per day (347.3 million gallons per year or 73% of total 2006 water volume used). Included in that volume is the 700 to 800 people who currently live in family housing (with a maximum of approximately 4,500 people in the past). Water use in family housing would be higher than 50 gallons per person per day because it includes 24-hour domestic water use.

Prior to privatization, HAFB did not provide any incentives for water conservation and required high water use landscaping rather than xeriscaping in family housing areas. Since its privatization, Soaring Heights reimburses HAFB for water consumption by housing units. Since the metering systems is not operational, HAFB collects revenues generated by the consumption of 9000 gallons per month (standard amount) regardless of the number of individuals residing in the dwelling for each housing unit. Under privatization, Soaring Heights purchases from HAFB. It is assumed that the contractor will desire to keep costs low by encouraging water conservation, both inside and outside the houses.

7.6 Wetland Protection

Applicability Statement

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

Program Overview/Current Management Practices

Executive Order 11990, Protection of Wetlands, dated 24 May 1977, requires all federal agencies to provide leadership in wetland protection when acquiring, managing, and disposing of federal lands; providing federally undertaken, financed, or assisted construction and improvements, and conducting federal activities and programs that affect land use. In support of this Executive Order, DoD issued DoD Instruction 4715.3 Environmental Conservation Program (May 1996), which sets a goal of no net loss of wetlands on DoD lands. The USAF has been directed to avoid undertaking or providing assistance for any new construction that is located in wetlands unless no practicable alternatives to construction are available and the proposed action includes all practicable measures to minimize harm on wetlands that may result from such use. Under Executive Order 11990, a Finding of No Practicable Alternative (FONPA) must be prepared by the base and signed by the Commander, ACC, before any action in wetlands may proceed.

HAFB is current and in compliance with all jurisdictional determinations and permits associated with water bodies and waterways found on base. Because waters are not jurisdictional, it will be imperative that HAFB be proactive in wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants.

With less than 1 percent of the installation considered wetlands, their protection is vital to maintaining the natural environment at HAFB. Wetlands are protected to the greatest extent possible, but are still vulnerable to threats such as non-native invasive species, loss of plant species diversity due to insufficient fire, and non-point source pollution in the form of sediment, nutrients, pesticides, oil, grease, and debris. Ground disturbance and hydrologic alteration (primarily from past practices) are also concerns for HAFB's wetlands. HAFB complies with the following regulations which have been instituted to protect wetlands:

- EO 11990, Protection of Wetlands
- EO 11988, Floodplain Management
- Watershed Protection and Flood Prevention Act

Projects or activities that may impact wetlands must go through EIAP review. During this process, required permits are identified and other protective measures are developed to avoid or minimize impacts. The 49th Civil Engineer Squadron, Installation Management Flight Environmental Element, (49 CES/CEIE) shall ensure wetland are protected prior to execution of projects. Ground disturbing activities such as off-road driving and digging are restricted in wetlands, unless the proper permits have been obtained.

<u>Monitoring Needs</u>
Successful management of the wetlands complex depends on the adaptive management approach to determine if the operational actions taken are meeting effluent evaporation, wildlife habitat, and invasive plant species objectives.

Therefore, an active program will monitor:

- Water levels in the north end of Lake Holloman, Lagoon G and the ponds
- The location, acreage, and spread/decrease of invasive plant species, with an emphasis on salt cedar and five-horn smotherweed, and of native alkali bulrush
- The proportion of mudflat to open water, along with depth of water, at these sites
- Mudflat invertebrate populations, especially Bledius spp. beetles
- Nesting populations of shorebirds, wading birds, and waterfowl, including numbers, nest predation, and locations and habitat use
- Species, numbers and habitat use of migrating birds using the wetlands as stopover habitat, and trends
- Mosquito and Gambusia levels

Based on this monitoring program, 49 CES/CEIEN would determine additional to and/or adjustments in the operational management of the discharged effluent to meet management objectives.

Goals and Direction for Wetlands Management

The 1995 WTP EA required development of a wetlands management plan for meeting the objectives of wastewater effluent storage and evaporation and for wildlife management. This requirement has been recognized but not accomplished. Studies and recommendations have been made for management of the water resources for the integrated purposes of flow regime, shorebird habitat and management of invasive species (Freehling et al. 2002, Smith et al. 2003, Johnson and Freehling 2005; Johnson et al. 2011), but no comprehensive planned management approach has been submitted or approved to date. This chapter of the INRMP includes this comprehensive management and operational plan.

Since before the construction of the wetlands and throughout its development, HAFB has monitored vegetation changes, colonization by invertebrate species, and breeding and migrating birds at the constructed wetlands (Freehling et al. 1999, Freehling et al. 2002; Smith et al. 2003; Johnson et al. 2011). Generally, the biodiversity of invertebrates has increased through time and with it the numbers of breeding birds. However, a constructed wetland complex in the desert is an artificial ecosystem that must be carefully and skillfully managed to maintain healthy function.

The purpose of the operational and management plan is to address the main issues in the management and maintenance of the Lake Holloman wetlands complex, with particular focus on the constructed wetlands. The plan presents the goals of HAFB and other stakeholders, recommends a suite of actions to achieve those goals and resolve conflicts, and outlines approaches to achieve implementation of those actions. The ideal result will be a fully operational wetland that serves HAFB storm water and wastewater management needs while maintaining excellent wildlife habitat and addressing public health needs (Johnson and Freehling 2005; Johnson et al. 2011).

In general, the control structures allow ponds to be filled and drained separately (with the exception of Pond 1, which cannot be filled apart from Pond 2, except by storm water runoff). Thus, Lagoon G, the four constructed wetland ponds, and Lake Holloman can each be considered for separate management treatments within the wetlands. Lake Stinky can only be filled passively from overflow from Lake Holloman. Hydrology and vegetation can be effectively managed separately in each unit, or units can be managed in combination, allowing many possible strategies for managing the whole wetland. Rather than attempting to anticipate all possible future management needs and constraints for all ponds, Lagoon G, the pond complex, and Lake Holloman are addressed so that the manager can plan management actions for each year based on climatological conditions and management objectives. The various units of this management puzzle can be pieced together by Holloman managers, depending on conditions in the various units of this dynamic system at any time (Johnson and Freehling 2005; Johnson et al. 2011). Management of water levels in the wetlands, Lagoon G, and Lake Holloman will:

- Maintain sufficient storage for the wastewater treatment plant and large storm water events
- Maintain sufficient water levels for shorebirds and waterfowl in the wetlands and Lake Holloman
- Manage water levels to control and/or eliminate invasive salt cedar and Five-horn smotherweed and control of dense monotypic stands of native alkali bulrush and cattails

Management of Wetlands for Birds:
The value of wetland habitat for wildlife depends on physical and biological characteristics such as vegetation communities, invertebrate communities, water chemistry, and water depth (USAF 1996). Shorebirds in migration select stopover areas based on a specific combination of habitat characteristics, including:

- A wetland in partial drawdown with a combination of open mudflat and shallow water in a basin with gradually sloping sides
- High abundance of invertebrate prey
- Sparse vegetation (Eldridge 1992, cited in Smith et al. 2003)

Invertebrates are the critical element, so it is critical to encourage and make available invertebrate prey by implementing a proper regime of drawdown and flooding to stimulate plant growth and decomposition is critical (Smith et al. 2003). Regarding the presence and abundance of invertebrate prey species, duration of inundation is a major factor determining invertebrate assemblages in playas and other temporary wetland habitats. Management for increased diversity of aquatic invertebrates will be successful only when a reliable source of water is available to create moist-soil in the constructed wetlands (Smith et al. 2003).

A wetland in partial drawdown with a mixture of mudflat and shallow water provides a diversity of foraging habitats and a dependable food supply (Smith and Johnson 2003). Studies in southern Texas indicate that creating and maintaining sparse vegetative cover (<25% cover), adequate mudflat (>10%-15% of the area), and shallow water (>10%-15%) may be appropriate for wetland management on HAFB (Davis and Smith 1998, cited in Smith et al. 2003).

The constructed wetland should maintain both a vertical and horizontal diversity of habitats (Knight 1997). Vertical structure is provided by a variety of canopy, subcanopy, and groundcover species. A diverse horizontal structure is maintained by a matrix of open water and microhabitats ranging from dry to saturated soils on undulating topographic surfaces. A diversity of alkaline-adapted plant species providing diverse microhabitats is important for developing a broad food base for migrating birds and terrestrial and aquatic fauna. A range of water depths in wetlands provides diverse niches and fulfills habitat requirements for terrestrial and aquatic fauna as well as avifauna. Animals found in wetlands and constructed wetlands typically include microscopic invertebrates, macroinvertebrates, fish, reptiles, amphibians, birds, and mammals (Knight 1997).

Creating wide mudflats in Lagoon G by keeping water levels low could increase nesting habitat for snowy plovers. Although mammalian nest predation is higher when numbers of nests are higher, rates of nest predation are still lower for western snowy plover than for avocets and stilts because of small size, cryptic coloration, and elusive behaviors. Overall, keeping water levels in Lagoon G low would encourage avocet, stilt and plover nesting, especially if predators could be managed (Smith et al. 2003).

In summary, a wetland in partial drawdown creating shallow water or moist soil with a mixture of mudflat and shallow water habitats provides a diversity of foraging habitats and a dependable food supply. Although different shorebird species forage at different water depths or substrates, 70% to 80% of shorebird species prefer depths of less than four inches. Without drawdown, avian predators can deplete invertebrates at the mud-water surface. The ideal drawdown schedule for the constructed wetlands would optimize the creation and maintenance of mudflat habitat during both spring and fall migration while controlling invasive plant species (Smith et al. 2003).

Vegetation management is the most difficult aspect of shorebird habitat to maintain at the constructed wetlands and Lake Holloman area, especially avoiding creating dense monotypic stands of salt cedar, which needs moist soils for seed germination, and alkali bulrush. The constructed wetlands area is currently dominated by saltgrass, salt cedar, and alkali bulrush, although the salt cedar treated in the fall of 2006 is responding well to the herbicide. The area is also a good mix of mudflat, shallow water, emergent, and deepwater habitats (Smith et al. 2003).

Salt cedar is already present, although was treated in 1999 and again in September 2006 with herbicides to decrease abundance and densities. The fact that salt cedar requires moist soil as a substrate for seed germination can have confounding effects on schemes for drawdown and other moist-soil management options. Alkali bulrush may also become a problem in the constructed wetlands, as it has the potential to make areas unsuitable shorebird habitat through loss of unvegetated areas preferred for foraging (Smith et al. 2003). Five-horn smotherweed is increasing rapidly in the area and eliminating necessary unvegetated areas.

<u>Management of Wetlands for Desired Vegetation and Control of Invasive Species</u>: Successful management of the wetlands complex to meet goals and objectives will encourage wetland birds and their invertebrate prey while controlling invasive vegetation and mosquitoes, at the same time providing for storm water and wastewater management and supporting recreational use. This plan presents management strategies to attempt to accomplish these often-competing goals simultaneously.

Obstacles to accomplishing these goals are the presence of undesirable vegetation, the intermittent absence of water, and timing of water availability. By this scheme, direct control measures such as burning, disking, and herbicide application will focus on Lagoon G and the constructed ponds. It is important to recognize that vegetation control must be ongoing at the Lake Holloman wetlands complex. It is not possible to anticipate every new vegetation issue that might arise, and monitoring and adaptive management of vegetation must be ongoing to maintain functionality of the wetlands (Johnson and Freehling 2005; Johnson et al. 2011).

A plan for ongoing hydrology management is also presented to achieve HAFB goals for the wetland complex (Johnson and Freehling 2005; Johnson et al. 2011). This plan outlines a baseline schedule for annual fill and drawdown that will provide mudflat and shallow water foraging areas for migrating and nesting shorebirds and help to control vegetation through scheduled inundation. The schedule presented does not include specific timing for drying particular ponds to allow burning, disking, and herbicide application prior to inundation. The particulars of ongoing vegetation control in each pond will depend on several factors, including but not limited to:

- Vegetation remaining after previous control actions
- Extent of new vegetation encroachment at each pond during the growing season
- Management priority of particular habitats in each pond
- Availability of water for inundation
- Seasonal precipitation
- Personnel availability, experience, and skill
- Budget Constraints

One primary management goal is to retain some moist soil/shallow water in some ponds during the winter months, to provide refugia for overwintering macroinvertebrates. It is not advisable to dry all ponds for simultaneous disking, burning, or herbicide application; rather, only one or two ponds be dewatered at a time for management actions requiring dry soil. Invertebrates will be able to re-colonize other ponds as ponds are inundated. Ponds targeted for drying/vegetation control should depend on habitat and vegetation management priorities, and remaining ponds should then follow the general flooding/drawdown scheme (Johnson and Freehling 2005; Johnson et al. 2011).

<u>Salt cedar Control:</u> Killing salt cedar by short-duration flooding of seedlings the first few weeks after germination can be effective and efficient but it requires good control over water levels. The most suitable substrate for seed germination is moist fine silt deposits, making drawdown areas particularly suitable for salt cedar seed germination and establishment. Seeds remain viable for only four to five weeks and do not remain dormant in the soil. Seed dispersal coincides with spring and fall migration (late August and September), creating a conflict between management for shorebirds and control of salt cedar by flooding. Therefore chemical treatment is most effective at these times (Smith et al 2003). Salt cedar control methods suggested for use at the HAFB wetlands include (Johnson and Freehling 2005; Johnson et al. 2011):

- Applications of herbicide (imazapyr or triclopyr) to the stumps of freshly cut trees
- Foliar spraying of herbicide by helicopter or from the ground
- Inundation of seedlings in the 4 to 6 weeks after germination in conjunction with application of pre-emergent herbicide. Later in the first growing season, inundation for one to two months in the fall has proven successful in experimental studies at Bosque del Apache National Wildlife Refuge (Johnson et al. 2011).
- Mechanical removal (bulldozers, disking, root plows, root rakes)
- Burning alone is not an effective control method, because salt cedar plants re-sprout vigorously after fire. However, foliar application of imazapyr or triclopyr to salt cedar re-sprouts after burning has been used successfully in monotypic stands of salt cedar.

Bulldozing and mechanical clearing of mature stands were used during wetland construction. In 2001, foliar spraying from the ground was done at Lagoon G and the north end of Lake Holloman. Aerial chemical treatment of salt cedar with imazapyr was conducted in the area in September 2006 and preliminary examination indicates that the mature trees are responding to the herbicide. This treatment program will continue, including either additional aerial chemical treatment if determined to be needed after two years, and/or prescribed burning of the remaining dead stems to clear the area.

Biological control using introduced beetles that feed on mature salt cedar was initiated experimentally on HAFB in summer of 2007 to further control salt cedar, results for this study are anticipated in fall of 2017. The effectiveness of this program will be closely monitored. In May 2017, we examined all sites where beetles were found the previous fall. Time and funding constraints precluded a full survey of the salt cedar stands in the wetland complex. Our primary objective for monitoring in May was to determine if the beetles were reproducing in the spring. In May 2017, larvae were feeding on several plants in a cluster or in larger patches. Defoliation area at the two larval sites was more extensive than seen previously, 75 m2 and 160 m2. We did not quantify larval density. Our observations suggested that site-specific densities were higher in 2016-2017, an inference supported by conspicuous defoliation. Conclusions from our field monitoring 2015-2017:

- Presence of larvae in May 2017 confirmed that the *Diorhabda* population at Holloman is capable of two or more generations per year
- The beetles are gradually dispersing within the salt cedar stands in the wetland area and defoliating single plants or small stands
- Tamarisk leaf beetle infestation is in an early stage at the wetland area
- Salt cedar density and coverage at the Holloman wetlands are more than sufficient to sustain beetle populations at a low level
- Future monitoring will be necessary to document the fate and population dynamics of the beetles, especially in relation to management of salt cedar

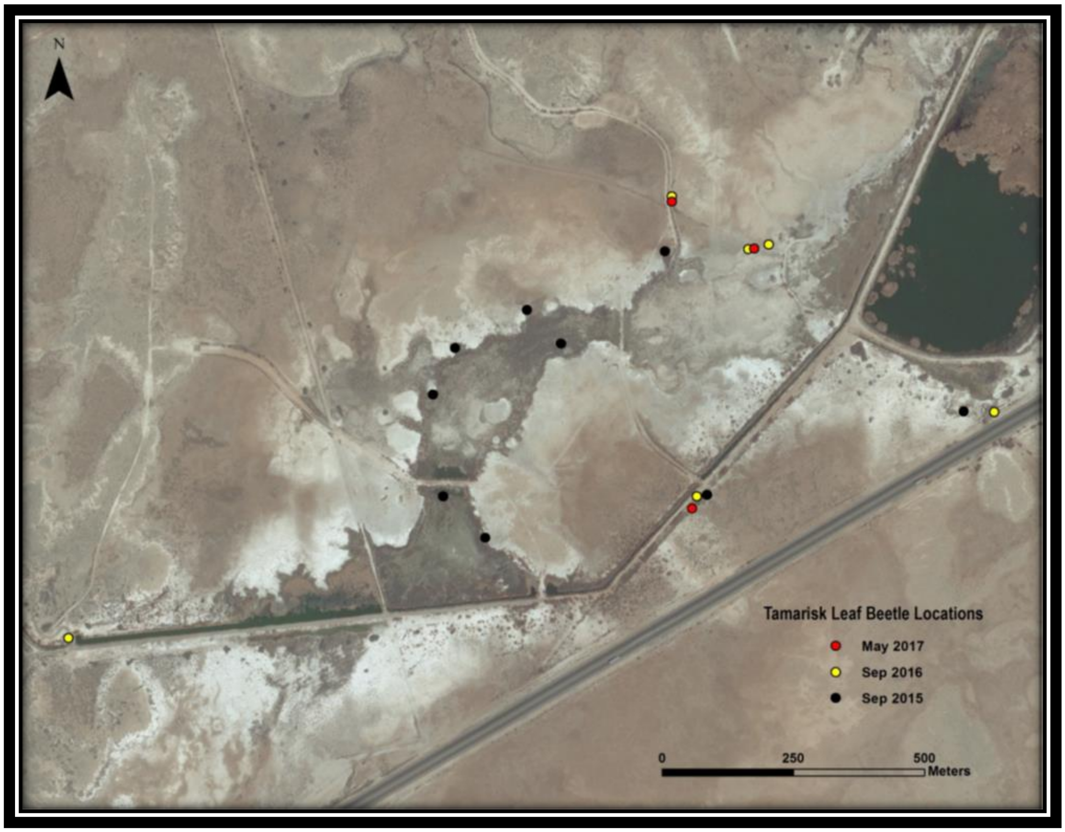

Figure 7.6-1. Tamarisk leaf beetle (*Diorhabda spp*) locations.

Reduction of Tamarix spp. seedling density by flooding can be effective but requires the capability and skill of base personnel to properly manage water levels. Smith and Kadlec (1983) found that maintaining water depth of an inch or two prevented establishment of salt cedar in a Utah saltmarsh. Within the first few weeks after germination, seedlings can be killed by relatively short periods of flooding. Later in the first growing season, inundation for one to two months is required. Salt cedar can survive prolonged spring flooding in its second year (Gladwin and Roelle 1998). Mature plants can survive flooding of three months or more. Experimental studies at Bosque del Apache National Wildlife Refuge have shown that first-year salt cedar does not survive well after fall flooding. Complete submergence of late-germinating salt cedar seedlings (4 weeks old at time of flooding on 15 August) caused high (98%) mortality (Sprenger et al. 2001).

Late fall flooding at the constructed wetlands could be an effective management strategy to reduce salt cedar seedling density at sites where shorebird foraging habitat is to be maintained by slow drawdown of the flooded areas. Interference with shorebird nesting in spring and early summer would be avoided and the need for costly future control methods (root plowing, herbicide application) would be reduced. Ideally, effectiveness of inundation would be enhanced if seedlings were flooded for long periods shortly after establishment (<4 weeks of age). Flooding tolerance appears to increase with plant size and may occur relatively early in development (Sprenger et al. 2001).

Late-season flooding may be a difficult to implement depending on water availability and climatological conditions. An alternative method is late summer disking, which has been shown to be effective in riparian restoration sites with high densities of salt cedar seedlings at Bosque del Apache NWR (Smith et al. 2002). Roots of first-season salt cedar seedlings are not well developed, yet by the following growing season root systems are too well established for disking to be effective, and root plowing and raking or herbicides are required. Costs for disking are small in comparison to mechanical control using heavy equipment (Smith et al. 2002).

The effects of herbicides proposed for use on invasive plants in the wetlands complex on aquatic organisms have been found to be not of particular concern. The three primary herbicides, imazapyr (Habitat®), triclopyr (Garlon®), and glyphosate are not hazardous to aquatic organisms and are approved for use in aquatic areas when used according to the label. Details on these herbicides are found in the Management of invasive Species on HAFB.

<u>Five-horn Smotherweed Control:</u> An effective control method for extensive stands of five-horn smotherweed is probably flooding, which would prevent seed germination. If moist-soil management of the constructed wetlands is conducted, burning the dead stems, followed by spring flooding, would be a preferred method to prevent re-establishment. Pre-emergent herbicides may be necessary in areas that cannot be flooded, but precaution is necessary and must be applied per the label (Johnson and Smith 2005). Thick patches of five-horn smotherweed near Control Structure 3 should be burned and inundated, because it impedes water flow through the structure and interferes with application of larvicides for mosquito control (Johnson and Freehling 2005).There is currently no water flow at the control structure. Temporary pools might persist after rain but smotherweed is not a problem.

<u>Alkali Bulrush Control:</u> Alkali bulrush management should be considered an ongoing maintenance requirement or the plant will become an undesirable dominant component of the wetland. Cutting and burning are effective control techniques if flooding to a depth of at least 8 inches follows the treatment. Deep flooding is required because heat penetration into the soil from fires is insufficient to cause belowground plant mortality. Inundation soon after burning or mowing will cause rapid oxygen consumption in the submerged plant parts, resulting in decay of the plant material and inhibiting its capacity to regenerate (Smith and Kadlec 1985).

Bulrush control done in late fall or winter and followed by flooding would have minimal effect on shorebird habitat and would not promote salt cedar seedling establishment. If bulrush control is determined to be necessary earlier in the year (March through mid-October), a schedule alternating between seasons or years among ponds would assure moist-soil habitat in selected ponds. Bulrush could be burned and disked with a 36” disk and a ripper, or a smaller disk if the equipment were available, followed by flooding. Care must be taken because drawdown and flooding schedules for controlling salt cedar could promote proliferation of bulrush (Johnson and Freehling 2005). This was relevant for the constructed wetland, but doesn't apply now. There is no permanent water or bulrush in those ponds. Bulrush was only a potential problem at those sites.

<u>Use of Prescribed Fire as Management Tool for Control of Invasive Plant Species:</u> The use of prescribed fire as a management tool is discussed in more detail in Section 7.9 Wildland Fire Management and the associated HAFB WFMP (2018; Chapter 15.0 Associated Plans Tab1), including New Mexico state law

regarding smoke management and permit and notification requirements and experienced agency partners for actually conducting any burns on HAFB. A detailed prescribed burn plan for the constructed wetlands complex was collaboratively developed by 49 CES/CEIE, 49 CES/CEF, and USFWS. The USFWS has extensive expertise and experience in planning and conducting prescribed burns for meeting natural resources management objectives. Only information pertinent for using this tool in the wetlands complex is discussed here. Recommendations for using prescribed fire as a vegetation management tool (Kearney 2003) are:

- The wetland lends itself to division into multiple burn units. The ponds are separated by dikes or roads, creating a break of at least 15 feet of bare ground. Fuel loading in areas adjacent to the wetlands is low. The upland vegetation is sparse, providing little chance of escape fires.
- A burn plan can be set up to include the entire wetland complex. The burn units can replicate the existing pond designations or may be more finely divided. Each pond or lagoon would be a separate burn unit. These can be ignited separately or in any combination as directed by the natural resources manager. Operationally, the burns should be of low complexity.
- All units have similar resource objectives and will require a similar fire prescription. Fire could be used to reduce cattail and bulrush densities, to burn salt cedar piles or standing dead trees resulting from flooding or herbicide treatments, and to rejuvenate saltgrass and alkali sacaton. The timing of the burns would be similar in all units. Grass burns could be implemented any time before green up and salt cedar burning could occur at any time of year.
- The burn prescription should be kept as wide as possible. Even under high-end indices (air temperature, humidity, and wind speed) burning within the wetland complex is possible because of the low adjacent upland fuel load. It is highly unlikely that fire will carry under any condition in the adjacent uplands.
- For salt cedar control, fire can be used in conjunction with flooding or herbicide treatments. Burning should be done three years or more after herbicide treatment, which provides time for the chemical to kill the plant and reduces or eliminates sprouting, preferably in the fall. For bulrush, cattails and five-horn smotherweed, burn the standing dead in the summer or fall, then flood (Johnson and Smith 2005).
- Fire treatment in wetland areas will be operationally less difficult if the area is relatively dry. The burn sequence should be coordinated with the water management schedule. Areas that cannot be drained or have water diverted should be ignited first.

<u>Mosquito Control and Management:</u> Common mosquito species known from HAFB and adjacent areas include *Aedes campestris*, *Aedese vexans*, *Culex tarsalis*, *Culiseta inornata*, *Ochlerotatus dorsalis*, and *O. sollicitans* (Clark et al. 1986, USAF 2001). As vectors of arboviruses (viral agents that replicate in and are transmitted by arthropods), mosquitoes are a public health concern. Western equine encephalitis, St. Louis encephalitis, and West Nile virus (WNV) are arboviruses of concern that are transmitted by the preceding mosquito species (Clark et al. 1986, CDC 2003, Sublette and Sublette 1970). Details on mosquito management on HAFB are included in Section 7.11 of this INRMP and the HAFB Pest Management Plan (2017; Chapter 15 Associated Plans, Tab 5).

If mosquitoes do become problematic at a wetland, control measures need not be isolated from natural resource management. Predaceous insects and vertebrates such as mosquito fish, such as those living in the wetland complex, are effective in controlling mosquito populations in well-developed functioning wetlands. Optimal habitats for mosquito larvae in semi-arid regions include small temporary pools and basins that are not inhabited by predaceous insects, fish, or amphibians.

Some features of the constructed wetlands may be conducive to mosquito emergence. Catchment basins associated with water control structures provide habitat for larvae and adult emergence when water stands behind the stoplogs for prolonged periods. Monitoring the sites and draining or flushing standing pools would help prevent mosquito production in these small areas, and biological and chemical control for mosquitoes may be necessary.

Mosquito surveillance is an ongoing program conducted by HAFB Public Health and Entomology personnel from February through October. Surveillance methods include larval dipping surveys in potential breeding habitats and light traps for adult mosquitoes. 49 CES/CEOIE Pest Management receives twice-weekly reports on the number of mosquitoes trapped. Specific monitoring sites are located on the golf course, on the jogging course, at the junction of Dillard Draw and Hwy 70, and on the west area of the base. Mosquito specimens are sent to off-base health laboratories for identification and arbovirus assays. Both West Nile Virus and St. Louis encephalitis have recently been documented in mosquitoes at HAFB. Mosquito control at HAFB involves a combination of mechanical, cultural, biological and chemical methods. Insecticides are used primarily in residential areas. Chemical fogging is employed in the housing area and the golf course. Mosquitofish, biological agents and a growth regulator are used in larval breeding areas. Fogging is initiated when counts of female mosquitoes reach a minimum threshold, a public health advisory has been issued, or complaints are high. The stated objective of Public Health and Pest Management is to find potential breeding sites and prevent adult emergence, thus minimizing the need for fogging. (K. Johnson et al, NHNM Pub. No. 11-GTR-361, Aug 2011).

<u>Operational Management of Riparian and Wetland Habitat and Associated Wildlife:</u> Proposed actions for meeting management objectives for invertebrates, wetland birds, and desirable wetland vegetation while discouraging plant species that are incompatible with the goal of enhancing shorebird habitat by managing water and vegetation in Lagoon G and the constructed ponds include the following:

- **Lagoon G** (Johnson and Freehling 2005):
  - For shorebird foraging habitat during the nesting season and spring and fall migration, remove salt cedar and five-horn smotherweed, and reduce alkali bulrush and cattail
  - To create mudflats for foraging for spring and fall migration, draw down and maintain mudflat during the spring and fall migrations
  - For nesting habitat for avocets, stilts, and snowy plovers, keep water levels low to maintain mudflats from May through June
  - For closure compliance and hydrology, maintain water to the extent possible year-round
  - For restricting the growth and spread of salt cedar and smotherweed, flood mudflats after fall migration
  - To conduct management for control or elimination of invasive plants (such as burning, herbicides, or disking), allow to dry as needed. Lower effluent levels are necessary in summer to maintain appropriate nesting habitat for birds

- **Ponds** (Freehling et al. 2002, Smith et al. 2003, Johnson and Freehling 2005):
  - For stilt nesting habitat and shorebird foraging habitat during spring and fall migration as well as for shorebird nesting habitat, remove salt cedar, reduce alkali bulrush, and control five-horn smotherweed
  - For stilt nests, maintain open pools and retain some alkali bulrush and saltgrass mosaics during breeding season (April through July)
  - For migrating and nesting shorebirds and wading birds, create foraging and nesting mudflat habitat by drawing down water in late winter and maintain mudflats until increasing water levels beginning in the fall
  - For wetland bird nesting habitat, retain nearby upland areas in acceptable condition
  - For killing salt cedar seedlings, flood, then draw down in late winter and late summer
  - For shorebird foraging habitat, using flooding and gradual drawdown techniques: <25% vegetative cover (sparse), >10-15% mudflat and >10-20% shallow water
  - Decrease vegetation encroachment to increase desirable nesting habitat
  - Maintain a small (0.50 ha), proportional, well-drained, drawdown area located adjacent to stable water areas and within a large wetland complex
  - A chronology beginning around the middle of March with a slow, evaporative drawdown, ending September with the area largely dewatered and the soil surface dry throughout the summer, followed by a slow continuous refill starting in late October

A potential strategy could be to use the recommended chronology at one pond, followed by a year without filling to use the dry conditions for salt cedar and bulrush control; then alternating the cycle between ponds to allow one dry site and one wet site available for nesting. Overall, an interval of 3 to 5 years between drawdowns in a specific area would maintain productivity of emergent vegetation.

Dunelands Black Cottonwood Stand

Cottonwood stands (*Populus deltoides* ssp. *wislizeni*) are found within dune fields in only two locations within New Mexico, in the white dunes within the boundaries of WSNM/WSMR/HAFB and within the Mescalero Sands east of Roswell managed by the BLM. These unique communities have not been studied; therefore, little can be said about this habitat type and its importance to other organisms. This community represents the only high vertical structure in the dunes. Research to determine ecosystem functions and processes will contribute to developing appropriate management strategies for the dunes.

It is likely the cottonwood stands were established prior to the dune encroachment (E. Muldavin, NHNM, pers. comm.). Tree ring studies may offer clues to past climatic changes and fire occurrence history within this portion of the basin. Holocene climate history for the Chihuahuan Desert has been extrapolated from data collected primarily from midden sites of the white-throated woodrat (*Neotoma albigula*, Betancourt et al. 1990). These data were collected at midden sites within the surrounding mountain ranges and exclude information from the Tularosa Basin. Dendrochronology research on these cottonwoods may contribute to filling an important gap in climate and fire history for pre-settlement times. The possibility exists that older, preserved trees lie beneath the dunes and could provide even earlier data.

Cottonwoods require a permanent water source. A potential threat to this ecosystem is diminished groundwater flow. Satellite images suggest that the majority of these duneland cottonwoods on HAFB are located at the terminus of Hay Draw within the dunes. Changes in groundwater flows from either the headwaters of this drainage or diversions due to Test Track activities may imperil this unique community. Physical channel conditions are known to affect biotic composition (Cummins et al. 1984). Future research should include groundwater data and water holding capacity of the dunes. These stands could potentially hold fire and climate history for the basin, which is not available elsewhere.

7.7 Grounds Maintenance

Applicability Statement

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

Program Overview/Current Management Practices

Great effort has gone into the establishment of base wide landscaping plan (Holloman AFB 2018 - Design Compatibility Standards). With the constraints of the harsh desert climate, traditional approaches - tree lined streets, dense multi-layered planting banks and thick screens of vegetation – are simply not practical. In many cases site walls and building placement serve the visual and wind screening function that hedgerows would provide in a more moderate environment. At HAFB, the most successful landscape applications implement basic landscape design principles adapted to the specific climatic constraints through the use of xeriscaping (Figure 7.7-1. Examples of HAFB xeriscaping).

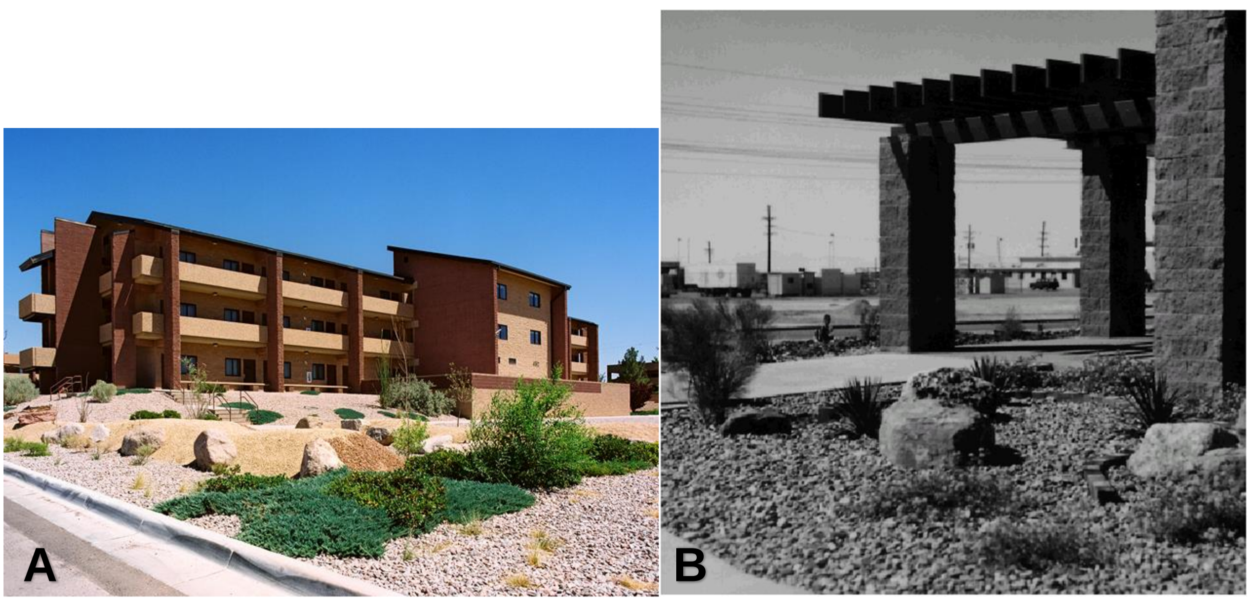

Figure 7.7-1. Examples of HAFB xeriscaping; A) as a force protection barrier at the dormitories; B) xeriscape at the western dining hall.

The use of native plants adapted to the arid Chihuahuan Desert Ecosystem has many benefits. Native plants are hardy because they have adapted to local conditions, the dry environment, and poorer soils. Once established, native plants do not need pesticides or fertilizers and require little or no mowing or watering. Native landscapes, including lawns of native, warm-season grasses, do not need to be mowed, reducing both effort and air emissions. Application of pesticides may kill beneficial insects. Eliminating the use of pesticides and fertilizers prevents these pollutants from running into wetlands and groundwater. Landscaping with native wildflowers, shrubs, trees, groundcovers, and grasses provides habitat for native mammals, birds, reptiles, and insects, thus enhancing the biodiversity of the area. Environmentally sound landscaping practices restore beneficial soil bacteria, earthworms, and most importantly, mycorrhizae, which are soil fungi that plants need to derive nutrients and moisture from lean, dry soils. Standard practices that use herbicides, pesticides, and fertilizers destroy these below-ground organisms. The beauty of native wildflowers and grasses creates a sense of place, both at home and work. The native plants increase our connection to nature, help educate our neighbors, and provide a beautiful, peaceful place to relax.

Existing planting materials and methods visible at HAFB demonstrate, in physical form, the basic landscape conflict that must be resolved in any harsh climate; native versus non-native landscape design. Both can be found throughout at HAFB. While some non-native plants are desert adapted, most imported plant material at HAFB suffers because of the harsh soil and weather conditions. Those that appear to survive, both plant material and groundcover, do so because of drastic measures. Extensive irrigation, construction of plant wells stocked with imported soils, etc. allows non-desert plant species to survive. They are however, high maintenance and are expensive. Even the mature shade trees and established lawns in the military and family housing areas survive based on irrigation. Most native and desert adapted plant material used on the base fares relatively well with limited maintenance required. (Holloman AFB 2018 -Design Compatibility Standards).

The most positive landscape trend on the base is clearly the use of native or desert adapted plant material requiring minimum water combined with gray rock/multi-colored rock with boulders and rock mulch ground covers. This practice, referred to as Xeriscape, reduces the need for irrigation and maintenance. The New Mexico Avenue landscape illustrates a very successful example of a low maintenance Xeriscape application using native plants, gray rock/multi-colored rock ground cover and boulders. Another dramatic application of this approach can be observed at the Intersection of Sixth and Delaware. While variation from this Xeriscape approach may be justified in some instances it is clearly the most logical and aesthetically pleasing landscaping approach currently in use at HAFB. (Holloman AFB 2018 - Design Compatibility Standards).

<u>Presidential, DoD, and Air Force Guidance on Xeriscaping</u>

The President prepared a Memorandum for the Heads of the Executive Departments and Agencies on 26 April 1994 entitled, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds. This Memo is based on the Report of the National Performance Review that included the recommendation for environmentally and economically beneficial landscaping practices at Federal facilities and federally funded projects. It defines “environmentally beneficial landscaping” as utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effects that the landscaping will have on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution…as well as generating long-term cost savings to the Federal Government.” The Memo recognizes that the use of native plants not only “protects our natural heritage and provides wildlife habitat, but also can reduce fertilizer, pesticide, and irrigation demands and their associated costs because native plants are suited to the local environment and climate.”

The President directs, for Federal grounds, Federal projects, and federally funded projects:

- Use regionally native plants for landscaping
- Design, use, or promote construction practices that minimize adverse effects on the natural environment
- Seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff. Landscaping practices that reduce the use of toxic chemicals provide one approach for agencies to reach reduction goals established in Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements."
- Implement water-efficient practices, such as the use of mulches, efficient irrigation systems, audits to determine exact landscaping water-use needs, and recycled or reclaimed water and the selecting and siting of plants in a manner that conserves water and controls soil erosion
- Create outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques to promote awareness of the environmental and economic benefits of implementing the presidential directive

In response to the presidential memorandum, the Under Secretary of Defense (Environmental Security) Memorandum, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds, 23 September 1994) suggests that environmentally and economically beneficial landscaping practices be incorporated as standard policy in installation INRMPs. Both DoDI 4715.3 and AFI 32-7064 strongly encourage the use of native plants and landscaping that is environmentally and economically beneficial.

As early as August 1988, the Air Force, in conjunction with the US Army, issued AFM 126-8 (Army TM 5-803-13), "Landscape Design and Planting." Recommendations for landscaping in arid areas were included in one paragraph and focused on landscape designs, plantings, and irrigation systems being appropriate to the natural environment, with careful water management as the key to success.

This guide was updated ten years later, with an entire Section (7.5) dedicated to xeriscaping. Xeriscaping is defined by the Air Force as: "the conservation of water and energy through creative and adaptive landscape design. Xeriscaped landscapes provide attractive solutions that save money, water, and maintenance. The objective of the Xeriscape Design Guide is to provide a framework for the successful implementation of water-efficient landscape by providing insight into the design process that incorporates the seven xeriscape design principles:

- **Start with a plan:** the most important step in the design process
- **Minimize turf areas**: Turf requires the most water and maintenance of all plant types. Areas planted to xeriscaping instead of turf uses 90% less irrigation water. Any turf areas should use varieties that thrive in the local environment and require minimal irrigation, design larger turf areas in shallow depressions that will naturally collect rainwater, and consider using inert materials, such as plastic turf.
- **Improve the soil:** Conduct a soils analysis to determine what soil improvements might be required, such as the addition of organic matter and amendments may change soil acidity (pH) with the addition of lime or sulfur, or improve water absorption and water-holding capacities of soils while providing nutrients to native plants. Improving soil in xeriscaping helps plants grow better and use water more effectively and efficiently and better collects, absorbs, and holds rainwater, reducing runoff, erosion and the need for more frequent irrigation.

- **Irrigate efficiently:** Xeriscaped landscapes need to be watered slowly to ensure infiltration, deeply to ensure water reaches the root zone, and infrequently
- **Select water-efficient plants:** Select native plants that are adapted to the local environmental conditions and soils, as well as considering shade tolerance or intolerance. Installations should populate their recommended plant lists with native plants that have demonstrated their long-term landscape value through their hardiness, availability, and minimal maintenance and water requirements.
- **Use mulches:** Organic or inorganic mulches applied to proper depths reduce water need and weed growth while providing visual interest and surface erosion control, as well as improving the soil by the slow decomposition of organic mulches. Avoiding plastic sheeting and plastic-based fibrous matting avoids maintenance difficulties during decomposition.
- **Practice proper maintenance:** In general, a properly planned and installed established xeriscape planting naturally requires minimal maintenance, saves water, and requires less fertilizer and insecticides

To further conserve water, raise the height of turf grass mowers, regularly inspect sprinklers for leaks or breaks, prune and thin out heavily foliated trees and shrubs to reduce evapotranspiration, and replenish mulches.

State of New Mexico Guidance on Xeriscaping

The State of New Mexico (New Mexico Office of the State Engineer 1999) incorporates the recommendations and seven principles of xeriscaping from the "Air Force Landscape Design Guide (1999)." New Mexico recommends the following water saving actions:

- Water early in the day (before 9:00 AM in the warm months) to minimize evaporation
- Adjust sprinklers to water landscape plants, not sidewalks, streets and other undesired areas
- Adjust water-delivery devices to concentrate water at the roots, not trunks and leaves
- Don't water when it is windy or raining
- Water deeply and less frequently instead of lightly every day
- Eliminate overwatering by measuring moisture at root level and water only when needed
- Mow turf grass higher and never remove more than 1/3 of the grass blade to promote deeper rooting and shading the root zone
- Adjust watering schedules to compensate for changing seasons
- Use reclaimed water to avoid use of potable water, recognizing that reclaimed water typically has higher salinity, potentially requiring mixing with potable water to avoid damage to plants

Holloman Air Force Base Implementation of Xeriscaping

The overall goals of HAFB landscaping guidelines are:

- To emphasize the regional identity of the area (Chihuahuan Desert plant communities)
- Encourage plantings that benefit wildlife, and decrease the area of improved grounds
- Converting nonnative and non-xeric adapted landscaping to native xeric adapted plants
- Reduce costs substantially
- Improved community morale
- Provide a sense of home and space, while changing attitudes about traditional high-water use lawns and landscaping

Most importantly, the use of xeriscaping base wide has substantially reduced the potable water used on base by over 637 million gallons per year from a high of 1,111 million gallons in 1976 to a low of 474 million gallons per year, a reduction of approximately 57% in 30 years. 49 CES:

- Installs landscaping and xeriscaping on base
- Incorporates xeriscape designs in projects and requests for proposals, substantially decreasing the use of potable water for irrigation, which then directly decreases the total volume of water used by the base (Table Water Use at the Apache Mesa Golf Course 1997 through 2007, Total Annual Potable Water Use by HAFB, 1976-2006)
- Provides technical advice on designing xeriscapes for facilities on base
- Select plants that do not create a traffic problem within the Cantonment area

Sediment Control Plan for Main Base

The Master Sediment Control Plan for HAFB (Bhate 2006) provides information relative to temporary and permanent sediment controls for construction activities throughout the main base to inhibit discharge of contaminated and non-contaminated sediments as defined by US Environmental Protection Agency NPDES General Permit pursuant to the Clean Water Act. The primary objective of the plan is to reduce sedimentation at construction sites caused by stormwater runoff to minimize or eliminate runoff of stormwater through implementation of Best Management Practices (BMPs) for sedimentation and erosion. The Plan segments the main base into zones based on soils, vegetation, and topography, and a buffer zone along the banks of arroyos and provides a methodology for calculating predicted soil loss from specific construction sites based on soil type and slope length. Since the topography on HAFB is relatively flat and soil types are generally moderately to highly erosive, stormwater can create erosion, typically with nearby sedimentation. Two types of soil erosion occur on HAFB:

- Surface erosion: caused by raindrops resulting in shallow, low velocity sheet flow
- Stream erosion: caused by concentrated flows from storm events that move at high velocity through and even causing rills, gullies, and channels

Surface erosion is best controlled by stabilization practices, such as seeding, mulching, surface roughing, and buffer strips, as well as minimizing the area disturbed and minimizing the time of exposure to disturbance. Stream erosion is best controlled by structural actions such as silt fences and straw bales, check dams, sediment traps, compost filter berms, and stabilized entrance and exit points to construction sites.

Seeding Mixtures for Protection of Disturbed Soils

Selecting the appropriate seed mixture for ensuring recovery of native vegetation and for soil protection will be based on the conditions of the site to be reseeded. Separated into two general categories, the mixtures are in the Table 7.7-2. Seeding Mixtures for Protection of Disturbed Soils.

Table 7.7-2. Seeding Mixtures for Protection of Disturbed Soils

Lowland/Swale Mixture		Upland Mixture	
Alkali sacaton (*Sporobolus airoides*)	3.5 lbs PLS[1]/acre	Alkali sacaton (*Sporobolus airoides)*	3.5 lbs PLS/acre
Fourwing saltbush (*Atriplex canescens*)[2]	3.0 lbs PLS/acre	Fourwing saltbush (*Atriplex canescens*)[2]	3.0 lbs PLS/acre
Inland saltgrass (*Distichlis spicata*)	2.0 lbs PLS/acre	Sand dropseed (*Sporobolus cryptandrus)*[3]	1.0 lbs PLS/acre
		Little bluestem var. Pastura (*Schizachyrium scoparius*)	3.0 lb PLS/acre
		Desert marigold (*Baileya multiradiata*)	1.5 lb PLS/acre
		Purple threeawn (*Aristida purpurea*)	1.5 lbs PLS/acre

1 PLS = pure live seed.; 2 Relatively local seed origin; 3 Local/New Mexico or west Texas seed source.

Urban Forestry on Holloman AFB

Urban forestry is the management of woody plant populations in developed or improved environments and infrastructure. The urban forest on HAFB is managed to:

- Monitor, prevent and correct potential hazards from woody plants, especially large trees, to personnel, government, and personal property and for operational readiness
- Develop and sustain woody plant populations and diversity
- Maintain and enhance aesthetics, vitality, and useful life of woody vegetation and increase the quality of life of personnel on the installation

The overall goal of the urban forest management program on HAFB is to maintain and manage the urban forest in a cost-effective manner while minimizing the risks of hazard to personnel and property. The specific goals include:

- Maintain a healthy tree population by systematically replacing unhealthy trees and replacing older/aging population to ensure a dynamic tree population
- Improve the quality of life for Holloman's community by providing shade in the summer, wind breaks in the winter and noise abatement as well as the aesthetic value of the trees themselves
- Enhance HAFB's landscape and appearance with selected trees to improve the appearance at facilities, residences and recreational areas
- Maintain a 2:1 tree replacement ratio such that for every tree removed two trees shall be planted, which will ensure a healthy tree population for HAFB

Maintenance and management of the urban forest includes:

- Manipulation and trimming of both natural and transplanted woody plant materials
- Knowledge of water and soil elements available to and necessary for the plants
- Use of (IPM)
- Knowledge of environmental factors affecting the plants
- Implementation of xeriscaping techniques

Holloman AFB Policies for the Program

It shall be the policy of HAFB to maintain an active tree program consisting of three areas: 1) Tree planning; 2) Tree planting; and 3) Tree maintenance. Each of these areas will provide a detailed approach to tree care and celebration at HAFB. The purpose of this policy is to outline and implement a tree program that will benefit HAFB, and its community, for years to come. HAFB tree program shall be governed by the Environmental, Safety, and Occupational Health (ESOH) Council. The ESOH Council is:

- a highly visible group whose primary duty is environmental issues concerning HAFB
- is chaired by the 49 WG/CC
- Largely made up of senior base leaders at the group command level

HAFB 49 CES/CEIE manages the program based on available limited funding, personnel and time. HAFB's arid climate is a major consideration for tree planting. Trees to be planted will fall into two categories, depending upon their function:

- Greenspace trees are trees that occupy space between structures, are generally low-maintenance and are native or desert adapted varieties planted in non-irrigated areas
- Recreational trees are trees that occupy recreational areas and are generally ornamental flowering trees that require some additional maintenance and specialized plantings in locations, usually near irrigation

Trees shall be planted at staggered times to ensure varied ages of trees at HAFB. Recommendations for tree planting include:

- Trees shall be properly spaced between one another and from structures, according to species requirements
- Trees near sidewalks shall not be planted closer than 4 feet for large trees (canopy at maturity), 3 feet for medium-sized trees and 2 feet for small trees
- All trees shall be planted at least 20 feet from any street corner, trees shall not be planted within 10 feet of any fire hydrant or overhead utility wire
- No tree shall be planted within 5 lateral feet of any underground water line, transmission line or other underground utility

Trees on HAFB will be pruned when they become unsafe or pose a danger to base personnel, utilities or surrounding tree population. Trees shall be pruned by HAFB maintenance personnel, as well as by contracted personnel. Tree topping shall not be permitted, except in special cases to certain trees located under utility wires and trees that violate the transitional surfaces of the airfield. Dead and diseased trees shall be removed in order to maintain a healthy tree population. Trees shall be removed when they are deemed a hazard. Stumps remaining from removed trees shall be ground to below surface grade.

Approved Landscape Plants

Plants for landscaping and/or xeriscaping on HAFB must be chosen from the Approved Landscape Plants list (Appendix G. Approved Landscape Plants). Most of the plants on the list are native, or desert adapted, so no distinction is made as to recreational or greenspace function. This list shall be reviewed and updated annually by 49 CES/CEIE, and will be available in the HAFB Design Compatibility document that is updated annually by 49 CES/CENMP.

7.8 Forest Management

Applicability Statement

This section applies to AF installations that maintain forested land on AF property. This section **IS NOT** applicable to HAFB.

Program Overview/Current Management Practices

Not applicable

7.9 Wildland Fire Management

Applicability Statement

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

Program Overview/Current Management Practices

HAFB's Wildland Fire Management Plan (WFMP) was updated in 2018. The plan addresses the history and frequency of wildfires on the installation, the threat of wildfire to the mission and natural resources, the organizational structure for wildland fire protection and wildfire response protocols, and the use of prescribed fire on the installation, and other program objectives. See Section 15 Associated Plans Tab 1. Wildland Fire Management Plan. Actions in the WFMP plan will be performed by stakeholders in the wildland fire management program of HAFB, including the Fire and Emergency Services (FES) of HAFB, Fort Bliss, and White Sands Missile Range (WSMR), HAFB Natural Resources (NR), Civil Engineering (CE), and the Air Force Wildland Fire Branch (AFCEC/CZOF). The WFMP is written as an integral, and supporting part of the INRMP as mandated by Air Force Instruction (AFI) 32-7064, Chapter 13. While wildfire suppression and prescribed fire activities are the primary activities described in this document, it also includes information and references to other related natural resources management activities including, but not limited to, ecological monitoring, endangered species management, forestry activities, remote sensing, and more.

On a fire-adapted landscape such as that found on HAFB, fire management is a pivotal activity upon which nearly all other natural resources management activities depend. Without a successful fire management program, there can be no success in the overall natural resources management program. Lack of a successful natural resources program would have direct negative impacts on HAFB's military mission. Implementation of the WFMP assures achievement of fire-related resource management and mission support objectives. HAFB has an overall low risk of wildfire between the main installation and its GSUs, though there are areas of moderate to high risk of wildfire throughout, particularly at the bombing ranges north and south of the main installation. Wildfires beginning on these ranges could damage property on and off of Air Force land, which would negatively impact the military mission of HAFB. A regular cycle of fuels treatments, both fire and non-fire, is necessary in addition to fire break maintenance and wildfire prevention through training range restrictions to reduce the potential for wildfire in these locations. Prescribed fire is also used for invasive species control, particularly for invasive salt cedar (*Tamarix ramosissima)*, in the constructed wetlands complex of the main HAFB installation.

7.10 Agricultural Outleasing

Applicability Statement

This section applies to AF installations that lease eligible AF land for agricultural purposes. This section **IS** applicable to Holloman AFB.

Program Overview/Current Management Practices

Grazing Management

<u>History of Grazing in the Tularosa Basin and HAFB</u>

Climatic factors within the Tularosa Basin have remained steady for the last 100 years; however, land use patterns have effected a change in water availability and native plant and faunal distributions. Prior to 1890, early settlers described "lush grasses" that stood "belly high to a horse" and foothill blue grama grass that grew "stirrup high" (Hawthorne-Tagg 1997). By 1934 the range was said to be "as bare as a rat's tail" (Hawthorne-Tagg 1997). Oral histories taken from previous landowners and lessees of Holloman lands recalled year-round springs near Tularosa (Tula) Peak and within Reagan and Sheep Camp Draws (Hawthorne-Tagg 1997). These springs dried up around 1952; residents blaming the drilling of wells in Tularosa. In 1939, Grazing Service inspectors noted only minor encroachments of pickleweed within the wide draws that dissect the main base. This species is now widespread and common within the draws, which may have occurred due to overgrazing (Trammel 1995). Furthermore, in the 1920's inland saltgrass, now found in high densities within the wetlands south of the Cantonment Area, was widespread within the drainages and a common forage for cattle (Hawthorne-Tagg 1997). Runoff is now reduced within these draws, possibly due to irrigation diversions at the mountain front (Hawthorne-Tagg 1997). Increase in mesquite within the basin may be due to multiple factors, including climatic and grazing practices.

The Homestead Act of 1862 was the culmination of more than 70 years of controversy over the distribution of lands under the jurisdiction of the United States government. The Act allowed any person to file for a quarter-section of free land (160 acres), which became private property after five years with land development and residency. This opened much of the western lands of the United States to agriculture and livestock grazing. The Native Americans occupying the Tularosa Basin were mainly agriculturalists who developed drainage systems (acequias) to re-direct mountain runoff for irrigation purposes between 600 to 1200 AD. However, settlers of primarily Hispanic origin from the flooded Rio Grande regions moving to the foothills of the Sacramento Mountains were predominantly cattle ranchers who homesteaded acreage within the basin, pursuant to the Homestead Act of 1862. Some of the first settlements were at the mouth of the Rio Tularosa and La Luz Creek (Hawthorne-Tagg 1997).

Livestock grazing was common in the grasslands of the Tularosa Basin since the late 1800s until approximately 1945 (Hawthorne 1994a). By 1916, due to droughts, limited water resources, and poor crop returns, 90% of the homesteads were abandoned. The only HAFB property to remain in continual use for farming purposes until condemnation by the government was the BWWSA, which is still grazed by livestock under the jurisdiction of the BLM. Much of the soil there has been eroded and native grasses have been replaced by shrubs, due to farming and grazing practices. Sparse vegetative cover and monsoonal precipitation events subject the area to extensive sheet erosion. Within the southernmost extent of the BWWSA, an archaeological site, sensitive to destruction by fire, sits between two drainages on the alluvial fan. The site has historical importance to ranching in the Tularosa Basin and could be considered for the National Register (Hawthorne 1994a). In response to overgrazing of public domain lands, the Taylor Grazing Act of 1934 implemented a state and federal lease permit system for grazing policy on public lands. Prior to that time, livestock had "free range" with no legally enforceable restrictions on grazing boundaries. The Act created grazing allotments, with first preference given to ranchers already using the lands for grazing.

Under this system and up to 1942 when the government took over lands now known as HAFB, five grazing allotments overlapped these lands. The permittees had ranches on private lands, grazing allotments on federal lands, and leases on state lands. In comparison to other ranches throughout the Tularosa Basin, Holloman ranches were much smaller, but their proportion of federal range was much higher. For example, privately-held lands amounted to roughly 2% of the area, while 82% were federal allotments. Another difference between Holloman ranches and others within the basin was the production of supplemental feed. Dry farming techniques were used in Malone, Hay, and Carter Draws. Grass hay and field corn were planted for livestock feed and small gardens occasionally were planted for personal use.

Lands on AFB were taken out of agricultural production in 1942. Several remnants of this historic period have either been destroyed by military personnel or deteriorated in the harsh desert environment. Fifty-eight historic sites, including remains of ranches, farms, irrigation systems, and refuse scatter, have been inventoried and documented (Hawthorne-Tagg 1997). These sites represent an important cultural and historic link to past lifestyles and occupants, particularly characteristic of the Tularosa Basin, and some are considered eligible for the National Register of Historic Places (Hawthorne-Tagg 1997).

Current Grazing Patterns on HAFB

The HAFB perimeter in the far northeast corner of the base was originally fenced approximately two miles inside, not at, the boundary. Cattle from the adjacent BLM grazing allotment commonly grazed land under HAFB management, affecting the archaeological sites and the quality of the grassland. This was corrected by construction of a fence along the boundary. Some limited trespass in areas with poor boundary fence repair also occurs along the eastern boundary from adjacent private, state, and BLM allotments.

Grazing has not occurred on the land transferred from the BLM to the Air Force under the National Defense Authorization Act for Fiscal Year 1995. This area consists of 1,262 acres covering portions of Lake Holloman and Stinky Playa. The law recognized grazing as a pre-existing allowable use on the land south of US Highway 70 (termed South Stinky Playa) as part of the transfer. The law requires HAFB to adjust the boundary of the grazing allotment "in such a way as to retain the portion of the allotment located south of Highway 70 in New Mexico and remove the portion of the lands that is located north of such highway;…The Secretary of the Air Force shall offer to enter into an agreement with each person who holds a permit for grazing on the lands transferred to the Department of the Air Force at the time of transfer to provide for the continued grazing by livestock on the portion of the lands located south of the highway." The boundary survey was completed in 1998. An initial evaluation of the forage potential indicates that less than one Animal Unit Month (AUM) for less than one week is available on 18 out of 130 acres in this area for grazing. A Letter offering to enter into an agreement was refused. Therefore, grazing outleases will not be allowed on this area.

7.11 Integrated Pest Management Program

Applicability Statement

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

Program Overview/Current Management Practices

Integrated Pest Management (IPM) on HAFB

The primary objective of the pest management program is to ensure effective control of identified pest species within the mission perspective. All control procedures are planned and accomplished consistent with current laws, regulations, the DoD Pest Management Program, and the HAFB pest management plan and policies. The pest management program, which is the responsibility of the Entomology Shop (49 CES/CEOIE), is responsible for the development and implementation of a PMP. This plan is reviewed annually by the Natural Resources Manager (49 CES/CEIEN), Public Health (49 ADOS), and other personnel associated with environmental compliance and contracting when the plan is updated.

Scope of the INRMP Pest Management Chapter

The Pest Management program at HAFB is responsible for four main types of pests: general household pests, stored products pests, ornamental plant pests, and miscellaneous pests including mosquitoes. The specific programs are applied in only limited areas of the installation. This section of the INRMP will focus on the following pest management activities because of the potential effects on the environment (not commensal household pests including household insects, rodents, and feral pets such as cats and dogs) and relationship to mission:

- Management of mosquitoes
- Management of wild vertebrate pests
- Management of invasive species

Although 49 CES/CEOIE is responsible for the control of invasive and noxious plants in the Cantonment, 49 CES/CEIE Natural Resources is responsible for invasive species outside the Cantonment. For this reason, all analysis of control and eradication of invasive and noxious plants will be covered in this section. The management of Oryx populations on HAFB is covered in the BASH section (Section 7.12), since the primary control method is conducting population control hunts under the jurisdiction of NMDGF. Vertebrate pests potentially causing BASH concerns are analyzed in Section 7.12 of the INRMP consistent with the HAFB BASH Plan (Chapter 15.0 Associated Plans Tab 2). Dealing with unwanted bats in buildings is covered in the Sensitive Species section (Section 7.4). This chapter does not cover any pest management activities in base residential housing as HAFB no longer has jurisdiction over the privatized base residential program.

Summary of Non-Residential Pest Management with Potential Environmental Effects

Wildlife will be controlled with non-chemical methods to the extent possible. Unless approved under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), use of chemicals in fish-inhabited waters, wetlands, Waters of the United States, and in areas with sensitive species habitats or in areas that drain into these areas is to be stringently avoided to avoid toxic effects to aquatic species. Lost River, Malone Draw, and Ritas Draw are identified as Essential Habitat for the White Sands pupfish and therefore are environmentally sensitive to chemical pest control procedures. Waterfowl, shorebirds, and other migratory birds occupy the Lake Holloman area in large numbers and occasionally use Lagoon G. BWWSA is also considered a sensitive area.

Other Wild Vertebrates

In addition to the standard pests managed under the PMP (Chapter 15.0 Associated Plans Tab 5), coyotes, jackrabbits, cottontails, bats, and snakes are common wildlife species on HAFB. In dry years, these species increase in the housing areas, airfield, and HSTT. The "rainfield" area at the intersection of Hay Draw and the HSTT has consistent wildlife use.

Predator control programs initiated by the federal government in the 1920's targeted coyotes, jackrabbits, and kangaroo rats. These past management practices may have contributed to the slow recovery of these populations (Hawthorne-Tagg 1997). Other "pests," e.g., prairie dogs and rattlesnakes, were most often controlled by residents; today there is no evidence of prairie dogs within the boundaries of HAFB. However, a number of prairie dog towns were extirpated on the WSMR (V. Anglin, Wildlife Services, pers. comm.). Historically, WSMR supported over 46 separate location records over 100,000 acres of black-tailed prairie dogs (Cynomys ludovicianus). These colonies within WSMR are hypothesized to be part of a large prairie dog complex consisting of individual colonies interrelated over time by dispersal. Distribution was dramatically reduced between 1918 and 1940 when federal rodent control poisoning programs, targeting prairie dogs living in large colonies in the flat open country of the Tularosa Basin, were implemented to improve range conditions for cattle. At the time of the initiation of the military mission on WSMR, tiny widely-separated colonies covering a total of 500 acres were still located in the area, each with 50 to 100 individuals. These tiny colonies probably persisted into the 1970s, when they died out. One active colony that originally occurred on both sides of the boundary in the West Malpais area still survives just outside the boundary, after poisoning in 1982. Originally over 18,000 acres in size, it is now approximately 4,900 acres (Oakes et al. 2004).

The plan for managing nuisance wildlife depends on all base building occupants reporting such wildlife to the Entomology Shop. To the extent possible, methods used to control wildlife are non-chemical in nature. Any time a call is received, Entomology personnel will first survey the area and identify the nuisance species. If species cannot be identified by 49 CES/CEOIE personnel, 49 CES/CEIE will be called to identify the species to ensure appropriate response. Nuisance wildlife will be captured with live traps, snares, and tongs. Live traps should be removed at the end of the regular work-week to prevent any harm to captured wildlife from staying in a trap over the weekend. Wildlife may also be captured by hand, providing that adequate safety measures have been taken. Such methods require leather gloves and a thorough knowledge of the species and its habits. Captured wildlife, if not injured, are relocated and released to an approved location on the base.

Any protected or sensitive species (such as species protected under the MBTA, including all native species of birds) found and/or captured will be brought to the attention of the base Natural Resource Manager (49 CES/CEIE). Injured wildlife will be relocated to the Alamogordo Zoo with a report forwarded to the base Natural Resource Manager. The report details the species, location, date, time, and type of injury.

Entomology personnel remove all deceased wildlife. If the deceased animal is a protected species, the report is forwarded to the Natural Resource Manager.

Pest Management personnel should thoroughly review and integrate the requirements of the INRMP into the PMP and vice versa. This action will ensure that wildlife populations on base are not negatively impacted by pest management control activities.

Coyotes are known to occur on the airfield and at the HSTT. In 1991, coyote populations were high and concentrated in the housing area and near the runways. A month-long program was initiated by the USFWS in cooperation with HAFB Pest Management to reduce coyote populations, using cyanide in M-44s. Since that time, studies indicate artificial controls such as those conducted in 1991 are ineffective in controlling reproduction rates. Therefore, if a coyote becomes a problem on the airfield, 49 CES/CEIEN or 49 CES/CEOIE will contact USDA APHIS Wildlife Services under the existing MOU to trap or otherwise remove the offending animal. If USDA APHIS Wildlife Services cannot respond, then Depredation can be executed under the current bash plan.

Ringtails (*Bassariscus astutus*) are infrequently observed on the main base. Pest Management personnel have previously live-trapped and relocated six ringtails, with the most recent caught in Building 809 in January 2000. Guidance for not attracting wild vertebrates to inhabited areas includes:

- Personnel should not leave food outside to attract coyotes, raccoons, skunks, snakes and other animals and should not feed any wild animal
- Facility managers and personnel should ensure that all refuse is properly secured in containers inaccessible to animals

Snakes are important components of the ecosystem. Rattlesnakes are especially common near the HSTT from spring through early fall, especially along the entire length of the test track and most often at the Hay Draw intersection. Because of their ecological importance, facility managers, base employees, and contractors must contact HAFB Entomology and the CE Natural Resource manager for assistance in capturing live snakes for relocation rather than killing them. Rattlesnakes may not be captured, traded, or sold on base. Entomology is equipped to live-trap and handle any snake considered a nuisance or threat. Captured snakes are to be transported in a cooler and released in the northern portion of the Base.

Barn owls and great horned owls occasionally nest and roost outside buildings, and may roost inside hangars. Owls are not normally considered nuisance pest animals. A permit from the USFWS, under the MBTA, is required to capture or harass any raptors. The USFWS amended the MBTA to simplify the nonlethal removal of trapped migratory birds, except threatened or endangered species, or bald or golden eagles, by the general public from the interior of buildings in which their presence may be a threat to the birds, to public health and safety, or to commercial interests, without requiring a permit per the MBTA. The bird must be captured using a humane method and, in most cases, immediately released to the wild. The regulation does not allow removal of birds or nests from outside of buildings without a permit. Removal of active nests from inside buildings must be conducted by a Federally-permitted migratory bird rehabilitator. Any bird that is exhausted or ill or is injured or orphaned during the removal must be transferred immediately to a Federally-permitted migratory bird rehabilitator. Department of Interior employees authorized to enforce the provisions of MBTA may, without a permit, take or otherwise acquire, hold in custody, transport, and dispose of migratory birds or their parts, nests, or eggs, as necessary in performing their official duties (05 October 2007, effective on 05 November 2007, 50 CFR 21.12, 72 FR 193:56926-56929).

Entomology has an ongoing program to trap pigeons that are creating a nuisance inside buildings, hangars, and sheds outside of Military Family Housing (where residents tend to feed pigeons). Entomology has also been installing spikes on pigeon roosting areas to discourage pigeons. Removal of nonnative birds such as pigeons (*Columbia livia*), European starlings (*Sturnus vulgaris*), and English sparrows (Passer domesticus) does not require a permit from the USFWS under the MBTA.

49 CES/CEIE and 49 CES/CEOIE will develop educational materials (brochure, pamphlet, newspaper articles, etc.) on the benefits of predatory animals, and snakes in particular, by FY 11.

<u>Pocket Gophers</u>

Pocket gophers damage turf areas with underground tunnels throughout the year. Because of their tunneling habits, lawns and fairways on the golf course can become unsightly with mounds and may affect golf play. For pocket gopher control on base, the 2006 approved HAFB PMP (Chapter 15.0 Associated Plans Tab 5) states: "Gopher control will be conducted in the cantonment (base proper) area. Any trapping outside the cantonment will be coordinated through the Natural Resources Manager."

Entomology personnel are responsible for all trapping and chemical treatment of the gopher-inhabited area (neither method is considered better than the other). Pocket gopher control at the Golf Course is performed under contract with traps provided by Entomology and is coordinated through 49 CES/CEIEN. Macabee™ and other style gopher traps are utilized in gopher trapping procedures, primarily in areas without high public use. Traps are the first method used in areas where the ground cannot be disturbed. When in use, the traps are checked daily and once a gopher has been trapped, the trap is removed and the gopher disposed of appropriately.

ZP Bait (EPA Reg. 12455-17) is one of two chemicals (pellets with 2% zinc phosphide) used in gopher control in approved areas per the HAFB Pest Management Plan. The second of the two chemicals, Phostoxin (EPA Reg. 40285-3), is a Degesch-America, Incorporated pellet that is applied in the same manner as the ZP Bait applied per the HAFB Pest Management Plan. However, Phostoxin must not be applied within 15 feet of any occupied structure because of the potential that toxic fumes that might seep into those structures. Any Phostoxin pellets that have dropped on the ground must be collected. Though Phostoxin™ is considered more toxic to non-target animals than zinc phosphide bait (USDA 1994; Johnson and Fagerstone 1994), it biodegrades within hours of application; therefore, it may be the chemical control of choice. If other sensitive species are known to occupy pocket gopher burrows, chemical control will not be used.

<u>Mosquitoes</u>

Some of the species of mosquitoes known to inhabit HAFB are *Aedes dorsalis*, *Culex tarsalis*, and *Culiseta inornata*. Of these species, the first two are secondary vectors of western equine encephalitis; with the third being a secondary vector of California encephalitis.

49 ADOS/SGGFM and 49 CES/CEOIE conduct a weekly monitoring program between February and October using weekly dipping surveys in potentially breeding habitats and the use of light and/or CO2 traps. Monitoring sites include Dillard Draw east of the housing area, under the overpass along US Highway 70, at the golf course, along the stormwater ditches at 49er Avenue, and beside the jogging track. Control methods are activated when female mosquito counts are above 50% of the total count and/or customer complaints are high. Control methods consist of a combination of mechanical, cultural, educational, biological and/or chemical procedures. Locations of mosquito traps are listed in Appendix M and mosquito surveillance techniques are described in Appendix N of the 2006 HAFB PMP (Chapter 15.0 Associated Plans, Tab 5).

The Entomology Shop conducts all chemical applications (i.e., mosquito fogging) on base. Mosquitoes are controlled by chemical fogging within the Cantonment area, use of mosquito fish and biological agents (*Bacillus thurengensis*) and the use of a growth regulator (Altosid XR-Methoprene™) in larval breeding areas. Altosid XR-Methoprene™ will not be used in any waters containing White Sands pupfish because it is mildly to moderately toxic to fish.

HAFB implements an aggressive mosquito control program that includes the following:

<u>Biological Controls</u>: Mosquito fish (Gambusia spp.) are maintained in Dillard Draw east of Military Family Housing, stormwater runoff ditches, in the constructed wetlands and Lake Holloman area, and in golf course ponds. *Gambusia* are not allowed into White Sands pupfish habitat in Lost River, Malone Draw, or Ritas Draw. Mosquito fish have been introduced into base ditches, lagoons, and Lake Holloman to control mosquito populations. Additionally, Entomology personnel restock the main storm water ditch that runs parallel to Lagoon G. Exact population figures are unknown, but the populations are self-sustaining. The best mosquito fish habitat within the Lake Holloman wetlands complex is in storm water runoff ditches. The population seems reasonably secure, even in the alkaline and saline waters of the area. Because the constructed wetland receives treated effluent from Lagoon G and the base stormwater ditches, mosquito fish have entered the constructed wetlands. The water is too saline and alkaline to introduce other species of game fish. *Gambusia* will not be placed into any waters north of Douglas Road.

A biological larvicide, *Bacillus thurengiensis* (*B.t.*), is a bacterium used to control mosquitoes. It is placed in Dillard Draw behind the Military Family Housing, storm water drainage ditches, and other stagnant water areas. These areas are inoculated with *B.t.* from February through September. *B.t.* is used as needed in other places as determined appropriate by Entomology per the HAFB PMP (Chapter 15.0 Associated Plans Tab 5). The aerial spray program of salt cedar on main base should also substantially decrease mosquito resting areas near residential and recreational areas and the wetlands areas.

<u>Mechanical Controls</u>: Eliminating breeding sites by conserving water, minimizing flow into constructed wetlands during mosquito breeding season, repair of pipe leaks by the base Utilities shop, proper landscaping and filling in low areas that collect water after rains, and ensuring that the base Heavy Repair shop properly maintains drainage ditches and filling in unnecessary ditches. Entomology has constructed a check dam in Dillard Draw and has removed some salt cedar which provided resting habitat for mosquitoes. 49 CES/CEIEN sprayed the salt cedar stands in wetland and playa areas base-wide in September 2006. Further treatments is necessary.

Cultural Controls: Request that the golf course and lawns have a grass height no higher than two inches to eliminate mosquito resting areas and restricting excess lawn watering to avoid standing water and reduce moist environments for resting. It is also necessary to remove any containers or objects that can hold standing water that provides breeding habitat.

Chemical Controls: Chemical controls can involve lethal methods for either the larval stage or the adult stage. Chemical treatment for mosquitoes of all fish-inhabited waters, wetlands, Waters of the US, and all habitats with threatened, endangered, and sensitive species will be applied according to the label, per the HAFB Pest Management Plan and consistent with the INRMP. Application of pesticides will not be used in any waters supporting White Sands Pupfish populations without prior consultation with the White Sands Pupfish Conservation Team, USFWS, and NMDGF.

Larvicides: A growth regulator, Altosid XR™ (EPA Reg. 2724-421), Altosid pellets™, (EPA reg. 2724-448) and Agnique MMF™ (EPA Reg. 2302-14) are residual insect growth inhibitors. Altosid XR™ is rated for 150 days residual and Altosid pellets™ is rated for 30 days residual. Agnique MMF™ is a monomolecular liquid film that reduces water surface tension making it difficult for the larvae to attach to the surface, blocking their breathing tubes. Agnique MMF (a thin oil film) is used only as needed where appropriate on small puddles or pockets of still water after the rain stops. All are safe for fish.

Adult control: Anvil 10+10™ (EPA Reg. 1021-16888-8329) and Permethrin 10EC™ (EPA Reg. 4816-688-8329) are used against adult phases of mosquitoes. Anvil 10+10™ is used as an aerial spray in outdoor residential and recreational areas during early morning or sunset hours when breezes are less than 8 miles per hour. It is hazardous to fish and cannot be sprayed on or near (drift) sensitive aquatic areas. Permethrin 10EC™ is sprayed on vegetation to kill resting adults in the housing and golf course area. It is hazardous to pollinating insects, so is sprayed at dawn or dusk.

Education: Base occupants are educated on IPM mosquito control by Entomology personnel through the use of pamphlets, news articles in the base paper, the 49 CES/CEOIE intranet web page, and one-on-one counseling. During the mosquito season, Entomology publishes educational information on protecting oneself against mosquitoes in the Base paper and on the intranet; the Shop is working on getting this same information into the public domain.

Mosquito Magnet Traps: Two Mosquito Magnet traps (non-chemical traps) will also be used for the control of adult mosquitoes at the Apache Mesa Golf Course. These units attract mosquitoes through the release of carbon dioxide (i.e., extremely low amounts of propane gas). Public Health's (49 ADOS) objective, in coordination with 49 CES/CEOIE, is to seek out potential breeding sites and prevent mosquitoes from reaching adulthood. This approach minimizes the need for fogging. Aerial spraying of Dibrome is not recommended. Dibrome could be allowed in extreme cases, such as an outbreak of encephalitis. An AF Form 332 would be required before any aerial spraying could be conducted.

Noxious Weed and Invasive Plant Species

An Overview of the Problem

Many nonnative (alien) plant species have invaded landscapes (both natural and developed) at HAFB. The term "weed" means different things to different people. In the broadest sense, it is any plant growing where it is not wanted. Weeds can be native or introduced, invasive or non-invasive, and noxious or not noxious. Executive Order 13112, Invasive Species, defines an invasive species as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.” “Noxious weed” is a legal term applied to any living stage of plant which is of foreign origin, is new to or not widely prevalent in the US, and can directly or indirect injure crops, other useful plants, livestock, poultry, or other interests of agriculture, including irrigation, navigation, fish and wildlife resources, or the public health (Federal Noxious Weed Act of 1974, as amended.

Weeds are also defined as “pests,” to be managed using an IPM approach, and therefore their management regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; 7 U.S.C. 136(t)). An IPM approach is defined by FIFRA (7 U.S.C. 136r-1) as a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks.

“The Secretary of Agriculture, in cooperation with the [EPA] Administrator, shall implement research, demonstration, and education programs to support adoption of Integrated Pest Management…The Secretary of Agriculture and the Administrator shall make information on Integrated Pest Management widely available to pesticide users, including Federal agencies. Federal agencies shall use Integrated Pest Management techniques in carrying out pest management activities and shall promote Integrated Pest Management through procurement and regulatory policies and other activities.”

The 49th Civil Engineer Squadron (49 CES/CEIE), which manages noxious weeds and invasive species on lands under the jurisdiction of HAFB, is concerned about these invasive plants for many reasons. First, large infestations of noxious weeds could affect the Air Force’s ability to maintain and utilize ground training areas, as well as creating safety hazards to implementing the installation’s military missions. Secondly, noxious weed and invasive species infestations adversely affect ongoing natural resource activities targeted at soil erosion control, revegetation, maintenance of biological diversity and native plants, wetlands protection, and wildlife management.

Executive Order 13112 requires Federal agencies, “to the extent practicable and permitted by law” to identify its actions that may affect the status of invasive species and to use its programs and authorities (within budgetary limits) to:

- Prevent the introduction of invasive species
- Detect and respond rapidly to and control populations of invasive species in a cost-effective and environmentally sound manner
- Monitor invasive species populations reliably and accurately
- Provide for restoration of native species and habitat conditions in ecosystems that have been invaded
- Conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species
- Promote public education on invasive species and the means to address them

The Executive Order also prohibits Federal agencies from authorizing, funding, or carrying out actions that might cause or promote introduction or spread of invasive species unless the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions. It created the National Invasive Species Council (NISC) and requires the development of a National invasive Species Management Plan, which was recently updated in December 2008 (NISC 2008). The NISC is charged with providing coordination, planning, and overall leadership for Federal invasive species programs and outreach to state, tribal, local, and private partners. The Secretary of the Department of Defense is one of ten Federal department and agency heads on the Council.

HAFB is required by the Federal Noxious Weed Act of 1974, as amended, to enter into cooperative agreements with local counties to control undesirable plant species. Both New Mexico state law (Noxious Weed Management Act of 1998) and an Otero County Ordinance govern the control of noxious plants in New Mexico.

HAFB has signed a 1998 MOU including Otero County, Otero Soil and Water Conservation District, NRCS, BLM, Bureau of Indian Affairs (BIA), Lincoln National Forest, New Mexico Department of Transportation, Mescalero Apache Tribe, New Mexico Cooperative Extension Service, and others to voluntarily coordinate management of noxious weeds. A new MOU is currently in the process of being signed. The MOU creates the Voluntary Noxious Plant Control Interagency Working Group, which meets annually to foster coordination, cooperation, and implementation on goals and objectives, education and training, action plans and implementation, monitoring, program assessments and applying eradication and control techniques, using IPM approaches.

Of the 32 plants currently classified as noxious weeds in the state of New Mexico (New Mexico State Noxious Weed list), seven have been documented on HAFB, with 7 more known to exist on adjacent lands and likely to move on to the installation. Other invasive plant species, which are not currently classified as noxious but are being monitored and reviewed by the state and county governments, also occur on HAFB and adjacent lands. The list of Otero County invasive species that were found on HAFB in 2006 includes African rue, Malta star-thistle, Russian knapweed, Russian olive, salt cedar, Russian thistle, and Siberian elm. The New Mexico Department of Agriculture developed the official state list of noxious nonnative plants in 1999, with a manual that includes most of the species on the list. The plants on the state list are divided into three classes:

- Class A: Species that are not currently present in the state or that have limited distribution. If these species are found in the state, eradication is the highest priority. To date, none of the species on the list are known to be on HAFB.
- Class B: Species that are limited to portions of the state. Containing these species and preventing further spread to other portions of the state is the primary management goal. In areas with severe infestations, these species should be treated as Class A species. Species known on HAFB include African rue, Malta star-thistle, and Russian knapweed.
- Class C: Species that are widespread in the state. Management decisions on these species are to be made at the local level and should be based on the resource management objectives, the feasibility of control, and the level of infestation in the local area. Species known on HAFB include Russian olive, salt cedar, and Russian elm.

Russian thistle (commonly known as 'tumbleweed') and five-horn smotherweed, although not on either list, are also of concern on HAFB. Russian thistle is common throughout New Mexico. Five-horn smotherweed, a facultative wetland plant, is common on the base in moist areas, including the Lake Holloman wetland complex.

To address these issues regarding invasive plants, multiple sections within 49 CES have cooperatively developed this chapter using the principles of IPM. This chapter will be periodically reviewed, to include new information and control measures, during the review and update schedule of the INRMP (annual internal reviews, external review with necessary updates every 5 years).

Noxious Weed Impacts and Need for Effective Control

Small and large size infestations of noxious and invasive weed species occur throughout the HAFB main base, BWWSA, and the GSUs (Red Rio Bombing Range, Oscura Bombing Range, and RATSCAT Advanced Measurement Site (RAMS)). These weed populations and others documented on adjacent private and public lands are resulting in:

- Actual and potential negative impacts to military training activities
- Reduced biological diversity and wildlife habitat
- Direct and indirect adverse effects on current and future natural resource management activities
- Adverse effects on the ecological and physiological health of native plant communities
- Potential for introduction of alien insects, diseases, and parasites which could affect native plants/communities and/or agricultural crops in the area
- Decreased public and private property values

The control and, where practical, eradication, of noxious weeds and invasive species on HAFB and its GSUs is crucial from both the natural resource management and military readiness perspectives. An effective, integrated weed management program is needed to ensure compliance with federal, state, and county weed regulatory programs. Implementing a comprehensive, long-term weed management program will help promote and sustain the military mission and protect the natural environment by:

- Maintaining soil, water, and native vegetation resources which provide a quality and realistic military training environment
- Enhancing the success of revegetation efforts to replace native vegetation cover, minimize soil erosion, and restore wildlife habitat
- Minimizing the impact of military construction and training/testing activities on the spread and establishment of noxious weed species within and outside HAFB and its GSUs, boundaries, and
- Fostering a "good neighbor" relationship with adjacent land owners and managers

The Department of Defense (DoD) has entered into a MOU with nine federal agencies (BLM, Federal Highway Administration, US Geological Survey, National Park Service (NPS), Office of Surface Mining, USDA Agricultural Research Service (USDA-ARS), US Forest Service, and USFWS and an additional 253 cooperating entities to be a participating member of a Federal Native Plant Conservation Committee to strive to conserve and protect our native plant heritage by ensuring that, to the greatest extent feasible, native plant species and communities are maintained, enhanced, restored, or established on public lands, and that such activities are promoted on private lands. This MOU recognizes that plants represent over half of all species that are federally listed as threatened or endangered in the US. As of August 2006, 744 species, of 1,310 total listed species, were plants. Federal lands provide habitat for more than 200 listed plant species and 25% of the known occurrences of listed plants. Therefore, federal agencies have a substantial potential to not only conserve native plants on public lands, but also provide expertise to assist non-federal land managers in plant conservation and protection efforts. Controlling invasive plants and noxious weeds can make a major contribution toward that vision.

Installation Site Descriptions

This section addresses noxious weeds and invasive plants located on main base, the BWWSA, and the GSUs. Over 5,000 acres of the base, including approximately 700 acres of disturbed roadsides, have established populations of noxious weeds. Three of these noxious plants have been exceptionally problematic on HAFB main base: salt cedar, African rue, and Malta star-thistle. These species are also a problem in the BWWSA. A full inventory of nonnative invasive and noxious weed species has been completed and prioritization for control of these species was accomplished in 2009. Salt cedar and African Rue have been continually monitored and treated from 2009-2016. An Invasive Species Management Plan is being established for implantation in FY18 to aggressively control the invasive species Salt cedar and African Rue to restore natural Chihuahuan Desert habitat and wetlands condition and function on HAFB. The primary concerns for the specific areas of HAFB are identified below.

Holloman AFB Airfield: The HAFB airfield commonly has issues with salt cedar and African rue. Salt cedar is the primary concern as it creates frangible airfield obstructions and loss of line-of-sight visibility for pilots. Both of these safety issues can directly impact mission accomplishment, and must be maintained. Height restrictions exist within the flightlines of the airfield (FAA approach/departure imaginary surface criteria areas), and salt cedar may pose a hazard to operations due to its location and height within these zones. The height requirement is that any object must meet a 200:1 ratio (i.e., a 10 foot high object must be 2,000 feet away from the imaginary surface criteria area, within the approach/departure zone). The salt cedar was treated with ground application of imazapyr in September 2006. African rue can cause Foreign Object Damage (FOD) issues, especially in cargo loading areas, and will be controlled in areas where weed growth is causing premature paved/improved surface damage resulting in FOD.

Cantonment Area: The main cantonment area is highly developed, with a high density of paved and unpaved roads and a high degree of mowing along the roadsides. Common invasive species issues include African rue, salt cedar, and five-horn smotherweed, although other invasive and noxious weed species are also present. A full inventory of invasive and noxious weed species has been completed (FY06) and prioritization for control of species was completed in FY09. Salt cedar in portions of the cantonment was treated with aerial application of imazapyr in September 2006.

Lake Holloman and the Constructed Wetlands: The enhanced wetlands and Lake Holloman wetlands complex area, including surrounding upland areas, have a high degree of diversity in habitats and environmental conditions, including varying water depths among the various wetland areas and seasonally. The purpose of the enhanced wetlands area is to dispose of treated effluent produced at the Holloman AFB wastewater treatment plant, absorb peak storm water runoff, and provide important wildlife habitat (USAF 1995). In recent years, invasive plant species including salt cedar and five-horn smotherweed have infested the area, reducing functionality of the wetlands as well as reducing valuable shorebird and waterfowl habitat. The salt cedar was treated with aerial application of imazapyr in September 2006.

Northern Base Areas: This area includes the remaining portion of the main base not included in the airfield, Cantonment and constructed wetlands areas. A full inventory of nonnative invasive and noxious weed species has been completed and prioritization for control of these species was completed in FY09. All species are of concern in this large area, with salt cedar generally confined to areas with surface or subsurface water. The salt cedar was treated with aerial application of imazapyr in September 2006.

BWWSA (BWWSA): The BWWSA is comprised of five water wellsfields that provide drinking water to Holloman AFB for a significant portion of the year. African rue and salt cedar are both found in the BWWSA (Muldavin et al. 2006).

GSUs: Red Rio Bombing Range, Oscura Bombing Range, and RATSCAT Advanced Measurement Site (RAMS) lie entirely within the boundaries of the US Army WSMR. Primary management responsibility for invasive species lies with WSMR, although HAFB assists and/or collaborates with management. HAFB will work with WSMR to complete an inventory for nonnative invasive and noxious weed species. Priorities for control efforts will be established by the end of FY11. HAFB invasive species management goals will be consistent with WSMR management goals.

Between June 2000 and August 2002, the results of multiple planning meetings and field visits with the HAFB and WSMR environmental staff designed a new invasive monitoring program. Plots were established and baseline data collected. Among the management recommendations control of invasive species especially African Rue (Peganum harmala), should be a top priority. Alternative methods of keeping the target areas clear of vegetation is a second management priority. Mowing and/or spraying are viable options that would facilitate continued target visibility from aircraft. Either option would also enable munitions to be detected within the target areas. Additionally, either option should improve soil stability through the formation of cyanobacterial crusts (specially mowing), and both alternatives should reduce mission creep caused by blading. A third management priority would be to determine what the most important stressors are to integrity of Oscura Bombing Range This would involve research aimed at separating the military training impacts and the impacts of berming (which prevents overland water flow from entering the Impact Area). (Long-Term Monitoring Report Oscura Bombing Range, Oct 2005).

Noxious Weed Biology and Ecology

Noxious weeds and invasive plant species include all types of plant life, including annuals, biennials, and perennials. Annual plants live a single year or growth season, and are generally herbaceous (non-woody). They establish themselves through annual seeding. Biennial plants are also herbaceous, but usually live for two years. The first year’s growth is typically a ground-level vegetative rosette, with seed production (reproduction) in the second year, followed by death of the plant. Perennial plants live longer than two years and can be herbaceous, semi-woody, or woody. They may reproduce from rhizomes, root bud, seed, or other specialized tissues. Perennial weeds and invasive plants can be difficult to control because of their ability to accumulate relatively large energy reserves, primarily in underground storage tissues (roots and tubers), as well as their multiple modes of reproduction.

Weeds can be spread through seed or vegetative propagules, making control difficult without using repeated and often multiple types of control methodologies. Typical modes of propagule dissemination include wind, water, animals, soil disturbance, and human disturbance activities, such as cultivation, mowing, or construction. Seed viability is species- and site-specific, but many weed seeds can remain viable in the soil for over a decade, further making weed control difficult and long-term management a necessity.

Many noxious weeds in the U.S. were introduced inadvertently via escape of intentionally cultivated species, such as salt cedar, Russian olive, and Siberian elm, or the import of unintentionally contaminated seed/grain, such as hay and straw. Generally, noxious weeds and invasive species are aggressive invaders outside their native habitats due to the absence of natural enemies such as insects, parasites and diseases that regulate population density of native plants under normal conditions. These invasive species often readily displace native plants through competition for essential resources (light, water, soil, nutrients, or space). They also tend to out-compete native species through prolific reproduction, early seasonal growth, and/or rapid growth rates which deplete resources available to native vegetation communities, as well as the ability to survive and thrive with disturbance and harsh environmental conditions.

In arid and semi-arid environments such as HAFB, where plant communities are particularly dependent on seasonal availability of limited resources to meet biological demands of native communities, this aggressive competition can be especially detrimental. Invasive species can also modify the local environment by increasing fine fuel loads and changing natural fire-regimes, allelopathy, shading, or other physio-chemical changes such that native vegetation cannot survive the new conditions. Thus, the native vegetation communities transition to a vegetative community dominated by the nonnative species. Sites on which soil and vegetation have been disturbed can provide greater opportunity for invasive species to become established by creating “competition-free” niches, stimulating germination of weed-seed banks in the soil and by altering resource availability and competitive interactions between native and exotic species. Presently, soil disturbance and propagule dissemination during construction activities, ground-based training exercises, and current grounds maintenance activities, especially mowing, significantly contribute to the spread and maintenance of noxious weeds on HAFB.

Noxious Weed Regulatory Programs

<u>Federal Noxious Weed Act of 1974</u>

The Federal Noxious Weed Act of 1974 (as amended), 7 U.S.C. 2814 et. seq., entitled “Management of Undesirable Plants on Federal Lands,” delineates specific requirements for all federal agencies to develop, implement and coordinate an undesirable plants management program, including:

- Designating an office or person to develop and coordinate an undesirable plants management program for control of undesirable plants on federal lands
- Establishing and adequately funding an undesirable plants management program through the agency’s budgetary process
- Establishing integrated management systems to control or contain undesirable plant species targeted under cooperative agreements
- Entering into cooperative agreements with state agencies to coordinate the management of

undesirable plant species on federal lands. These agreements clearly identify the prioritization and targeting of all plant species to be controlled or contained within the boundaries of the federal lands and shall describe the integrated management system to be implemented in the control of all identified species of noxious weeds

- Utilizing an interdisciplinary approach to making decisions regarding the containment or control of an undesirable plant species or group of species, including participation by experienced personnel of federal or state agencies, giving consideration of the most efficient and effective method of containing or controlling the undesirable plant species, integrating scientific evidence and current technology into planning and decision-making, considering the physiology and habitat of a plant species in decision-making, and evaluating the economic, social, and ecological consequences of implementing the program

<u>The Noxious Weed Control and Eradication Act of 2004</u>

This legislation provides grants to "weed management entities", including only the USDA Forest Service and the BLM, state, and local governments, Tribes, and State-recognized weed management districts. For HAFB to benefit from these funds, the base would have to partner with identified weed management entities and receive funds indirectly, as DoD is not recognized by the legislation.

<u>Executive Order (13112)</u>

The Invasive Species Executive Order, signed in February 1999, created the National Invasive Species Council and an Invasive Species Advisory Committee and required preparation of a national-level Invasive Species Management Plan. This EO also outlines the responsibilities and duties of federal agencies to prevent the introduction of invasive species, to detect and control populations in a cost-effective and environmentally sound manner, to monitor populations, to provide for restoration of native species and habitats, to conduct research and develop technologies to prevent introduction and provide for environmentally sound control of invasive species, and to promote public education on invasive species. The main intent of the EO is to minimize the economic, ecological, and human health impacts that invasive species cause.

<u>Executive Order (13751)</u>

Amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

Per the E.O., the NISC prepared the first national plan to deal with the issue of invasive species in 2001, which was revised in December 2008. The revised plan, the 2008-2012 National Invasive Species Management Plan, directs Federal efforts, including overall strategy and objectives, to prevent, control, and minimize invasive species and their impacts for the next five fiscal years. The five long-term strategic goals focus Federal efforts in invasive species work related to prevention of invasion, early detection and rapid response to invasions, control and management of established invasions, restoration of invaded areas, and organization and collaboration with other entities for meeting the first four goals. The following objectives and Implementation Tasks within these Strategic Goals are applicable to HAFB:

- Objective P.2 of the Prevention Strategic Goal: Prevent establishment of unintentionally introduced invasive species introduced through high risk pathways. Implementation Task P.2.1: Reduce the movement of invasive plants, pests, and pathogens with propagative plant material. HAFB purchases carefully selected native plants adapted to xeric conditions for landscaping on base, and has a greenhouse for growing landscaping plants, which minimizes the potential for unintentional introduction of invasive plant species.
- Objective CM.2 of the Control and Management Strategic Goal: Reduce the spread and harm caused by invasive species. Implementation Task CM 2.1: Reduce the spread of invasive species through increasing the number of cleaning treatments conducted of potentially contaminated equipment and other conveyances and increasing the number of acres of invasive species treated. HAFB attempts to have all mowing equipment cleaned before moving to another area, especially to control the spread of African rue. HAFB has treated over 1,400 acres of salt cedar across the base since 2006 and attempts to use management of water levels and selective herbicide treatments in the Lake Holloman Public Access Area to control aquatic-habitat invasive species (Section 7.4).
- Objective R.1 of the Restoration Strategic Goal: Include invasive species considerations in formal guidance for restoration projects. Implementation Task R.1.1: Address invasive species concerns in planning for restoration projects in Federal land and water management field and guidance manuals. When feasible, HAFB requires the use of native plants after the control or eradication of invasive plant species for restoration toward natural conditions (Section 7.11).
- Objective OC.2 of the Collaboration Strategic Goal: Expand the coordination of invasive species programs and expenditures to leverage resources. HAFB has formal cooperative agreements with many Federal and local entities for coordination of invasive species eradication and control efforts and for sharing information (Section 7.11).

<u>National Fish and Wildlife Foundation-Pulling Together Initiative</u>

This is a public/private partnership funded by the National Fish and Wildlife Foundation and six federal agencies, including the USFWS, DoD, USDA Animal Plant Health Inspection Service (USDA APHIS), USDA-Forest Service, BLM, and NPS. The goals of the program are to:

- Prevent, manage or eradicate invasive and noxious plants through a coordinated program of public/private partnerships
- Increase public awareness of the adverse impacts of invasive and noxious plants

<u>New Mexico Weed Management Act</u>

In 1998, the New Mexico Weed Management Act (76-7D-1 to 76-7D-6 NMSA 1978) was amended. The Act concluded that weeds had caused extensive economic impacts within the state and that managing noxious weeds would improve the state’s economy and environment. This law provides the New Mexico Department of Agriculture the authority to provide technical assistance to private landowners and appropriate federal and state agencies, New Mexico commissioner of public lands, and Indian nations, tribes, and pueblos, upon request, for developing a noxious weed control program.

Otero County Noxious Weed Management Program

Multiple agencies located in-part, or wholly, in Otero County have signed a voluntary cooperative weed management agreement. Signatories have agreed to meet at least annually, coordinate weed control activities, and to conduct weed control activities to the extent possible.

Coordinated Resource Management Memorandum of Understanding

The Coordinated Resource Management (CRM) MOU is an interagency agreement allowing for multiple governmental agencies (federal, state and local) and non-governmental entities (organizations, not-for-profits, etc.) to work together on conservation measures and other resource management issues which cross political boundaries. A copy of the CRM MOU is at Appendix D. Memoranda of Agreement and Cooperative Agreements.

Salt cedar Biological Control Consortium

This group meets annually to promote the development, application, and use of biological control for salt cedar by providing technical expertise, guidance and advice, to act as a liaison with federal, state, and private entities, and to promote cooperation among various interested parties. This consortium is a local branch of the national Salt cedar Biological Control Consortium to consider special conditions existing in Texas and New Mexico. Since its first meeting in 2005, in general, 29 federal, state, and private organizations participate in this consortium. Through this consortium, HAFB was selected as a release site for the salt cedar leaf beetle (*Diorhabada elongata*).

Partnerships for Weed Management

Numerous federal, state, and local agencies and personnel will directly or indirectly assist HAFB in implementing its noxious weed and invasive species management program. Cooperative agreements and partnerships between HAFB and state and local agencies are required by the various federal and state weed laws. The purposes of these agreements and/or partnerships are to develop integrated weed management programs, prioritize control efforts and define responsibilities so that coordinated, efficient and effective regional weed control is achievable. The following organizations have been identified as potential partners, and 49 CES/CEIE is already actively involved in/with most of these organizations on various natural resource management issues on the Installation:

- **Otero County:** A voluntary Memorandum of Understanding with the county and other area stakeholders ensures that regional weed management efforts are coordinated and have a higher opportunity for success. 49 CES/CEIE participate in the county's noxious weed list designation, as well as communicates with local weed control experts to determine most successful and practical weed management practices for HAFB managed lands. Information sharing is critical to the development of local weed control strategies.
- **Natural Resources Conservation Service (USDA NRCS):** The NRCS supports weed control efforts across political boundaries. They provide additional financial/treatment support to private entities.
- **New Mexico Department of Agriculture (NMDA):** The NMDA provides technical expertise and assists entities in organizing weed management activities and outreach on request. This agency also manages the pesticide applicator certification program for private applicators in the State of

New Mexico.

- **U.S. Fish and Wildlife Service (USFWS):** The USFWS provides Chapter 7 Consultation (under the ESA) on actions that may affect listed threatened or endangered species.
- **Bureau of Land Management (BLM):** Manages invasive species on BLM lands and provides assistance to private land owners and grazing lessees with allotments on BLM land.
- **Agricultural Research Service (USDA-ARS):** The ARS has developed long-term monitoring methodologies that are used to monitor resource conditions that are used in resource management decision-making.
- **U.S. Geological Survey (USGS), New Mexico Cooperative Wildlife Research Unit:** Researchers are modeling invasive species infestations, evaluating sites at risk for new infestations, and monitoring success of developed models through a partnership with HAFB established in 2006.
- **New Mexico State University (NMSU):** NMSU researchers have been conducting phenological and cohort studies on selected noxious weed species on HAFB since 2002. Researchers and Extension Service specialists also provide recommendations for best management practices for control of multiple noxious weed and invasive species.
- **New Mexico Interagency Weed Action Group (IWAG):** This ad-hoc interagency working group has met periodically since approximately 2000. Members participate in information and technology sharing, and have provided technical input into strategic planning documents for the management of invasive species.
- **Tularosa Basin Weed Action Group:** This local ad hoc working group consisting of the San Andres National Wildlife Refuge (USFWS), WSMR, WSNM, BLM, HAFB, and Fort Bliss cooperate for sharing of information and technology for control of invasive species and noxious weeds.

Setting Priorities for Invasive Species Management

<u>National Invasive Species Council Suggested Factors for Setting Management Priorities</u>

Per Executive Order 13112 “Invasive Species”, the National Invasive Species Council suggests the following factors for setting priorities for invasive species control and eradication projects (2005), as adapted to HAFB conditions:

- Does the invasive species or resource have a statutory or policy designation, potentially increasing its priority?
- Is NEPA compliance and other coordination (Endangered Species Act, state law, or other ordinances) in place, ensuring that projects have proper planning, notification, coordination, oversight, and review?
- Are adequate and environmentally sound management methods and resources available and effective for the circumstances, such that adverse environmental impacts are balanced with the effectiveness of control methods?
- Are target populations not located in sensitive environmental areas such that control options are not restricted, efficacy is ensured, and management actions can be implemented successfully and safely?
- Can the potential for successful control be determined, would the selected control methods produce a consistent and predictable result, and is there a high probability of long-term success?

- Can the ecological plant and animal communities be restored naturally and/or are the necessary resources and materials available for restoration of plant and animal communities?
- Is the seasonal scheduling of management actions biologically optimal to ensure successful control?
- Are the current and potential social, economic, and/or cultural adverse impacts of the invasive population or species significant (cultural, recreational, historic resources, or human health)?
- Is there sufficient support from HAFB management for sustained action to ensure long-term success?

Guidance for Setting Priorities for Invasive Species Management on HAFB

The following criteria will be considered, in context of the National Invasive Species Council suggested factors for setting management priorities:

- Control efforts will be focused first on areas that impact mission capabilities. These areas include the airfield, constructed wetlands, and Cantonment areas
- Control efforts at HAFB will be focused initially on salt cedar, African rue, Malta star-thistle, and Russian knapweed
- Localized infestations, or newly identified populations of any noxious weed or invasive species, will receive immediate management priority for control over other, more widespread weed species in order to attempt to avoid establishment and spread
- Infestations closest to the Installation boundaries will generally receive higher management priority than interior sites, unless military mission capability is threatened or impacted by interior populations/infestations
- Rapidly expanding weed populations (based on data collected) will receive higher management priority than well-established, stable populations
- Weed populations found in training or other areas which routinely experience higher levels of ground disturbing activity will receive a high management priority if the military mission capability is threatened or impacted by the invasive species. If the population is fairly contained within the training area, priority will be placed on preventing the spread of the invasive species outside the already highly disturbed area. This may include requiring cleaning of vehicles, equipment and personnel following the use of the area
- Weed populations located in ecologically sensitive habitats (including wetlands or rare/sensitive species habitats) will receive a high management priority
- Difficult-to-prioritize populations and/or species data will be analyzed using the “Alien Plants Ranking System” module. This is a data analysis tool produced by the National Park Service which uses data input by the resource manager to help prioritize invasive species management efforts to maximize success

Integrated Weed Management Techniques

Noxious weed and invasive species control on HAFB will be achieved through an integrated weed management strategy (IWM, an application of the IPM approach to noxious weed and invasive plant management, control, and eradication) utilizing a combination of educational tools and materials, preventative measures, physical/mechanical methods, biological control, chemical methods and cultural methods as appropriate to the conditions. Site-specific implementation of this chapter will take into consideration economic factors, control or containment effectiveness, current scientific evidence and technology, developmental stage (phenology) of the target species, environmental/ecological consequences, and potential impact to the military mission. Compliance with the NEPA and other environmental laws (including, but not limited to, the ESA; Clean Air Act (CAA); Clean Water Act (CWA); Archaeological Resources Protection Act (ARPA); Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and others) will be applied on a case-by-case basis. The following measures are included in the IWM 'toolbox':

- **Educational Tools:** Educational tools include 1) development and distribution of informational handouts, brochures, and CD's to entities involves in potentially spreading and/or controlling noxious weeds and invasive plants; 2) working with specialty groups giving presentations or holding interactive work groups; and 3) partnering with other agencies in developing and distributing these types of tools
- **Preventative Measures:** This involves implementing methods to minimize introductions of new invasive species from one location to another such as washing mowing equipment when moving from an infested area to a non-infested area and minimizing mowing along roadsides to enable native plants to maintain the competitive advantage. It also may mean applying due diligence in monitoring areas for new species and by removing individuals of new species invasions before they become established
- **Physical/Mechanical Methods:** These methods involve the physical expenditure of energy to manually remove invasive plants. This includes hand- or machine-pulling, mowing, blading, digging and other methods.
- **Biological Control Measures:** Biological control measures involve the introduction or placement of some biological agent, whether microbial, viral, or macrobiological (insects, mammals, etc.), which reduce the chances of successful propagation of the target invasive species. This must be very carefully considered and implemented to avoid creating unforeseen ecological problems with another nonnative species. Any biological controls must be approved by USDA APHIS prior to use on Holloman AFB, and, if appropriate, coordination with the USFWS, following compliance with NEPA.
- **Chemical Control Methods:** This widely used method involves the application of some sort of chemical directly to the plant, the soil surrounding the plant, or water applied for uptake by the plant, which affects the invasive plant adversely. There are many modes of action that chemical controls take within noxious weeds, and often, chemical control requires changing the mode of action of herbicides used in order to minimize the development of resistance to the chemical controls. All chemicals must be applied by certified applicators and per the package labeling. Any herbicide control projects must have the Scope of Work reviewed and approved by the ACC Command Entomologist prior to contracting work. Herbicides not presently approved for use on Air Force installations or HAFB must be approved by the ACC Command Entomologist. All chemical usage (active ingredient) must be reported to HAFB Pest Management Shop (49 CES/CEOUE) using either form DD Form 1532 and/or DD Form 1532-1 or a contractor generated form providing the same information presented in form DD Form 1532 and/or DD Form 1532-1.
- **Cultural Control Methods:** These methods include identifying land use or management practices that contribute to the invasion or spread of invasive species and changing those practices. An

example is mowing after a noxious plant has flowered and set seed or avoiding mowing in areas with native plant communities. A cultural method to use here would be to mow the plant either before flowering has taken place, or before seed has set.

- **Prescribed Burns:** This method is the use of fire as a management tool for either populations of live plants or to clear standing dead plants from an area previously treated using another methodology (see Chapter 15.0 Associated Plans Tab 1 for HAFB Wildland and Prescribed Fire Management Plan)

Species Specific Descriptions and General Management

An Invasive Species Management Plan is being established for implementation in FY18 to aggressively control the invasive species Salt cedar and African Rue to restore natural Chihuahuan Desert habitat and wetlands condition and function on HAFB.

Outlined below are species descriptions and control strategies that will be employed to reduce or contain noxious weed and invasive plant species on HAFB. The species addressed include those species which are presently known to occur on HAFB and/or its GSUs, and are required by regulation to be controlled, as well as species which presently are known to interfere with current natural resource and military mission management of resources. All species will be addressed utilizing IWM strategies with appropriate priorities.

African Rue (*Peganum harmala*)

Infestation Locations: African rue is widespread across much of HAFB. Milder infestations are found in the BSSWA and other GSUs. Treatment along right of ways occurred in 2009 with some success. An aggressive invasive management plan is currently in work to eliminate this threat.

Species Description: African rue is an herbaceous perennial of the Caltrop family, native to northern Africa, the Middle East, and Asia. The introduction point was near Deming, New Mexico in the late 1920s or early 1930s. The introduction method was either from military vehicles returning from operations in northern Africa and/or from an individual attempting to farm the plant as a source for a desirable natural red dye called “Turkish Red”. The plant has since spread to at least eight states in the western U.S. (Texas, Arizona, California, Nevada, Idaho, Oregon, Washington, and Montana) and is problematic in southern New Mexico, including HAFB.

The plant is a bright green succulent perennial with many branching stems and narrow leaves. The flowers are white with five petals. The plant is highly prolific, with each mature plant producing 200 to 300 seed pods annually, with each pod holding 45 to 60 seeds. African rue invades highly disturbed areas where native vegetation has been removed or disturbed, such as along roadsides and at construction sites.

7.11-1 African Rue

African rue spreads by both seeds and sprouting from adventitious roots or root fragments. It can tolerate the alkaline soils characteristic of HAFB and extreme drought conditions. Its roots can reach depths of 20 feet into the soil. African rue can maintain a competitive advantage over native plants because:

- Seedling establishment probably occurs during droughts when establishment of seeds of native plants is depressed
- Most parts of the plant contain chemicals that retard or prevent the establishment and growth of native plants
- Plant growth begins early in the spring before that of many native plants
- No native insects or diseases are known to exist in the United States to control is growth and spread

The seeds may be dispersed by attaching to vehicles and equipment, including and especially mowing equipment. High densities of African rue have been found along all road rights-of-way, the HSTT, the Space Command testing area, 46 Test Group administrative office area, and most areas of the flight line infield. Although colonization typically begins in disturbed areas, the plant is rapidly spreading into the native grasslands, shrublands, and roadways throughout the base. African rue has been found in the Lake Holloman Public Access area, which represents a major management concern.

Mowing and blading of roadside infestations have done little to impede the spread of this plant on HAFB and actually disperses the seed and plant and root fragments to other areas. Mowing can stress native desert plants, disturbing the site and encouraging infestation.

<u>Control Measures:</u> In its native range in Asia, successful reduction of this plant has been accomplished by repeated cultivation to a depth of 8 to 10 inches, followed by seeding perennial grasses. This methodology, or any ground-disturbing activity, actually encourages spread in southern New Mexico. DuPont has used trial plots to test different foliar application sprays on African rue on HAFB.

Control measures include herbicide application and cultural methods. Research activities and practical applications have indicated that optimal timing and use of the correct chemical product are key to successful herbicide application for controlling this species. Research in New Mexico indicates that hexazinone and imazapyr treatments work best in June or July; metsulferon methyl treatments are most successful in October. Targeting the specific application times focused on the growing season may be a successful management tool if applied in spot treatments over multiple years using different herbicides with different modes of action, or if imazapyr is aerial broadcast at high rates, but only if the loss of desirable plant species can be tolerated. However, regardless of the method or herbicide used, it is critical to revegetate the site after a successful control operation prior to the next growing season to minimize reinvasion by African rue and other weedy species (Branum 2006).

On HAFB, fall applications show better kill-rates, and therefore treatments of African rue will primarily be conducted between August and November (prior to frost) each year (Parker and Reiser 1997).

In areas where mission requirements dictate bare ground must be maintained at all times, treatment may occur at any time, although repetitive regular use of mechanical means, such as use of a weed-eater, mower or manual cutting of stems, may be more effective and less costly.

Chemical products that will be used in the control of this species include imazapyr, triclopyr, or metsulfuron methyl. These herbicides will be used only in accordance with the label and all personal and environmental protective measures will be taken during application procedures. Glyphosate is not labeled for, nor is it effective for control of this species, and therefore will not be used for treating rue-infested sites, though it may be used to enhance the activity of other herbicides. All plant materials removed manually will be bagged and discarded as solid waste. Chemically treated areas will be evaluated annually following treatment. If re-treatment is determined to be required, it will take place no sooner than two years following initial chemical treatment.

Cultural practices include modifying grounds maintenance mowing schedules to ensure that plants/areas are mowed only before seed pods are produced. An additional desired best management practice is that grounds maintenance equipment that is utilized in African rue infested areas will not be moved to new, non-infested areas without being cleaned/washed to reduce the amount of seed/live plant materials that can act as propagules moved to new areas. Also, not mowing areas with existing communities of native plants is encouraged. No parts of this plant will be composted on HAFB.

<u>Salt cedar (*Tamarix ramosissima*)</u>

<u>Infestation Locations:</u> Salt cedar is fairly widespread across HAFB Main Base with milder infestations found in the BWWSA. Currently known populations occur on the Oscura Bombing Range and Red Rio Bombing Range. A preliminary inventory of the main base and BWWSA has been conducted; however a full inventory of other GSUs is needed.

<u>Species Description:</u> Salt cedar is an invasive large woody species from Eurasia in the tamarisk family that requires high levels of water (phreatophyte) for establishment and survival. The species was introduced in the early 1900s for ornamental use and erosion control/wind breaks. On Holloman AFB, it was planted as a windbreak in Carter Draw and other former ranch sites, and the military planted the species in one area of the HSTT for dune stabilization over 25 years ago. Salt cedar trees have subsequently dispersed aggressively into the drainage bottoms and lowland depressions at the southern end of the base, including in the Lake Holloman wetland complex, in Dillard Draw near the residential area, and in drainage ditches near the flightline and golf course (HAFB 2002).

Salt cedar species are relatively long-lived tree-like plants that can survive in arid conditions where groundwater is inaccessible. Mature plants are tolerant of inundation, drought, high soil salinity, and nutrient stress. Flowers develop continuously under favorable environmental conditions but require insect pollination to set seed. In the southwestern US, salt cedar produces large quantities of minute, wind- or water-dispersed seeds throughout the growing season (Warren and Turner 1975, Shafroth et al. 1998). Seeds survive for only a few weeks during the summer and the few seeds surviving over winter do not form a persistent seed bank. Seeds are viable for four to five weeks under ideal conditions during summer and germinate within 24 hours following contact with water. There are no dormancy or after-ripening requirements. Optimal substrate for germination is saturated, fine-grained sediment. Conditions conducive for first-year survival are saturated soil during the first few weeks, a high water table, and open sunny ground with little competition from other plants. In the initial stages of establishment, roots grow slowly for the first four weeks and seedlings will not survive more than one day of soil drying. Seedlings are vulnerable to inundation in the 4 to 6 weeks after germination. Mature plants will re-sprout from roots if top growth is damaged or removed by cutting, fire, flood, or herbicide treatment. Also, adventitious roots develop from submerged or buried stems or stem fragments (Brock 1994, Diatoms 1998).

By using high volumes of subsurface water, phreatophytes can significantly alter the flow of streams and increase evapotranspiration rates, estimated to be as high as over two cubic meters of water/m^2. By withdrawing water from the soil, it can also substantially increase the salt in the soil to such an extent that native species, such as willows and cottonwoods, can no longer compete. In drainages with intermittent flows, soil salinity can also be severely increased by leaf-shed, because the leaves are high in excess salts. During droughts, as water decreases in intermittent drainages, conditions for increasing salt cedar improve. This is occurring in the constructed wetlands, where decreased treated effluent flows from the water treatment plant are resulting in increases in salt cedar communities. In summary, it is a prodigious water consumer, it tends to increase soil salinity, it often outcompetes and replaces many native plants, it both promotes and tolerates wildfire, it provides poorer quality wildlife habitat than native species, and forms impenetrable monotypic stands in many riparian and wetland areas (USFWS 2007).

Without significant control actions, salt cedar can rapidly take over desert riparian areas, thereby decreasing biodiversity and surface and subsurface water supplies. Well-established communities can lower the water table, resulting in drying conditions and more xeric-adapted understory plant species becoming established. In areas barren of native trees, such as on HAFB, salt cedar stands may provide some habitat for neotropical birds, as well as resting areas for mosquitoes. However, in areas with more natural structural diversity, salt cedar stands may decrease biodiversity and dry up riparian areas.

Though Holloman is approximately 70 miles from the nearest known occupied habitat for the endangered Southwestern Willow Flycatcher, salt cedar stands on the installation could potentially provide habitat for the species. Surveys for the flycatcher will be conducted prior to control and/or removal of moderate to large salt cedar stands following USFWS and USGS survey protocols. Document located at:

(https//www.fws.gov/southwest/es/NewMexico/documents/SP/Southwestern_Willow_Flycatcher_survey_protocol.pdf).

Effective Chemical and Mechanical Control Methods: Efforts to control the spread of salt cedar and eradicate salt cedar communities on HAFB have been limited. Both mechanical and chemical methods have been used in the draws and wetlands areas. Control measures currently in use on the installation include primarily chemical means, with different herbicides and utilizing multiple application methods. These include cut-stump methodology, foliar application and basal bark application.

The cut-stump method is usually considered to be useful for areas of 5 acres or less. In areas requiring no aboveground obstructions for mission, such as within the airfield environment, this method is appropriate as well. Over 2,000 acres have been successfully treated over the past 10 years using this method to include the airfield, west ramp and the constructed wetlands area.

The four cardinal rules for salt cedar control using this method are to (1) cut stems within 2 inches of the ground, (2) apply herbicide within a few minutes of cutting, (3) cut and treat the entire circumference of the stem cambium, (4) treat any re-sprouted foliage within 4 to12 months after initial treatment (Neill 1990). Managers have pointed out that the effectiveness of treatment is highly dependent on skill of the field workers. Both hand-held and backpack sprayers have been recommended for herbicide application.

Basal bark application method of herbiciding (Parker and Williamson 1996) applies a mixture of herbicide and vegetable oil applied with a backpack sprayer to the lower 2 feet of each young salt cedar stem (stems with reddish-brown, smooth bark). The most effective time for treatment appears to be during the period of active growth (May through September). This method eliminates the need to cut stems before application. Although labor-intensive, this method has several advantages: (1) selectivity for salt cedar (adjacent vegetation and invertebrate habitat can be maintained), (2) relatively low cost, and (3) environmental compatibility. An important point is to avoid contamination of water by over-application that results in runoff from the stems. A temporary barrier at the perimeter of a wetland would provide an additional safeguard against contamination of moist-soil or aquatic habitats from nearby treatment areas. This technique has been used successfully in riparian areas of the Southwest and is considered to be safe and effective in wetland habitats if the previous guidelines are followed (D. Parker, pers. comm., cited in Freehling et al. 1999).

Aerial application of herbicide by helicopter has been shown to be the best method to use on large areas with monotypic stands of Tamarix and/or where access is difficult due to isolation or soft substrates in wetland areas. This relatively new method, which has been successfully used in the Roswell Field Office Area (Bureau of Land Management 2004), the final Chico Arroyo Watershed near Albuquerque (Bureau of Land Management; undated), and at the Caballo and Elephant Butte Reservoirs on the Rio Grande River (Bureau of Reclamation 2003), uses a helicopter aerial application of herbicides as part of an IPM approach.

Using the three EAs for herbicide treatments in New Mexico, HAFB prepared an AF Form 332, and 49 CES/CEIE prepared an AF Form 813 using AF categorical exclusion A.2.3.11 (04 Aug 2006). This application method was subsequently conducted on approximately 1,000 acres on HAFB in September 2006. Aerial application included the constructed wetlands, the HSTT area and the La Luz Gate area to the northern boundary of the base. Chemically treated areas were evaluated annually following treatment. An approximate 80% success rate was noted and standing dead materials will be scheduled to be removed via mechanical means (bulldozer, bladed, cutting and removal, etc.) or burned in place, using prescribed fire, after all appropriate air quality/open burn permits are obtained and all planning and coordination with proper agencies is accomplished. All removal activities will be identified by submitting the AF Form

332. Proper public notification and prescribed fire and smoke management will take place prior to any burning activities per New Mexico state law (Chapter 15.0 Associated Plans Tab 1, HAFB Wildland and Prescribed Fire Management Plan).

Chemical herbicides that will be utilized in the control of this species, depending on application method and location, include triclopyr, imazapyr, or glyphosate. These herbicides will be used only in accordance with the label and all personal and environmental protective measures will be taken. Foliar and basal bark/stem treatments will be conducted in late summer or fall. Cut-stump treatments may take place any time during the year.

The HAFB airfield is an area designated as high priority for salt cedar removal for safety and operational purposes. Methods to be utilized in this area include cut-stump methods, with stumps being cut to less than 3” height and stem diameter larger than ¾” and herbicide applied immediately, and where necessary, actual removal of stump crowns to a depth of at least 16” below grade, and re-contouring the area to insure no grade irregularities. All cuttings must be removed off-site away from the airfield. Small trees still in the “whip stage” (smaller than 3’ in height and less than ¾” stem diameter) may be treated using basal-bark herbicide treatments.

Following these treatments, larger disturbed areas will undergo evaluation for native grass/forb reseeding, to minimize loss of soil and loss of mission due to blowing dust, as well as to discourage the use of the area by some seasonal migratory birds that have caused BASH problems in the past, such as horned larks.

Salt cedar located in the constructed wetlands area, designed for disposing of treated effluent from the HAFB wastewater treatment plant, is of high to moderate priority for control. Salt cedar alters vegetative communities in the area, changing plant species growing in the area and reducing appropriate available habitat for shorebirds and other wildlife. Salt cedar is also an ideal roosting/resting location for some mosquito species, which have been documented at HAFB as vectors for St. Louis encephalitis and West Nile virus. This area is near Married Family Housing on the installation, and with prevailing winds coming out of the west, minimizing potential for disease is important to the health of base residents. Control of salt cedar in this area is key to maintaining public health and military mission.

No management technique will provide 100% control, and follow-up treatments are required to achieve long-term, sustainable desired results. Annual monitoring assessment, based on written monitoring plans, must be conducted to evaluate if the measurable objectives were met. Artificial planting or seeding may be needed in areas with ground and surface water connectivity is low and/or flooding no longer occurs to compete with reinfestation of exotic species.

Restoration and rehabilitation methods include (USDA Forest Service 2004):

- Controlled flooding when seeds from desirable species such as cottonwood and willow are present (no cost stated, 20%-47% survival after 2 years)
- Planting stems/poles of willows and cottonwood into the water table during January through March ($900/acre, 90% survival)
- Planting tall pot containerized willows and cottonwood augured to the water table in August with

supplemental watering for 1 to 2 months ($2,700/acre, 90% survival)
- Planting seedlings in a long shallow V-shaped ditch lined with plastic during monsoon season ($7,200/acre, 90% survival)
- Seeding with 13.6 pounds per acre of saltbush and 1.5 pounds per acre of alkali sacaton ($120/acre, survival not stated)

See Table Recommendations for Treatment of Salt cedar in River Systems and Closed Basins in New Mexico for details on treating salt cedar.

Summary of Herbicides used for Salt cedar Control: Environmental toxicity and chemical behavior in aquatic environments for the herbicides used or recommended for salt cedar control at the Holloman wetlands is summarized here (Tu et al. 2001):

Imazapyr (Arsenal®) is a broad-spectrum herbicide effective in killing large woody species. Under most field conditions, it does not bind strongly to soils and can be highly mobile in the environment. However, it has not been reported in runoff or as a contaminant in water. If it enters the water column, imazapyr is degraded by sunlight, with an average half-life of two days. Its toxicity to fish is relatively low. Imazapyr is registered for aquatic use as Habitat®.

Triclopyr (Garlon®) is commonly used to control broadleaf herbs and woody species and is particularly effective on the latter in conjunction with cut-stump or basal bark treatments. There are two formulations of triclopyr, a triethylamine salt (Garlon 3A®) and a butoxyethyl ester (Garlon 4®). In soil, both formulations degrade to the parent compound, triclopyr acid. In water, the two forms can behave differently. The water-soluble salt is degraded in the water column through photolysis and hydrolysis (McCall and Gavit 1985). The ester is not water-soluble and can be persistent in aquatic habitats. The ester binds to organic particles in the water column and precipitates to the sediment layers. Rate of degradation is dependent on water temperature, pH, and sediment content. Triclopyr acid and the salt formulation are slightly toxic to fish and aquatic invertebrates; however, the ester is highly toxic to both groups (WSSA 1994). Most authors conclude that triclopyr, when applied according to the label, would not reach concentrations sufficient to kill aquatic organisms. Others suggest that there is a risk of lethal contamination in some water bodies, including shallow and slow-moving habitats where dissipation is slow (Kreutzweiser et al. 1994). Pathfinder II®, a triclopyr ester formulation, is often recommended as the most cost effective herbicide for salt cedar control (Tu et al. 2001).

Glyphosate (RoundUp®, Rodeo®) is a broad-spectrum, nonselective systemic herbicide that can be applied to foliage, green stems, and cut-stems but cannot penetrate woody bark (Carlisle and Trevors 1988). Not all formulations are registered for aquatic use (Rodeo® is). Glyphosate by itself is non-toxic to submersed plants (Forney and Davis 1981), but the adjuvants (e.g., surfactants) sold with glyphosate may be toxic to aquatic plants and animals. Glyphosate binds strongly to soils. Most glyphosate found in waters is probably a result of runoff from vegetation surfaces, spray drift, and direct overspray. Glyphosate will usually dissipate rapidly from natural water bodies through adsorption to organic substances and inorganic clays, degradation, and dilution (Folmar et al. 1979).

Different glyphosate formulations vary considerably in toxicity to aquatic species. Rodeo® is permitted for aquatic use; in addition, Rodeo® has no surfactant. By comparison, the surfactant X-77 Spreader®, often used in conjunction with Rodeo®, is approximately 100 times more toxic to aquatic invertebrates than Rodeo® alone (Henry et al. 1994). Roundup® is not registered for aquatic use because the surfactant MONO818® included with it is highly toxic to fish and amphibians (Folmar et al. 1979). Despite the high potential for toxic effects of glyphosate formulations in aquatic systems, it appears that under most conditions, rapid dissipation from aquatic environments prevents accumulation of herbicide concentrations that would be lethal to most aquatic species (Tu et al. 2001).

Biological Control Methods: No biological control methods are proven, but in 1999, USDA APHIS (USDA APHIS 1999) released an exotic salt cedar leaf beetle, Diorhabda elongata, at eight sites in six western states (not including New Mexico). The beetles are released and allowed to propagate in cages/tents until the populations are sufficiently large to ensure beetle congregations stay together, stimulated by pheromones. After at least one generation (normally about one month per generation), the enclosed population should be large enough for the pheromone-based social system to keep the beetles together long enough to maintain a reproducing population. Expansion rates of newly established populations are unpredictable, and the success rates of releases have been variable, depending on location, strain of beetle released, and other unknown factors. It is predicted that the rate of expansion of a successfully released population may include 10 acres of salt cedar defoliation the first year after release. Depending on the health of the individual tree, trees tend to die after three successive seasons of defoliation. New salt cedar seedlings will continue to germinate, but it is expected that most established trees and new seedlings would not survive in the long term. Even if some of the trees survive, their competitive edge over native species would be reduced and possibly reversed. Native plant communities tend to rapidly colonize suitable areas where salt cedar has been removed using mechanical or chemical treatments, so a similar response is expected with biological control (USFWS 2007).

Beetles have subsequently been released in FY07 in the Pecos River drainage in New Mexico. NMSU introduced salt cedar leaf beetle in cages in August 2007 and September 2008, south of the Observatory near the constructed wetlands on HAFB, to study the feasibility of using this control method in this area. The final release occurred in June 2009, all releases were conducted by researchers at NMSU, under USDA APHIS permit per 7 CFR 330 (Permit No. P526P-07-06966, expired 11/05/10), and approved by the USFWS (letter dated 5/21/07). The release site was separated by approximately 70 miles of upland habitat from any other salt cedar with no known Atriplex spp. plants in the surrounding habitat, and therefore qualified for an exemption for a release within 200 miles of Southwestern Willow Flycatcher habitat (Appendix H). Also, the site had no public access and transport of beetles offsite inadvertently by clothes or vehicles would not occur. This release was grandfathered when USDA APHIS PPQ placed a moratorium on further releases of Diorhabda spp. beetles per letter dated 6/15/10 because of concern for potential loss of nesting habitat for the endangered southwestern willow flycatcher.

Monitoring success of this release on HAFB indicated that the beetles were not dispersing among patches of salt cedar, and were not successfully feeding on the salt cedar at the release sites. Also the leafhopper Opsius stactogalus was apparently killing larval beetles in their honeydew both inside and outside the cages (NMSU memo dated 7/28/09). Monitoring will continue at a minimum through 2012; however, no further releases are anticipated. This biological control is showing some promise at the early release sites outside of HAFB, especially in northern New Mexico (USDA APHIS 1999, USDA APHIS 2005), but little success has been encountered to date in southwestern New Mexico.

Table 7.11-2. Recommendations for Treatment of Salt cedar in River Systems and Closed Basins in New Mexico[1]

Areas Not Yet Infested	Areas with Light Infestations	Areas with Extensive Infestations	Areas with Special Considerations
Priority is to maintain and improve the health of existing native plant communities and protect from infestation	Priority is to remove salt cedar and protect and enhance existing native plant communities	Priority is to remove dense or monotypic stands of salt cedar and restore desirable plant species to achieve specific objectives	Priority is to identify riparian areas or wetlands that have special focus, such as important wildlife habitat, and preserve, create, or enhance to unique site attributes
Limiting dispersal of seeds and plant parts from adjacent areas	Manual removal by hand-pulling or grubbing, removing most of the root structure to eliminate risk of vigorous regrowth \$0-\$5,000/A 95%-100% control	Mechanical removal of stems and trunks by heavy machinery followed by root plowing and raking, with use of heavy equipment during the winter to avoid equipment overheating and raking in the summer to aid in root desiccation; only used where there is no concern with affecting associated desirable plants. This may require replanting the area \$700/A 97%-99% control	No management technique will provide 100% control, and follow-up treatments will be needed to achieve long-term, sustainable desired results. Annual monitoring assessment, based on written monitoring plans, must be conducted to evaluate if the measurable objectives were met
Minimizing soil disturbance	Mechanical removal by grubbing, removing or destroying most of the root structure and minimizing soil disturbance \$40-\$300/A 97%-99% control	Aerial application of imazapyr or a mixture of imazapyr and glyphosate with a nonionic surfactant from late August through September prior to color change when plants are actively growing, removing trees after 3 years to achieve desired root kill. Subsequent prescribed burning or shredding and revegetation may be necessary \$240-\$510/A although cost- and project-sharing may reduce cost per unit area 89%-99% control, depending on method selected	Artificial planting or seeding may be needed in areas with ground and surface water connectivity is low and/or flooding no longer occurs to compete with reinfestation of exotic species. Restoration and rehabilitation methods include:

Areas Not Yet Infested	Areas with Light Infestations	Areas with Extensive Infestations	Areas with Special Considerations
Maintaining or improving the health of competitive plant species	Low-volume basal bark application of triclopyr (ester formulation mixed with vegetable oil) on stems less than 2-3 inches diameter at ground level and less than 8 feet tall at any time of year, although fall through spring application is preferred when desirable plants are dormant $40-$60/A 80%-95% control		Controlled flooding when seeds from desirable species such as cottonwood and willow are present no cost stated 20%-47% survival after 2 years) Planting stems of willows and cottonwood into the water table during January through March $900/A 90% survival
	Cut-stump application of triclopyr (amine or ester formulation with vegetable oil) or imazapyr on the cut surface of the stump immediately after cutting large trees $1,600-$2,500/A 60%-80% control		Planting tall pot containerized willows and cottonwood augured to the water table in August with supplemental watering for 1 to 2 months $2,700/A 90% survival
	Foliar application of a mixture of imazapyr and glyphosate (with nonionic surfactant) between June and September when trees are moving carbohydrate reserves to roots, with complete foliar coverage necessary without allowing drift to adjacent desirable plants $40-$300/A 97%-99% effective		Planting seedlings in a long shallow V-shaped ditch lined with plastic during monsoon season $7,200/A 90% survival Seeding with 13.6 pounds per acre of saltbush and 1.5 pounds per acre of alkali sacaton $120/A Survival not stated

1 New Mexico Interagency Weed Action Group (USDA Forest Service 2004).

Russian Knapweed (*Acroptilon repens*)

Infestation Locations: Russian knapweed historically occupied a small- to moderate-sized infestation in Hay Draw. It has also infested areas in the BWWSA, primarily the Boles Wells Wellfield. In a 2009 study it was noted that Russian knapweed incursion were primarily in the southern part of the base around commercial and residential areas, in Hay Draw, and areas next to the test track

Species Description: Russian knapweed is a native of Mongolia, Iran, and Asia Minor, but has now spread to every continent. Russian knapweed is known to have been introduced to the United States several times in the early 1900s in shipments of impure Turkestan alfalfa and possibly sugarbeet seed. This is a creeping perennial growing to a height of 18 to 24", which spreads via vegetative root buds and seeds. It is a member of the sunflower family. The roots have a brown to black scaly appearance, especially near the root crown. Flowers are ¼" to ½" wide with smooth papery bracts, and appear from late spring through fall on multiple erect branches. Petal color is pink, lavender or white. This plant is highly toxic to horses and may produce chemicals that prevent establishment of desirable native species.

Figure 7.11-3. Russian Knapweed (*Acroptilon repens*)

This plant disperses much the same way as African rue, attaching to machinery and vehicles and being mixed in impure hay. It is not a prolific seed producer, but it can spread vegetatively, making it difficult to control. Seeds appear to be viable for long periods, possibly increasing germination success in older seeds.

Planned Control Measures: There are a limited number of biocontrol agents for Russian knapweed in the United States, but their control capability is generally poor to fair. The best management practices for this species include cultural controls combined with mechanical and/or chemical control techniques. Mechanical methods of cutting or mowing above-ground parts following flowering but prior to seed maturity can effectively stop seed production, but will take several years of persistent action to reduce plant population size. If the infestation is very small, the plants may be removed by pulling from moist soil by hand to get the complete root. Prescribed fire may be helpful in controlling this plant by removing standing dead matter that can interfere with interception of chemical treatments. If burning is used as a tool, reseeding of appropriate seed should be employed to minimize re-infestation of the site by knapweed.

Effective herbicides for controlling knapweed are picloram applied at 0.25 lb ai/ac, dicamba or 2,4-D at 1 lb ai/ac, glyphosate at 1.5 lb ai/ac, clopyralid at 0.24 lb ai/ac. Tank-mixes of picloram and dicamba (0.25 to 0.5 lb ai/ac+ 0.125 to 0.25 lb ai/ac), picloram plus 2,4-D (0.188 lb ai/ac + 1.0 lb ai/ac), and dicamba plus 2,4-D (0.5 lb ai/ac + 1.0 lb ai/ac); clopyralid plus 2,4-D (0.2 lb ai/ac + 1.0 lb ai/ac).

The known populations for this species will be monitored annually, and if documented as spreading, chemical controls will be applied. Application timing will be when appropriate for each chemical and local environmental conditions, as each may be more effective during different growth stages of the plant. Best management practice recommendations include applying herbicides with a backpack sprayer or a wick in small areas to reduce damage to non-target plants. Plants from small infestations will be mechanically removed (pulled by hand). Any plant materials removed manually will be bagged and discarded. No parts of this plant will be composted at any time.

Malta Star-thistle (*Centaurea melitensis*)

Infestation Location: Malta star-thistle is located in the BWWSA, along the La Luz Gate entrance to the base, and around the base recycling center/composting facility. It appears to have entered southern New Mexico from Texas during the reconstruction of U.S. Highway 54. New infestation locations have been observed in the Cantonment area in 2007. Areas of infestation continue to be monitored to identify new infestation locations and rate and location of spread.

Species Description: This is an herbaceous cool season annual plant. It begins growth in the fall and overwinters as a rosette, usually producing a single flower in the rosette before sending up a flower stalk in late winter/early spring. Dispersal is by seed. The yellow flowers are approximately ¼" in size, with spines on the flower head.

Planned Control Measures: This plant will be chemically and manually controlled. Chemical controls will use glyphosate, applied in the rosette stage of growth in late winter to early spring. Manual controls (physically pulling up the plant) may be performed at any time of year, with the objective to remove the root as well as the top of the plant to prevent re-growth of a flower stalk from the root. All plant materials removed will be bagged and discarded. No parts or plants of this species will be composted at any time.

Russian Olive (*Elaeagnus angustifolia*)

Infestation Location: Russian olive is located in Dillard Draw and along U.S. Highway 70. Currently, the plant is only found as isolated individuals. The plant has historically been used as an ornamental plant on base within Married Family Housing and the FamCamp. Most isolated occurrences, outside plantings, on HAFB appear to have become established via water-borne- or wildlife transported-seed.

Species Description: This nonnative phreatophyte grows into a medium-sized tree, with grey-green leaves, producing reddish orange fruit in fall. Fruit of this species can be of some benefit to wildlife (primarily birds), but the tree competes with native vegetation such as willow and cottonwood and populations can hinder the achievement of natural resource management goals and objectives.

Planned Control Measures: Control of this species will primarily be done by chemical means, using glyphosate applied during late spring to early summer to foliar surfaces. The dead trees will be left standing in place for at least two years. After this period, evaluation of treatment will occur and either re-treatment or removal of standing dead matter may take place. Any treated plant materials removed will be disposed of off-base as solid waste. Non-treated plant materials may be removed off base or to the on-base compost facility provided that the facility is accepting waste materials, and may be composted. Prescribed fire may be used to clear stands of dead Russian olive, especially where they coincide with treated salt cedar plants. Proper public notification and prescribed fire and smoke management will take place prior to any burning activities per New Mexico state law (Chapter 15.0 Associated Plans Tab 1, HAFB Wildland and Prescribed Fire Management Plan).

Siberian Elm (*Ulmus pumila*)

Infestation Locations: Siberian elm seedlings grow infrequently in many areas on base. These seedlings establish quickly. Once site occupants notice their growth, residents often prefer to leave them to mature into shade trees. Many trees of this species have become established in landscaping.

Species Description: This nonnative drought tolerant tree in the elm family was introduced from Eurasia as a fast-growing functional shade tree. Growth is very rapid, even under adverse conditions, and once the tree is mature it can become a safety hazard and often damages property during storm events as the mature trees are very brittle. In unimproved areas, it can also function as a phreatophytic plant, taking advantage of available ground and surface water, out competing native species, thereby altering function of native ecosystems. Along roadsides it can inhibit visibility, increasing wildlife dangers as well as possibility for automobile accidents in areas with blind corners, although this is not presently a problem on HAFB.

Planned Control Measures: Control of this species lies with educating the base populace about problems it can cause. A brochure will be created featuring the species, showing how it harms the natural environment and how it can be dangerous to physical structures and personnel. This brochure will be available in the industrial self-help office, by the end of FY11.

In many on-base areas, mechanical means are most effective for removal and control of seedling to sapling sized trees. Unit facility managers and housing residents can easily handle manual removal of these trees while they are still small (less than 3 feet tall and less than ¾” diameter stem). These trees should be removed from areas in which they were not intentionally planted, ensuring that all the roots are removed or killed, as this species may resprout. All Siberian elms originally planted for ornamental or shade purposes should eventually be planned for removal, and those areas replanted with approved trees for use in landscaping on HAFB. This list is available in hard copy or CD from 49 CES/CEIE. Any plant materials removed via mechanical means (cutting, root extraction, etc.) may be taken to the HAFB composting facility for disposal, provided there are no disease, fungi or harmful insect infestations in the plant materials.

Chemicals effective in the control of Siberian elm include glyphosate (foliar application) and triclopyr, as cut-stump treatments applied to cut surfaces in late fall and winter. Triclopyr can also be used as a basal-bark treatment to young bark, applied in winter (Wieseler 2004).

Five-horn Smotherweed (*Bassia hyssopifolia*)

Infestation locations: Five-horn smotherweed currently has an infestation around Lagoon G, is prevalent throughout the constructed wetlands, and is located in many drainages and swales across the main base. It is not currently known to inhabit any GSUs.

Species Description: This warm season annual is a member of the goosefoot (Chenopodiaceae) family, closely related to and sometimes confused with Russian thistle (Salsola iberica) and kochia (Kochia scoparia). Bassia hyssopifolia is native to Europe and Asia, the type locality being near the Caspian Sea. It first appeared in North America near Fallon, Nevada in 1915, possibly introduced as a seed contaminant, and has spread rapidly throughout western North America (Collins and Blackwell 1979). B. hyssopifolia is an annual, reproducing only by seed, with stems branching from the base. Classified as a facultative wetland plant, five-horn smotherweed has a high salinity tolerance and is adapted to fine and medium-textured soils (USDA NRCS 2003). It invades shorelines in wetland areas and hinders wetlands management activities by altering habitats normally managed and suitable for shorebirds and other wildlife species. The seeds cannot survive freshwater inundation for extended periods (Bruns 1965).

Planned Control Measures: Control of this species is difficult to achieve. Mechanical, cultural and chemical controls will be undertaken, as well as use of prescribed burns. Mechanical means can be used in areas to remove flowering parts prior to seed set, although this method is often not very effective as the plant will try to re-flower and set seed. Small stands may be hand-pulled. Cultural methods will include minimizing ground disturbance and seed dispersal and eliminating seed production.

Chemical means can be used by using pre-emergent chemicals to suppress germination, or post-emergent herbicides may be utilized prior to and up to the growth of 6 to 8 true leaves on seedling plants. Dicamba at 1 pound active ingredient/acre, or glyphosate at 1.5 pound active ingredient/acre, as well as metsulfuron plus dicamba have been shown to be effective. Chemical treatments will be applied in early spring after seedling emergence. Prescribed burns may be used for management of this species primarily as a tool for clearing dead standing matter (previous year's growth) to return open shorelines in wetland areas. Burning will take place following all planning and coordination with appropriate agencies and after obtaining all appropriate permits. Proper public notification and prescribed fire and smoke management will take place prior to any burning activities per New Mexico state law (Chapter 15.0 Associated Plans Tab1, HAFB Wildland and Prescribed Fire Management Plan).

Russian Thistle (*Salsola tragus*)

Infestation Locations: Russian thistle is also known as tumbleweed. Originally from the steppes and grasslands of Russia, this species was introduced into South Dakota in the mid-1870s from Eurasia as a flax seed contaminant. Within 20 years, it had reached New Mexico. Russian thistle can be found base-wide in disturbed areas and along roadsides. It has increased within the HSTT area, but major infestations occur in the northern portion of the BWWSA in some years.

Species Description: This plant is a self-seeding annual herbaceous plant, growing to a height and diameter of 12 to 42 inches. Germination is in the spring, with primary growth during warm seasons and with plants maturing in late summer and fall. The plant subsequently dries, breaks off at the base and as it "tumbles" away, drops seed widely. It may also be accidentally included in hay. It germinates in loose or disturbed soil. Russian thistle displaces native plants and reduces valuable soil moisture, decreasing plant biodiversity and changing wildlife habitat. Its lack of natural enemies poses a threat to natural areas on HAFB.

Planned Control Measures: No control efforts have been planned for this weed. Although herbicide applications are effective, especially when plants are in early growth stages in the spring, (California Department Food and Agriculture 2003), control of Russian thistle is very low priority on HAFB. The species is now widespread and it would be inefficient and costly to control this plant in most infested sites. Some specific site locations should however, be treated. Areas that require bare-ground for mission-related purposes can be controlled using pre-emergent herbicides approved by the Armed Forces Pest Management Boards for use on Air Force installations.

In some locations, especially where the potential exists for wildland fires to be started, dried tumbleweeds will be removed manually (such as where they have become piled against fence lines or roads) and disposed of. Some populations of Russian thistle have developed resistance to herbicides, so caution will be taken in selecting sites and chemicals for controlling this plant. An integrated management approach is suggested to avoid resistance to herbicides and provide the best control for this species (California Department of Food and Agriculture 2003).

Monitoring

Monitoring for invasive plants and noxious weeds on HAFB will involve a five-step process:

- Identification and mapping of existing populations (inventory)
- Prioritization of sites for control/containment/eradication
- Evaluation of the qualitative and quantitative success/failure of control/eradication efforts, to be conducted annually following the initiation of treatments
- Conduct of annual monitoring and surveys for invasion of new species and expansions of existing populations
- Conduct of monitoring the impact of noxious and invasive plants on wildlife species and their respective habitats, and impacts to native plant communities

Permanent plots will be established in a subset of control areas to quantitatively monitor the response of the target population and condition of native plant communities. Data collected will include community richness, canopy cover, and density of target and native plant species within the community. This will assist in identifying the effectiveness of control strategies and modifying where necessary.

Annually, monitoring will be conducted and an annual report will be prepared by 49 CES/CEIEN which summarizes the status of noxious weeds and invasive plants on HAFB and its geographical units and the control activities implemented during the preceding year. The report will include, at a minimum:

- Summary of all control methodologies used
- Quantities and types of chemical products used
- Assessment of the effectiveness (success/failure) of the control efforts
- Qualitative evaluations of plant density

- Aerial extent of each population
- Phenological status
- Vigor of target and native species at control sites
- Environmental conditions
- Future planned monitoring and control activities, and adjustments made to previous plans;
- Recent updates to federal, state, and county weed lists pertinent to HAFB
- Summary of cooperative efforts with other federal, state, county, and local entities

Seeding Mixtures after Removal of Invasive Plants

Selecting the appropriate seed mixture for ensuring recovery of native vegetation subsequent to invasive plant control and eradication efforts will be based on the conditions of the site to be reseeded. Separated into two general categories, the mixtures can be found in Table 7.11-4. Seed Mixtures for Recovery of Native Vegetation.

Table 7.11-4. Seed Mixtures for Recovery of Native Vegetation

Lowland/Swale Mixture		Upland Mixture	
Alkali sacaton (*Sporobolus airoides*)	3.5 lbs PLS[1]/acre	Alkali sacaton (Sporobolus airoides)	3.5 lbs PLS/acre
Fourwing saltbush (*Atriplex canescens*)2	3.0 lbs PLS/acre	Fourwing saltbush (*Atriplex canescens*)[2]	3.0 lbs PLS/acre
Inland saltgrass (*Distichlis spicata*)	2.0 lbs PLS/acre	Sand dropseed (Sporobolus cryptandrus)[3]	1.0 lbs PLS/acre
		Little bluestem var. Pastura (*Schizachyrium scoparius*)	3.0 lb PLS/acre
		Desert marigold (*Baileya multiradiata*)	1.5 lb PLS/acre
		Purple threeawn (*Aristida purpurea*)	1.5 lbs PLS/acre

1 PLS = pure live seed.
2 Relatively local seed origin
3 local/New Mexico or west Texas seed source.

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

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

Program Overview/Current Management Practices

Bird/Wildlife Aircraft Strike Hazard Management (BASH)

The focus of the BASH program is to prevent wildlife-related aircraft mishaps and reduce the potential for wildlife hazards to aircraft operations. Accomplishing this goal requires knowledgeable natural resources management on and adjacent to installation airfields. INRMPs must support the installation's BASH Plan and the requirements of AFI 91-202, The US Air Force Mishap Prevention Program, AFI 91-204, Safety Investigations and Reports, and AFPAM 91-212, BASH Management Techniques.

Natural resources personnel will assist the installation flight safety office (49 FW/SEF) and others in the development and implementation of the BASH Plan. Although the Air Force Safety Center is responsible for the overall AF BASH program, natural resources and pest management personnel are an integral part of every installation BASH program. The natural resources manager must share information on biological species and habitat diversity with 49 FW/SEF to facilitate the development of a comprehensive BASH database. Share information on activity of neotropical migratory birds with 49 FW/SEF in order to enhance the installation's BASH program. "An affiliation with Partners in Flight Agreement" is one source for this information and coordination with other installations within the same flyway could obtain information on current migratory bird populations.

Natural Resources personnel should be active members of the installation Bird/Wildlife Hazard Working Group (BHWG), consisting of organizations involved in airfield bird control, habitat management, operations and safety.

Installations will establish procedures for coordination and review for installation construction and improvement projects (e.g. beautification, waste water treatment, golf courses etc.) to ensure that any BASH related impacts are considered.

All aspects of installation natural resources management must be reviewed for potential wildlife hazards to aircraft operations. The land adjacent to aircraft operations areas must be managed to minimize attractions to wildlife. Surveillance of the land surrounding the airfield and coordination with adjacent landowners to reduce strike hazards are recommended. In arid climates consider alternative ground cover vegetation that reduces the attractiveness of the airfield to wildlife. Manage drainage ditches to reduce their attractiveness to wildlife. The INRMP must evaluate both existing and potential wildlife hazards to aircraft operations.

The installation BASH plan details responsibilities for control of nuisance wildlife on the airfield. Lethal control is authorized only after all practical non-lethal control measures have been exhausted, provided that the proposed actions are reviewed in EIAP procedures as stipulated in 32 CFR Part 989. Obtain depredation permits from the USFWS pursuant to the MBTA Act for intentional takes of migratory birds in support of the BASH program. The installation BASH plan will designate the office responsible for maintaining all applicable federal and state depredation permits or MBTA permits. Conservation program requirements eligible for O&M funding are programmed through the Automated Civil Engineer System - Project Management (ACES-PM). Categorize conservation requirements as recurring or non-recurring, and designate funding priority as Level 0, 1, 2, or 3.

Natural resources personnel supporting the BASH program should receive flight line drivers training, training in identification of bird species occurring on airfields, and specialized training in the use of firearms and pyrotechnics as appropriate for their expected level of involvement.

Description of Bird and Small Mammal BASH Risks on HAFB

Various information in this chapter has been taken from the 2017 HAFB BASH Management Plan, which is revised annually including bird strike data provided by 49 FW/SEF.

A minimal bird-aircraft strike hazard exists at HAFB and its vicinity due to low populations of resident and migratory bird species and the distribution patterns of those species. The trend shows a slow decline despite increased flying hours. HAFB began recording bird strike data for planes within the 49 FW Flight wherever they were flying in 1985. The first strike recorded within the HAFB flight area was in April 1994. Within the HAFB area, a total of 35 strikes were recorded between January 2010 and December 2017 (See Table 7.12-1. Total BASH Strikes in HAFB Flying Area, 2010-2017 below). Most strikes are not discovered until the plane is in for post-flight maintenance and evidence of a strike is discovered on the body of the plane, with no resulting damage.

7.12-1. Total BASH Strikes in HAFB Flying Area, 2010-2017

2010	11 strikes
2011	7 strikes
2012	5 strikes
2013	1 strike
2014	4 strikes
2015	3 strikes
2016	2 strikes
2017	2 Strikes

However, daily and seasonal bird movements can at times create hazardous conditions. HAFB also experiences occasional runway encroachment by other animals such as coyotes, oryx, or small mammals that attract raptors. No single solution exists to this BASH problem and a variety of techniques and organizations are involved in the control program.

HAFB is located within a minor migration corridor in the Central Flyway. Near the Lake Holloman wetlands area is a complex of a small lake, enhanced wetlands, and existing playas southwest of Runway 34, which may potentially contribute to bird strikes. The complex serves primarily as storage for treated effluent from the wastewater treatment plant and provides some of the only permanent water near the base. The local waters sustain relatively low levels of breeding populations, primarily of small shorebirds, but can seasonally support large populations of migratory shorebirds and waterfowl, especially Wilson's phalarope, northern shoveler, ruddy duck, western sandpiper and blue-winged teal. However, local flying procedures and flight paths keep aircraft from direct overflights of the Lake Holloman area, and therefore no bird strikes in that area have been recorded to date.

A significant portion of the airfield, including most of the runways, taxiways and overrun areas is inhabited with the noxious invasive plant African rue, which provides very poor quality bird and animal habitat and creates very low biodiversity. This results in minimal bird-aircraft strikes within the airfield environment. The native grassland community on base also supports small numbers of grassland-dependent birds, such as horned lark, lark bunting, chestnut-collared longspur, black-throated sparrow, and house finch. The outlying vegetation areas are primarily Chihuahuan desert grasslands, shrub lands and dune shrub lands. This provides habitat for the nonnative oryx, as well as coyotes, desert cottontail rabbits and black-tailed jackrabbits, but these seldom venture onto the runways.

BASH incidents are so rare on HAFB that little bird control has been needed near the runways. Closing the six wastewater lagoons located within the runway clear zone at the end of the south runway has further reduced the potential for problems. Waterfowl and shorebirds using Lake Holloman, Stinky Playa, and Lagoon G are not found flocking near the airfield and in the clear zone at the end of the runway. Vegetation is regularly maintained between seven and fourteen inches high 100 feet from the edges of each runway in accordance with airfield regulations for safety reasons. This may minimize rodent and bird activity near the airfield. The low stature of native grasslands in the infield also minimizes the number and diversity of birds using the area.

Description of Oryx BASH (Wildlife) Risks on HAFB

Some oryx access the base from WSNM, but this avenue is controlled by a fence near the western base boundary. The fence was designed by WSNM to prevent oryx from gaining access in the southern and western portions of the Monument. HAFB granted an easement to WSNM to extend their oryx control fence across the Lost River basin in the spring of 1995. Although the fence prevents oryx from passing through, it may be restricting movement of mammals such as fox and coyote between WSNM and adjacent lands, because it was installed upside-down for portions of its length, with the larger openings at the top of the fence rather than the bottom. The fence was properly installed where it crosses H AFB which ensures movement of small mammals through the fence.

Oryx tend to concentrate in the northern shrublands area and the "rainfield" area of Hay Draw by the HSTT. They are considered a hazard to operation of the HSTT and aircraft operations. Oryx wandering near the runways and the HSTT are chased off by operational personnel when they are causing a hazard.

When requested by HAFB, population reduction hunts are conducted and managed by NMDGF. These hunts are conducted to reduce the threat to operations or military missions by reducing herd size, not for eradicating oryx. Hunts will be conducted on an 'as-needed' basis. The hunts will be coordinated with 49 SFS, with overall coordination occurring at least two weeks in advance of the scheduled dates, which will only be held on Saturdays and/or Sundays. Hunters are drawn from the state's oryx depredation list, and all hunters will be accompanied by NMDGF Law Enforcement or HAFB personnel. Permitted take numbers will be coordinated between the 49 CES/CEIEN and NMDGF representative. Currently, Holloman AFB does not charge fees for oryx population reduction hunts, although the adjacent WSMR (under the jurisdiction of the US Army) charges $100/hunter, which is allowable under the Sikes Act. HAFB will consider collection of fees authorized under the Sikes Act for hunters accessing the base for oryx population reduction hunts. 49 CES/CEIEN currently uses volunteers and NMDGF Conservation Officers for oryx hunts conducted on HAFB.

Recently, a single population reduction hunt was conducted each year in 2004, 2006, and 2007 on HAFB. In each hunt, 14 to 17 animals were harvested. Two hunts were held in 2005 and a total of 34 animals were harvested.

NMDGF personnel will be called out for any emergencies regarding oryx (such as for animals that are injured, entangled in fencing or equipment, or threatening to impact a military mission), although this is a rare circumstance.

BASH Hazard Reduction Efforts and Methods

Overall, the primary hazards to HAFB aircraft are mourning doves (*Zenaida macroura*), horned larks (*Eremophila alpestris*), and raptors during the March-April and September-October migrations, as well as ground squirrels and rabbits that attract raptors and coyotes, and occasionally oryx. Mourning doves and horned larks are routine threats, primarily in the short vegetation of the airfield along the sides of the runways and on border fences. The wooded habitat in the "rainfield," where Hay Draw crosses the HSTT, attracts birds, oryx, deer, kit foxes, and coyotes. These animals create BASH problems with testing activities at the HSTT. The HSTT has experienced bird and mammal strikes on test vehicles, especially by doves. In one incident, a strike was sufficiently hard to knock a vehicle off the track. HSTT personnel do not keep a log of strikes, except as part of data collection for tests. Problems at the HSTT have been evaluated in the Appendix Programmatic Environmental Assessment for Management of the High Speed Test Track.

Hazard reduction consists of removing sources of food along the runway, reducing the attraction for loafing along the clear ramp space and mowed fields, and removing birds by qualified personnel or using scare devices if necessary. Specific actions identified in the BASH plan to be implemented as appropriate during periods of increased bird activity include (HAFB BASH Plan 2015):

- Raise pattern altitude
- Change pattern direction
- Avoid takeoffs/landings within 1 hour of dawn/dusk
- Limit or prohibit formation takeoffs and landings
- Depart pattern in trail, rejoin 3000 feet AGL
- Reschedule local training or transition elsewhere
- Limit time on low-level routes to minimum for training requirements
- Raise altitude en route to low-level or training areas
- Use slower speeds during low level routes
- Split formation during recovery
- Make full-stop landings

Coyotes can be harassed away with noisemakers, trapped and removed or shot by qualified personnel, and/or their small mammal prey removed. Oryx populations are lowered when they become a problem on the airfield and/or at the HSTT by population reduction hunts conducted by NMDGF as requested by HAFB. All lethal animal control (depredation) activities are to be coordinated by 49 CEAN and must be consistent with the HAFB Fish and Wildlife Plan as presented in the INRMP, the INRMP itself, and the PMP.

If military aircraft are reported to be flying lower than necessary near waterbird habitats at the Lake Holloman area, the airfield manager is contacted and an advisory then goes out to the appropriate flying units for corrective action.

HAFB aircraft use Red Rio, Oscura, and Centennial ranges for bombing and gunnery practice, as well as IRs-133, 134, 142, 192, 194, 195, and 113, VRs-100, 125, and 176 for low-level navigation and tactics training. Restricted Areas R-5107 B/C/D/E/H/J, R-5103 B/C, R-5111 A/B/C/D and the Beak, Talon, Pecos, and Valentine MOAs are used for both high and low latitude air-to-air training. Raptors may be encountered in any of these areas, particularly in areas with thermal activity for soaring. A few examples of areas with significant raptor activity include the Guadalupe Mountains, the Black Range, and the western escarpment of the Sacramento Mountains. In addition to the largest body of standing water in the WSMR airspace, the Malpais Springs, the low level routes also overfly Elephant Butte, Caballo, and Brantley Reservoirs, Lakes Sumner and Santa Rosa, and the Rio Grande and Pecos Rivers. Along these two river systems are the Bosque Del Apache National Wildlife Refuge, Sevilleta National Wildlife Refuge, La Joya State Wildlife Management Unit, and Bitter Lakes National Wildlife Refuge, all of which provide seasonal habitat for up to a hundred thousand waterfowl of many species, as well as sandhill cranes. Bird strikes are minimal in these areas. 49 CES/CEIEN will maintain regular communication with land managers under the MTRs and MOAs managed and operated by HAFB regarding bird populations. This information will be directly communicated to 49 OG, 49 FW/SEF, and 49 OSS/OSA. This information will assist the 49 OG/CC determine flying hazard conditions for these areas.

For all areas of concern for HAFB, 49 CES/CEIE will coordinate with 49 OSS/OSA to ensure that the BASH intranet for pilots (https://Holloman-web/fw/safety/flight/fltsfty.htm) is updated to reflect changing conditions, major shifts in bird migration patterns or other pertinent changes. Annex C of the BASH Plan (2017) outlines responsibilities of base operations for managing BASH concerns.

The HAFB BASH Plan outlines the specific actions for managing BASH, including animals, under various severity of conditions. In addition, US Air Force Bird Avoidance Model (BAM) places bird survey and count data into a GIS model to assist range planners in selecting training times when bird activity is low. The BAM was developed as a predictive bird avoidance model using GIS technology as a key tool for analysis and correlation of bird habitat, migration, and breeding characteristics, combined with key environmental and man-made geospatial data (http://www.usahas.com/BAM/).

Migratory Bird Treaty Act Permits (MBTA)

The 2003 National Defense Authorization Act provided exemption for the Armed Forces from incidental take permit requirements under MBTA during authorized “military readiness activities” defined as all training and operations of the Armed Forces that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use.

This includes activities carried out by contractors when performing a military readiness activity in association with the Armed Forces. If any of the Armed Forces determine that a proposed or an ongoing military activity may result in a significant adverse effect on a population of migratory bird species, then they must confer and cooperate with the USFWS to develop appropriate and reasonable conservation measures to minimize or mitigate identified significant adverse effects. The animals taken on HAFB, including the HSTT, are few and actions are routinely taken through the BASH program and HSTT management actions to ensure that mission and tests are not adversely affected by animal and bird strikes. Therefore, no permits for animals incidentally taken, during military readiness activities only, are required per 50 CFR 21.72.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to AF installations that are located along coasts and/or within coastal management zones. This section **IS NOT** applicable to Holloman AFB.

Program Overview/Current Management Practices

Not applicable

7.14 Cultural Resources Protection

Applicability Statement

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

Program Overview/Current Management Practices

Cultural resources are an important and often permanent part of the landscape that requires proper protection. Documenting past uses of the land assists in understanding current environmental conditions. Section 110 of the National Historic Preservation Act (NHPA) requires the Air Force to complete an inventory of historic properties located on its land (36 CFR 60, 63, 78, 79, and 800). Section 106 of NHPA requires HAFB to evaluate and assess any action that could impact cultural resources prior to commencing work. Therefore, natural resource projects must go through the proper coordination to ensure no resources are adversely impacted.

Much of the archeological work done in the Tularosa Basin, has been conducted on behalf of the military, due in part to their vast land holdings within the basin (Anschuetz et al. 1990, Blair et al. 1990). The cultural history of the basin spans over 10,000 years. A majority of the prehistoric sites within the basin are associated with the Jornada Mogollon (Lehmer 1948). To date, a total of 383 sites have been identified and recorded within HAFB's main base and BWWSA area (141 sites are recommended eligible for inclusion on the NRHP, 133 require further evaluation, and 109 are considered ineligible). An additional 41 sites are recorded along the Bonito Pipeline and at least 62 sites have been recorded within the Red Rio, Oscura, and Centennial WIA's. Protection of cultural resources is discussed in more detail the Holloman Air Force Base Integrated Cultural Resources Management Plan (ICRMP) located in Section 15.0, Tab 4.

7.15 Public Outreach

Applicability Statement

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

Program Overview/Current Management Practices

Public outreach programs on HAFB are used to increase awareness, appreciation and conservation of natural resources on base. A number of public outreach events are conducted by various members of HAFB's Installation Management Flight. These outreach events primarily occur in association with the installation's Arbor Day/Earth Day celebration. These activities typically involve educational activities at the local schools and libraries, tours of the waste water treatment plant, and information booths on subjects such as recycling, responsible energy use, and local wildlife. The Environmental Element procures various promotional items such as reusable shopping bags, coloring books, and t-shirts promoting environmental awareness. The items are given out to the public by staff. On occasion, informational pamphlets and/or articles are produced pertaining to HAFB natural resources and programs (wildlife, habitat, recycling, etc.). Educational exhibits are designed, produced, and maintained for public viewing such as the White Sands Pupfish aquariums.

7.16 Geographic Information Systems (GIS)

Applicability Statement

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

Program Overview/Current Management Practices

GIS is a multi-use tool that supports HAFB:

- INRMP
- General Plan (GP)
- Cultural Resources Management Plan (CRMP)
- Integrated Pest Management, BASH plan
- White Sands Pupfish Conservation Planning
- Project site selection, and other decision making actions.

HAFB uses ESRI's ArcGIS for planning, engineering, natural resource management and the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) v3.1 data model; a logical data model that supports common implementation and maximizes interoperability for the Real Property and Installation Lifecycle across the DoD. Table 7.16-1. HAFB's Environmental Dataset Feature Class Summary provides an overview of available natural resource feature classes and whether or not it is populated with data. Unpopulated feature classes do not contain data but are available to accept applicable data in the future. All feature classes need significant editing, updating and quality control. It is recommended that this database is leveraged in the future for long term management of natural resource GIS data.

Table 7.16-1. HAFB's Environmental Dataset Feature Class Summary

3.1 Feature Class	3.1 Dataset	Populated/Unpopulated
AirEmissionSource_P	environmentalAirQuality	Populated
HazMatSite_P	environmentalHazMat	Populated
HazWasteSite_P	environmentalHazWaste	Populated
SolidWasteLandfill_A	environmentalIntegratedSolidWaste	Unpopulated
SolidWasteMgt_A	environmentalIntegratedSolidWaste	Unpopulated
SolidWasteMgt_P	environmentalIntegratedSolidWaste	Unpopulated
FloodPlainArea_A	environmentalNaturalResource	Populated
SoilSurveyArea_A	environmentalNaturalResource	Populated
SpecialStatusSpecies_A	environmentalNaturalResource	Populated
SpecialStatusSpecies_L	environmentalNaturalResource	Populated
SpecialStatusSpecies_P	environmentalNaturalResource	Populated
SpeciesArea_A	environmentalNaturalResource	Populated
WaterBody_A	environmentalNaturalResource	Populated
WatercourseLine_L	environmentalNaturalResource	Populated
WaterFeature_A	environmentalNaturalResource	Populated
Wetland_A	environmentalNaturalResource	Populated
Wetland_L	environmentalNaturalResource	Populated
Wetland_P	environmentalNaturalResource	Populated
AgriculturalTract_A	environmentalNaturalResource	Unpopulated
CoastalZoneMgtArea_A	environmentalNaturalResource	Unpopulated
DispersedRecArea_A	environmentalNaturalResource	Unpopulated
EssentialFishHabitat_A	environmentalNaturalResource	Unpopulated
FaunaIncidentPoint_P	environmentalNaturalResource	Unpopulated
FireArea_A	environmentalNaturalResource	Unpopulated
FireBreakLine_L	environmentalNaturalResource	Unpopulated
ForestCompartment_A	environmentalNaturalResource	Unpopulated
ForestMgtArea_A	environmentalNaturalResource	Unpopulated
ForestProductHarvest_A	environmentalNaturalResource	Unpopulated
ForestStand_A	environmentalNaturalResource	Unpopulated
FuelBreakLine_L	environmentalNaturalResource	Unpopulated
FuelMgtArea_A	environmentalNaturalResource	Unpopulated
HabitatProtectiveZone_A	environmentalNaturalResource	Unpopulated
HazSuppressionArea_A	environmentalNaturalResource	Unpopulated
HistoricRiverAlignment_L	environmentalNaturalResource	Unpopulated
LandCover_A	environmentalNaturalResource	Unpopulated
NatResRecFeature_P	environmentalNaturalResource	Unpopulated
NatResRestReclProj_A	environmentalNaturalResource	Unpopulated
NatResRestReclProj_P	environmentalNaturalResource	Unpopulated
NatResSurvey_A	environmentalNaturalResource	Unpopulated

3.1 Feature Class	3.1 Dataset	Populated/Unpopulated
NatResSurvey_L	environmentalNaturalResource	Unpopulated
NatResSurvey_P	environmentalNaturalResource	Unpopulated
NoxiousOrInvasiveSpecies_A	environmentalNaturalResource	Unpopulated
NoxiousOrInvasiveSpecies_L	environmentalNaturalResource	Unpopulated
NoxiousOrInvasiveSpecies_P	environmentalNaturalResource	Unpopulated
PrescribedBurnUnit_A	environmentalNaturalResource	Unpopulated
RecNatureTrail_L	environmentalNaturalResource	Unpopulated
SpecialMgtArea_A	environmentalNaturalResource	Unpopulated
SpeciesPoint_P	environmentalNaturalResource	Unpopulated
SpeciesSpecificHabitat_A	environmentalNaturalResource	Unpopulated
SpeciesSpecificHabitat_L	environmentalNaturalResource	Unpopulated
SpeciesSpecificHabitat_P	environmentalNaturalResource	Unpopulated
SurfaceRiparianArea_A	environmentalNaturalResource	Unpopulated
Vegetation_A	environmentalNaturalResource	Unpopulated
Watershed_A	environmentalNaturalResource	Unpopulated
WildlandUrbanInterfaceArea_A	environmentalNaturalResource	Unpopulated
WildlifeMgtArea_A	environmentalNaturalResource	Unpopulated
EnvRemediationSite_A	environmentalRestoration	Populated
EnvRestorSampLoc_P	environmentalRestoration	Populated
PollutionArea_A	environmentalRestoration	Populated
PotentialEnvSite_A	environmentalRestoration	Populated
EnvOperableUnit_A	environmentalRestoration	Unpopulated
EnvRemediationArea_A	environmentalRestoration	Unpopulated
LandUseControl_A	environmentalRestoration	Unpopulated
RestTreatmentSysComp_L	environmentalRestoration	Unpopulated
RestTreatmentSysComp_P	environmentalRestoration	Unpopulated
RestTreatmentSystem_A	environmentalRestoration	Unpopulated
StorageTank_P	environmentalStorageTanks	Populated
EnvWtrQualPermit_A	environmentalWaterQuality	Unpopulated
EnvWtrQualSampLoc_P	environmentalWaterQuality	Unpopulated
SpillIncidentArea_A	environmentalWaterQuality	Unpopulated

GIS provides for cost effective monitoring of ecosystem changes and enhances management capabilities but has not been fully implemented at the base. Various natural resource surveys and projects have generated GIS data over the years. However the data is not sufficiently managed. Digital files are not maintained in a centralized Geodatabase or similar database management system and without a centralized management system data lose is inevitable. A data management system should be developed and implemented. A review of GIS data is needed to determine data gaps. Once data gaps are determined complete surveys and/or acquire information (such as previous surveys) to fulfill GIS needs.

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

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

Installation Supplement – Management Goals and Objectives

ADMINISTRATION

Goal 1: Maintain a Fully Staffed Natural Resources Program. Recruit and retain qualified personnel to ensure quality management of natural resources consistent with mission requirements and to ensure HAFB meets the Sikes Act Amendment requirements to update the INRMP every five years.

> Objective 1.1: Ensure cooperative agreements are in place for contract support of all natural resource management activities, and review such agreements annually (from its inception) for any updates.
>
> > *Project 1.1.1:* Procure onsite contractor support to assist with management of the natural resource program.

FISH AND WILDLIFE MANAGEMENT

Goal 2: Designate, Map, and Monitor Important Wildlife Habitats within the Chihauhuan Desert. Determine areas of ecological importance and conserve and enhance such areas to maintain and improve the sustainability and natural diversity of ecosystems on HAFB while supporting mission requirements.

> Objective 2.1: Maintain and improve sustainability and natural diversity of ecosystems on HAFB.
>
> > *Project 2.1.1:* Plan and conduct ground-based activities to reduce impacts to important wildlife habitats and to protect biodiversity on base.

Project 2.1.2: Preserve areas of ecologically important vegetation communities and wildlife habitat in sufficiently large blocks to minimize habitat fragmentation while supporting mission requirements. This includes the White Sands Pupfish essential habitat.

Objective 2.2: Develop and implement monitoring and management strategies appropriate for grassland, riparian wetland and playa-like wetland habitats on HAFB.

Project 2.2.1: Examine long-term habitat plots (Lichen and erosion) every 3 years.

Project 2.2.2: Perform annual vegetation and aerial surveys of the base and associated properties to assist in management activities and planning.

Objective 2.3: Inventory, map, and monitor locations and suitable habitat for rare lichen every five years.

Objective 2.4: Monitor areas of high electrocution risk for birds. Mitigate raptor electrocutions by implementing the HAFB Avian Protection Plan (Johnson et al. 2013) and replacing or retrofitting power poles and associated components to the greatest extent possible, except where prevented by design, resources or funding limitations.

Goal 3: Document and Monitor HAFB Species Diversity and Population Trends. Determine species presence, abundance, habitat use and Federal status on HAFB main base, BWWS, and GSU's.

Objective 3.1: Conduct species inventories to determine species presence, abundance, and habitat use. Includes identifying the presence or absence of federally-listed threatened and endangered species on the main base and associated properties.

Project 3.1.1: Bat species inventory every three years.

Project 3.1.2: Raptor and grassland bird surveys annually including breeding bird surveys on established routes every three years.

Project 3.1.3: Neotropical bird surveys annually including breeding bird surveys on established routes every three years.

Project 3.1.4: Produce an all breeding bird survey report every three years summarizing findings of surveys with comparisons across sampling periods to determine trends and fluctuations of bird populations as well as recommendations for management.

Project 3.1.5: Mammal surveys every 3 years three years

Project 3.1.6: Herpetofauna species inventory every three years.

THREATENED AND ENDANGERED SPECIES, SPECIES OF CONCERN AND HABITAT MANAGEMENT

Goal 4: Conserve and manage, if present, threatened, endangered, and candidate species listed for regulatory protection by federal and state agencies, as well as critical habitat and wetlands on HAFB main base, BWWSA, and GSUs. Includes monitoring Species of Concern (SOC) for population trends and potential impacts.

Objective 4.1: Monitor and manage the White Sands Pupfish population and habitat. HAFB cooperates fully in implementing the interagency Cooperative Agreement for Protection and Maintenance of the White Sands Pupfish, both through implementing appropriate actions per the Cooperative Agreement and providing for appropriate access to HAFB by interagency agreement participants for furthering White Sands Pupfish protection and management to avoid listing under the ESA and designation of associated critical habitat. All projects associated with essential pupfish habitat are assessed through the NEPA process for potential adverse effects (AF Form 332-Base Civil Engineer Work Request & AF-813 Request for Environmental Impact Analysis).

Project 4.1.1: Perform annual monitoring of White Sands Pupfish under the Cooperative Agreement.

Project 4.1.2: Develop a HAFB specific White Sands Pupfish Monitoring Plan based on the White Sands Pupfish Conservation Plan within three years.

Project 4.1.3: Review the potential and need for habitat improvement such as: infrastructure repair (Lowering Culverts to provide aquatic habitat connectivity) on causeway road areas in conjunction with future construction projects; dredging and/or installing erosion control features; salt cedar removal.

Project 4.1.4: Monitor dune encroachments into White Sands Pupfish habitat in the lower Lost River drainage adjacent to the High Speed Test Track to determine if they pose a threat to habitat quality every three years.

Project 4.1.5: Determine the status of experimental pupfish populations at Bradford Spring and golf course ponds in 2019. The current status of the pupfish populations at Bradford Spring and those translocated to the golf course ponds in unknown.

Project 4.1.6: Prohibit and monitor (using field cameras) unauthorized off-road vehicle travel in White Sands Pupfish essential habitat areas.

Project 4.1.7: Establish a vehicle safety zone (signs, guard rail) across the Lost River to reduce risk of accidents which could cause negative impact to critical habitat areas.

Objective 4.2: Monitor and manage Burrowing Owl population and habitat on HAFB including assessing burrowing owl populations, artificial burrow usage, breeding and fledging success, owl diet and prey base, and effect of human activity on owl reproductive success.

Project 4.2.1: Conduct burrowing owl surveys annually and prior to construction projects

Project 4.2.2: Monitor and fill in or relocate burrowing owls from sinkholes on the edge of runways and taxiways outside of breeding season (breeding season is mid-March to mid-September).

Project 4.2.3: Repair or replace artificial burrows as needed.

Objective 4.3: Monitor and manage thrasher and longspur species on HAFB.

Project 4.3.1. Perform annual survey for thrasher and longspur species to determine population parameters, habitat suitability and breeding site characteristics, as well as survival and reproductive success, and comparative studies outlining how management activities such as mowing may impact wintering habit.

Objective 4.5: Perform targeted surveys for T&E/SGCN Raptors (other than Burrowing Owls) to evaluate habitat suitability and breeding site characteristic every three years.

Objective 4.6: Conduct Mexican Gray Wolf habitat study.

Objective 4.7: Perform survey for Desert Massasauga to determine population parameters and habitat suitability.

WATER RESOURCE PROTECTION

Goal 5: All activities on base under HAFB jurisdiction and control conserve use of potable water to maintain sustainable quantities of high quality surface water and groundwater resources.

Objective 5.1: Avoid inadvertent planting of high-water-use plant species.

Project 5.1.1: Update plant list approved for landscaping annually, including the xeriscaping webpages on the HAFB intranet.

Objective 5.2: Continue the reuse of treated effluent for irrigation at the golf course.

WETLAND PROTECTION

Goal 6: Lake Holloman and the constructed wetlands are managed, consistent with the primary purpose of the constructed wetlands and BASH concerns, for shorebird and waterfowl habitat. No filling of HAFB's wetlands are considered except when required for mission related purposes. All projects associated with HAFB's wetlands will be conducted under the federal policy of "no net loss" of wetlands and will follow the NEPA process for assessing potential adverse effects (AF Form 332-Base Civil Engineer Work Request & AF-813 Request for Environmental Impact Analysis).

Objective 6.1: Monitor the components of the wetland ecosystem, including vegetation, invertebrates, and nesting and migrating avian species in the enhanced wetlands area, including Lake Holloman and Lagoon G, for habitat function and health and population trends.

Project 6.1.1: Annually monitor the water levels and extent of invasive plant species in the enhanced wetlands, including Lake Holloman and Lagoon G.

<u>Objective 6.2:</u> Manage Lake Holloman and the LHWC in accordance with the Lake Holloman Wetland Complex Monitoring Plan (Johnson et al. 2011).

Project 6.2.1: Evaluate alternative methods and management strategies for managing Lake Holloman and the LHWC under recurring draught conditions.

Project 6.2.2: Revise the Lake Holloman Wetlands Complex Monitoring Plan (Johnson et al. 2011) as needed to compensate for mission changes.

*Project 6.*2.3: Evaluate and conduct habitat enhancements to benefit nesting and migrating shorebirds and waterfowl.

WILDLAND FIRE MANAGEMENT

Goal 7: Optimize the Wildland Fire Management Program for HAFB main base, BWWSA, and GSUs.

<u>Objective 7.1:</u> Continue operations as identified in the 2018 Wildland Fire Management Plan

Project 7.1.1: Update the Wildland Fire Management Plan every five years, or as needed to compensate for mission changes.

INTEGRATED PEST MANAGEMENT

Goal 8: Manage pests in a manner that reduces impacts to natural resources, watersheds, landscapes, and the base mission.

<u>Objective 8.1:</u> Continue operations as identified in the 2017 Integrated Pest Management Plan
Project 8.1.1: Update the Integrated Pest Management Plan every five years, or as needed to compensate for mission changes.

INVASIVE SPECIES MANAGEMENT

Goal 9: Manage noxious weeds and invasive plants on HAFB main base, BWWSA, and GSUs.

<u>Objective 9.1:</u> Develop and implement a systematic annual monitoring program to evaluate and document noxious weed/invasive species on HAFB main base, BWWSA, and GSUs.

Project 9.1.1: Complete a systematic and comprehensive noxious weed/invasive species inventory.

Project 9.1.1.a: Identify species and document size and density of existing populations every 2 years.

Project 9.1.1.b: Document previous treatment effectiveness for all invasive species control areas.

Project 9.1.1.c: Prioritize invasive plant species control and management.

Project 9.1.1d: Conduct annual monitoring of the salt cedar biocontrol beetle.

<u>Objective 9.2:</u> Perform annual mitigation of invasive species per the invasive species removal plan.

Project 9.2.1: Herbicide application and treatment of salt cedar or cut and treatment due to the density and growth size of the mature species.

<u>Objective 9.3:</u> Ensure timely restoration of disturbed sites to discourage invasion and spread of noxious plants and invasive species through coordination with engineering planner.

BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD (BASH)

Goal 10: Reduce Wildlife Aircraft Strike Hazards for HAFB. Manage wildlife habitat and populations to reduce the potential for bird and wildlife strikes during flying operations.

<u>Objective 10.1:</u> Continue operations as identified in the 2017 BASH Management Plan and update the plan every five years or as needed to compensate for mission changes.

Project 10.1.1: Complete annual and seasonal assessments of the bird strike risk for the local flying area, with periodic updates of bird populations, their locations, known seasonal migratory route descriptions, and any other information to reduce actual and potential hazardous environmental factors for the Bird Working group.

Project 10.1.2: Monitor infield and HSTT areas for strike hazards.

Project 10.1.3: Eliminate and reduce environmental conditions that attract birds and other animals to the airfield by fulfilling responsibilities consistent with the BASH Plan.

PUBLIC OUTREACH

Goal 11: Increase awareness, appreciation and conservation of natural resources on HAFB.

<u>Objective 11.1:</u> Develop and implement an education outreach program for base personnel and the public.

Project 11.1: Contribute to HAFB and Alamogordo community earth day, Arbor Day, and similar events.

Project 11.2: Develop and distribute informational pamphlets about Holloman AFB wildlife and habitat.

Project 11.3: Maintain educational exhibits for public viewing.

GEOGRAPHIC INFORMATION SYSTEMS (GIS) & DATABASE MANAGEMENT

Goal 12: Maintain Natural Resource data for HAFB and associated properties to efficiently plan ground-based mission activities and various projects as well as performing INRMP updates and revisions; meeting mission objectives while protecting biodiversity on base.

Objective 12.1: Identify and fill data gaps in GIS coverage for HAFB as well as updating and maintaining GIS layers and remotely sensed imagery within a Natural Resources geodatabase.

Project 12.1.1: Develop, implement, and maintain a Natural Resources geodatabase.

Project 12.1.2: Acquire aerial/satellite imagery, including infrared (IR) band, for the base and its GSUs, in coordination with HAFB GeoBase operations every five years. Supports GIS analyses; Allows for monitoring specific hazards; Assists in identifying specific attractants; and Documents changes in vegetative communities and land use in order to evaluate habitat fragmentation for example.

Project 12.1.3: Conduct individual surveys to update natural resource GIS coverage.

Project 12.1.4: Compile, update and maintain GIS/remotely sensed data from recently performed natural resource surveys and/or historical data (i.e. flora and fauna ground based survey transects, wildlife sighting points, and remotely sensed data such as aerial surveys).

Project 12.1.5: Ensure natural resources GIS data is available and forwarded to other units and agencies as appropriate such as HAFB GeoBase, 49 OSS/OSAA, & WSMR.

Objective 12.2: Compile, update and maintain digital copies of relevant reference material, previous survey reports, MOU's, photo documentation within a Natural Resources database.

Project 12.2.1: Develop, implement, and maintain a reference library.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

HAFB will use professionally trained natural resources management personnel to develop, implement and enforce their INRMPs. Natural resources managers at Category I installations must take the course, DoD Natural Resources Compliance, developed by the DoD Interservice Environmental Education Review Board (ISEERB) and offered for all DoD Components by the Naval School, Civil Engineer Corps Officers School (CECOS). Encourage installation natural resources managers to attend appropriate national, regional, and state conferences and training courses. Currently, 49 CES/CEIE has one natural resources manager, and two contractors to support the natural resources conservation efforts. Currently, neither the 49 CES/CEIE nor the Security Forces (49 SFS) have certified Conservation Law Enforcement personnel.

9.2 Monitoring INRMP Implementation

- Implementation – 49 CES/CEIE Natural Resources Manager is responsible for implementing the INRMP, and will conduct the annual review of the INRMP in cooperation with the USFWS and NMDGF
- *Natural Resources Management Staffing – consist of an Air Force Civil Service and two contractors (a research specialist and project specialist) for implementing the INRMP. At current staffing levels, no deficiencies training needs hinder INRMP implementation.*

9.3 Annual INRMP Review and Update Requirements

The INRMP requires annual review, in accordance with DoDI 4715.03, *Natural Resources Conservation Program,* and AFI 32-7064, to ensure the achievement of mission goals, verify the implementation of projects, and establish any necessary new management requirements. This process involves installation natural resources personnel and external agencies working in coordination to review the INRMP. If the installation mission or any of its natural resources management issues change significantly after the creation of the original INRMP, a major revision to the INRMP is required. The need to accomplish a major revision is normally determined during the annual review with USFWS, NMDGF, and NOAA (if required). The NRM/POC documents the findings of the annual review in an Annual INRMP Review Summary and obtains signatures from the coordinating agencies on review findings. By signing the Annual INRMP Review Summary, the collaborating agency representatives assert concurrence with the findings. If any agency declines to participate in an on-site annual review, the NRM submits the INRMP for review along with the Annual INRMP Review Summary document to the agency via official correspondence and request return correspondence with comments/concurrence. HAFB will update the INRMP every five years.

The USFWS, NMDGF, and NOAA (if applicable) and the NRM/IST conduct an Annual INRMP Review Meeting. This meeting takes place in person with respective representatives for each agency. Individuals may telephone or video call if they cannot attend in person. During this meeting the NRM/IST updates the external stakeholders/parties with the end of the year execution report and coordinates future work plans and any necessary changes to management methods etc. All parties review the INRMP and begin preliminary collaborative work on updating the INRMP (new policies, procedures, impacts, mitigations, etc.) as applicable. Following completion of updates, to include internal AF review, the INRMP is staffed for signature.

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 AF 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 Air Force 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 resources 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 support long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

Annual Work Plans (Include Year)	**OPR**	**Funding Source**	**Priority Level**
2018			
Interagency/Intra-agency Sikes Act Work	49 CES	MIPR	H
Mgt, Habitat, Chihuahuan Desert			H
Mgt, Invasive Species			H
Mgt, Species, Burrowing Owl			H
Mgt, Species, Lizard			M
Mgt, Species, Mammals			H
Mgt, Species, Raptors			M
Mgt, Species, Neotropical Migrant Birds			M
Mgt, Species, White Sands Pupfish			H
Mgt, Species, Threatened and Endangered Species			M
Mgt, Wetlands / Floodplain			H
Monitor, Wetlands			M
Outreach		OBAD	H
2019			
Interagency/Intra-agency Sikes Act Work	49 CES	MIPR	H
Mgt, Habitat, Chihuahuan Desert			H
Mgt, Invasive Species			H
Mgt, Species, Bat			H
Mgt, Species, Burrowing Owl			H
Mgt, Species, Herps			H
Mgt, Species, Mammals			H
Mgt, Species, Raptors			M
Mgt, Species, Neotropical Migrant Birds			M

Mgt, Species, White Sands Pupfish			H
Mgt, Species, Threatened and Endangered Species			M
Mgt, Wetlands / Floodplain			H
Mgt/Survey Mexican Gray Wolf			L
Monitor, Wetlands			M
Outreach		**OBAD**	H
2020			
Interagency/Intra-agency Sikes Act Work	**49 CES**	**MIPR**	H
Mgt, Habitat, Chihuahuan Desert			H
Mgt, Invasive Species			H
Mgt, Species, Burrowing Owl			H
Mgt, Species, Herps			M
Mgt, Species, Mammals			H
Mgt, Species, Raptors			M
Mgt, Species, Neotropical Migrant Birds			M
Mgt, Species, White Sands Pupfish			H
Mgt, Species, Threatened and Endangered Species			M
Mgt, Wetlands / Floodplain			H
Monitor, Wetlands			M
Outreach		**OBAD**	H
2021			
Interagency/Intra-agency Sikes Act Work	**49 CES**	**MIPR**	H
Mgt, Habitat, Chihuahuan Desert			H
Mgt, Species, Bat			M
Mgt, Invasive Species			H
Mgt, Species, Burrowing Owl			H
Mgt, Species, Herps			M
Mgt, Species, Raptors			M
Mgt, Species, Neotropical Migrant Birds			M
Mgt, Species, White Sands Pupfish			H
Mgt, Species, Threatened and Endangered Species			M
Mgt, Wetlands / Floodplain			H
Monitor, Wetlands			M
Outreach		**OBAD**	H
2022			
Interagency/Intra-agency Sikes Act Work	**49 CES**	**MIPR**	H
Mgt, Habitat, Chihuahuan Desert			H
Mgt, Invasive Species			H
Mgt, Species, Burrowing Owl			H
Mgt, Species, Herps			M
Mgt, Species, Mammals			M

Mgt, Species, Raptors			**M**
Mgt, Species, Neotropical Migrant Birds			**M**
Mgt, Species, White Sands Pupfish			**H**
Mgt, Species, Threatened and Endangered Species			**M**
Mgt, Wetlands / Floodplain			**H**
Monitor, Wetlands			**M**
Outreach		**OBAD**	**H**

MIPR - Military Interdepartmental Purchase Request

OBAD - Operating Budget Authority Document

11.0 REFERENCES

11.1 Standard References *(Applicable to all AF installations)*

- AFI 32-7064, *Integrated Natural Resources Management*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook – a 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 ACRONYMS

12.1 Standard Acronyms *(Applicable to all AF installations)*

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

12.2 Installation Acronyms

- (Add state, county, installation specific acronyms)

13.0 DEFINITIONS

13.1 Standard Definitions *(Applicable to all AF installations)*

- Natural Resources Playbook – Definitions Section

13.2 Installation Definitions

- Add unique state, local and installation-specific definitions

14.0 APPENDICES

Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the “Legacy Resource Management Program” for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, Protection and Enhancement of Environmental Quality	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, Protection and Enhancement of the Cultural Environment	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, Floodplain Management	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.
EO 11989, Off-Road vehicles on Public Lands	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, Protection of Wetlands	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, Federal Compliance With Pollution Control Standards	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to

Federal Public Laws and Executive Orders	
	conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.
EO 12898, Environmental Justice	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, Exotic and Invasive Species	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	The U.S. Fish and Wildlife Service (USFWS) has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet Federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended;	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this

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P.L. 93-205, 16 U.S.C. § 1531 et seq.	law, no Federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides Federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.

Federal Public Laws and Executive Orders	
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires Federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires Federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a Federal Permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.

Federal Public Laws and Executive Orders	
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other Federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an Integrated Natural Resources Management Plan and public access to natural resources, and allows collection of nominal hunting and fishing fees. NOTE: AFI 32-7064 sec 3.9. Staffing. As defined 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, August 4, 1983 (Revised 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 utilize DoD personnel to 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	
DoD Instruction 4150.07 DoD Pest Management Program dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, Environmental Security	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DODI) 4715.03, Natural Resources Conservation Program	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum – 17 May 2005 – Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation

Federal Public Laws and Executive Orders	
	commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum – 1 November 2004 – Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum – 10 October 2002 – Implementation of Sikes Act Improvement Act: Updated Guidance	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-7062, 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	This instruction 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 its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.

Federal Public Laws and Executive Orders	
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.
New Mexico State Laws (NMAC)	
20.2 NMAC Air Quality	Management and control of discharge of pollutants into the air.
20.4 NMAC Hazardous Waste	Management and control of discharge of Hazardous waste.
20.5 NMAC Petroleum Storage Tanks	Petroleum Storage Tank Regulations
20. 6. NMAC Ground and Surface Water Protection	Management and control of discharge of pollutants into surface and ground waters
20. 7.1 NMAC Drinking Water	Management and control of pollutants into drinking water
20 .7.3 NMAC Liquid Waste Disposal	Management and control of the disposal of liquid wastes
20 .8.2 NMAC Nuisance Abatement	Mosquito abatement and control
20. 9. NMAC Solid Waste Management	Management and control of the disposal of solid wastes
New Mexico Harmful Plant Act (76-6A-AA), NM Harmful Weed Management Act (76-6-1-76-7-22). NM Harmful Weed Act (76-6-23-7-7-30)	Management and control of harmful and noxious weeds and plants, including state technical assistance to private landowners and Federal and state agencies and Indian nations, upon request
Memoranda of Agreement/Understanding	
Coordinated Resource Management (CRM) in New Mexico (MOU)	Promotes collaborative communication, planning and decision-making among Federal and state agencies for effective management of New Mexico lands, natural resources and ecosystems
DoD and USFWS to Promote the Conservation of Migratory Birds (MOU)	Identifies specific activities where cooperation between the agencies will contribute substantially to the conservation of migratory birds and their habitats
DoD and Bat Conservation International (MOU)	Establishes policy of cooperation between the parties to identify, document, and maintain bat populations and their habitats on DoD installations
Cooperative Agreement for Protection and Maintenance of White Sands Pupfish	Parties agree to cooperate in the management, protection, and conservation of present and future populations of White Sands pupfish and habitat

DoD, USFWS, International Association of Fish and Wildlife Agencies Cooperative Integrated Natural Resource Management Program on Military Installations	Establishes a cooperative relationship in preparing, reviewing, and implementing INRMPs on military installations
NRCS and DoD MOU	Improves the conservation of natural resources, wetlands, prime farmlands, and the integrity of watersheds while reducing encroachment of military lands.
Watchable Wildlife Memorandum of Understanding (MOU)	Conservation organizations and Federal agencies agree to develop program for Watchable Wildlife
Interagency agreement between DOI, BLM & HAFB	Operational responsibility at Centennial Bombing Range.

Appendix B. Programmatic Environmental Assessment/Finding of No Significant Impact for Ground Based Training on Holloman Air Force Base

FINDING OF NO SIGNIFICANT IMPACT

GROUND-BASED FIELD TRAINING AND EXERCISES COMBINED WITH INTEGRATED GROUND-BASED FIELD TRAINING MANAGEMENT PLAN HOLLOMAN AIR FORCE BASE, NEW MEXICO

1. Need for Action and Proposed Action

1.1 Need for Action

Multiple units at Holloman AFB have a variety of mission-essential field training requirements. Problems have continuously surfaced with regard to the identification of specific training requirements, availability of suitable training areas, conflicting use of the same areas, and existing and potential environmental effects caused by long-term use of sensitive training areas. Many organizations have not been able to meet off-pavement vehicle training requirements because of lack of suitable and available training areas.

Holloman AFB proposes to improve the efficiency and effectiveness of its training requirements by ensuring that:

- Training activities conducted in areas already used are done so in a way that protects the environment and provides for long-term use of the area while meeting training objectives.
- Mission-essential training activities that are not currently being conducted because of lack of adequate training areas are implemented in areas that can support the requirements while protecting the environment long-term.
- Areas that are required for training activities by multiple squadrons are scheduled and coordinated through appropriate POCs and conducted in an environmentally sound manner to meet training objectives and protect the long-term viability of the area.
- Areas in which field training should not be conducted for environmental or other reasons are identified and excluded from consideration.

1.2 Proposed Action

This Programmatic Environmental Assessment (PEA) evaluates 30 different ground-based exercise/training requirements conducted on 17 different training areas by functional organizations located at Holloman AFB, and some units off-base that have traditionally used Holloman AFB for training. Through the analysis of requirements and environmental issues associated with meeting those requirements, suitable training areas and training area-specific mitigation measures for resolving environmental issues are identified.

The result of this PEA is a comprehensive *Integrated Ground-Based Field Training Management Plan for Holloman AFB*, incorporated into the Environmental Assessment as Chapter 2. The plan also identifies areas which are not suitable for training, as well as Points of Contact (POCs) and scheduling processes for scheduling use of each training area to avoid conflicts and to ensure that mitigation measures are implemented during training and exercise activities.

All training and exercises to be conducted on Holloman AFB upon approval of this FONSI will be evaluated by 49 CES/CEV, using the AF Form 813 prepared by the action proponent, against the descriptions of the training/exercises described in Section 2.2 of the PEA, the mitigation measures and processes outlined for the pertinent training area in Section 2.3 of the PEA, and environmental impacts predicted in Chapter 4.0 of the PEA.

If the proposed actions are consistent with the descriptions, mitigation measures, and environmental impacts, and have no extraordinary circumstances (AFI 32-7061, Attachment 2, A.2.2), then the action can be categorically excluded under categorical exclusion A2.3.11 (AFI 32-7061). If the training cannot be categorically excluded under this process, then the PEA will be supplemented to evaluate the environmental effects of the proposed training (40 CFR 1502.9). Any supplement for particular training will not effect the analysis of any other training/exercise evaluated in the PEA and decision included in this FONSI.

2. *Alternatives Considered in this PEA*

The alternatives considered in this PEA are:

- **No Action Alternative.** Ground-based training program as currently conducted on Holloman AFB, supports 14 units and squadrons on 11 different sites conducting 18 different training/exercises on Main Base. Under this alternative, none of the training efforts have been evaluated in terms of environmental impacts; some training has occurred on sites that were environmentally unacceptable; and no sites, other than existing roads, were available for any mission-essential off-pavement vehicle training. No specific units are responsible for maintaining, scheduling, or monitoring use of individual training sites, so some long-term use areas have problems with soil erosion, trash and debris, spread of noxious weeds, and the potential to adversely affect sensitive species and historical sites.
- **Proposed Action.** Proposed ground-based training program, would support 14 units and squadrons on 17 different sites conducting 30 different training/exercises on Main Base. Under this alternative, mitigation measures have been developed for each training site, based on the specific training that would be conducted there; environmental information to be included in each pre-exercise briefing, based on the mitigation measures, has been described; and responsible POCs and scheduling processes are identified for each site.

This PEA provides analysis for both planned and reasonably foreseeable ground-based training on Holloman AFB and is, therefore, both a site-specific and programmatic Environmental Assessment. It also develops an *Integrated Ground-Based Field Training Management Plan*, incorporated into this PEA as Chapter 2.

3. Decisions Made by 49 FW Commander

3.1 Selection of Alternative

Pursuant to 40 CFR 1508.9(a)(2), environmental assessments may be used for evaluating and selecting alternatives.

Based on the information and analyses provided by this Programmatic Environmental Assessment, I select the Proposed Action, as described in detail in Sections 2.2 and 2.3 of the PEA, while also ensuring that training is not conducted on the sites identified in Section 2.4 of the PEA.

I select this alternative because it provides a systematic comprehensive approach to meeting mission-essential training objectives while ensuring long-term use of the training sites through practical and appropriate environmental protection.

The *Integrated Ground-Based Field Training Management Plan for Holloman AFB*, as developed in Chapter 2.0 of the PEA, meets the mission needs of Holloman AFB organizations, minimizes scheduling conflicts, uses available sites optimally, identifies sites not suitable for training, provides long-term use of training areas by retaining necessary environmental requirements and components, and optimizes environmental quality, both short-term and long-term.

3.2 Finding of No Significant Impact (FONSI) Analysis

The FONSI provides the rationale for why the actions described and evaluated in this Programmatic Environmental Assessment are not "major federal actions" having significant impacts, pursuant to the National Environmental Policy Act (NEPA; 40 CFR 1508.18 and 40 CFR 1508.27), and, therefore, why an Environmental Impact Statement (EIS) is not being prepared.

The evaluation of lack of impact significance documented here is based on the criteria identified at 40 CFR 1508.27.

- **Impacts on Health and Safety**

Over 50 action proponents having training requirements were involved in the detailed identification of the training requirements, as currently met and as needed, described in Section 2.2 of the PEA. They also assisted the Holloman AFB subject matter experts in identifying new areas with suitable characteristics that were needed to meet mission-essential training requirements. Action proponents and subject matter experts worked together cross-functionally (See Section 5.0 of the PEA) to identify environmental, safety, and health issues associated with training on each existing and proposed site, and develop practical mitigation measures for each. Training and site-specific mitigation measures were developed to protect both training participants and trainers, and any other non-participating people that might be in the area, especially for training involving vehicles on main and secondary roads. The action proponents agreed to implement those mitigation measures as described in Section 2.3 and Chapter 4.0 of the PEA.

No significant adverse impacts on health or safety are therefore foreseen.

- **Unique Geographic Characteristics, Degree of Environmental Controversy, and Degree of Highly Uncertain Effects or Unique or Unknown Risks**

All existing and proposed sites were evaluated by Holloman AFB subject matter experts for potential adverse impacts on erosive soils, sensitive plants and animals and their habitat, wetlands, historical and archaeological sites, and other unique characteristics. Sites with concerns that could not be mitigated were eliminated from detail study, and therefore use for training, in Section 2.4 of the PEA. As described in detail in Chapter 4.0, no significant adverse impacts to unique geographic areas are foreseen.

Ground-based training has been ongoing on Holloman AFB and on bases across the Air Force for many years. None of the training activities described in Section 2.2 is unique, and all training activities are composed of activities with which the Air Force and Holloman AFB are well experienced. Environmental impacts associated with such training are well-known to the subject matter experts involved in the analysis (Section 5.0) and a high degree of confidence is placed in the resultant analyses documented in Chapter 4.0. No environmental controversy or unique or unknown risks are therefore foreseen.

- **Setting a Precedent for Future Actions**

The mission of Holloman AFB emphasizes air-based and ground-based training. This Programmatic Environmental Assessment simply conducts a comprehensive analysis of all the ground-based training currently conducted and proposed to be conducted on base. No action within this analysis would set a precedent for future actions that themselves would have the potential for significant environmental impacts, individually or cumulatively.

- **Potential for Adverse Cumulative Environmental Impacts**

As stated above, no actions are foreseen to set a precedent for future actions which would themselves have the potential for causing significant environmental impacts, either individually or cumulatively. The environmental analyses and associated mitigation measures described in Chapter 4.0 indicate that no significant cumulative impacts would be caused by long-term use of any of the areas, nor that any cumulative adverse impacts would occur to a particular resource across the base caused by the training program.

- **Potential to Adversely Affect Historic or Archaeological Resources, or Threatened or Endangered Species and Critical Habitat**

Based on the analysis in Chapter 4.0, with associated mitigation measures, no adverse impacts would occur to any historic or archaeological resources. No threatened or endangered species occur on any of the existing or proposed training areas on Holloman AFB. Analyses of potential effects on sensitive species such as grama grass cactus, White Sands pupfish, burrowing owls, barn owls, Swainson's hawk, or Texas horned lizards in Chapter 4.0 indicates no potential for significant adverse impacts to any of these species.

- **Potential to Violate Federal, State, or Local Environmental Law**

The subject matter experts carefully considered the requirements of the laws identified in Section 1.5 of the PEA, and ensured that all ground-based training complied appropriately with the requirements. Please see Section 4.0 of this FONSI for compliance with the General Conformity Rule pursuant to the Clean Air Act Amendments of 1990.

4.0 General Conformity Rule Determination Pursuant to the Clean Air Act Amendments of 1990

Due to the attainment status of Holloman Air Force Base with regard to criteria air pollutants, a formal Air Conformity Determination is not required.

5.0 Finding of No Significant Impact (FONSI) Conclusion

Based on this Programmatic Environmental Assessment conducted in accordance with the requirements of the National Environmental Policy Act (NEPA), its implementing regulations at 40 CFR 1500-1508, and AFI 32-7061, I conclude that the environmental effects associated with implementing the *Integrated Ground-Based Field Training Management Plan for Holloman AFB*, as incorporated in Chapter 2.0 and analyzed in Chapter 4.0, are not significant effects. Therefore an Environmental Impact Statement (EIS) will not be prepared.

William J Lake

WILLIAM J. LAKE
Brigadier General, USAF
Commander

10 Jul 98
Date

Supplement to the Programmatic Environmental Assessment Of Ground-Based Field Training

December 2008

49 CES/CEV
550 Tabosa Ave
Holloman Air Force Base,
New Mexico

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

01 December 2008

MEMORANDUM FOR ALL 49 FW AGENCIES AND TENANTS

FROM: 49 FW/CC

SUBJECT: Supplement to the Programmatic Environmental Assessment of Ground-Based Field Training

1. This document outlines the results of the programmatic environmental assessment of ground-based training activities listed in the Holloman AFB Ground Based Field Training Management Plan.

2. This document fulfills the requirements of the National Environmental Policy Act (NEPA) and other environmental legislation.

3. This document is to be used in conjunction with the Holloman AFB Ground Based Field Training Management Plan and is effective upon receipt.

4. All organizations on distribution for this plan will conduct an initial review upon receipt. Annual reviews are also required with suggested changes forwarded to 49 CES/CEV, 550 Tabosa Ave, Holloman AFB NM 88330-8277.

5. Tasked units will prepare appropriate plans, operating instructions or checklists to implement this plan within their organization and/or areas under their control.

6. The OPR for coordinating this plan is 49 CES/CEV, Environmental Flight.

JEFFREY L. HARRIGIAN
Colonel, USAF
Commander

Attachment

Supplement to the Programmatic Environmental Assessment of Ground-Based Field Training

Appendix C. Programmatic Environmental Assessment/Finding of No Significant Impact for Management of the High Speed Test Track on Holloman Air Force Base

FINDING OF NO SIGNIFICANT IMPACT

Programmatic Environmental Assessment

High Speed Test Track Operations

HOLLOMAN AIR FORCE BASE, NEW MEXICO

1. Need for Action and Proposed Action

1.1. Need for Action

The High Speed Test Track (HSTT) at Holloman Air Force Base (HAFB) is the longest, most precisely aligned, and best instrumented facility of its kind in the world. It is part of the Department of Defense (DoD) Major Range and Test Facility Base (MRTFB), DoDD 3200.11, and exists for the management and operation of track-related DoD developmental and operational test and evaluation activities in support of DoDD 5000.1 for weapons systems acquisition programs. The HSTT is also available for test and evaluation activities required by other Federal agencies, foreign nations, educational research organizations, and commercial entities. The 846th Test Squadron (846 TS) operates the HSTT. The 846 TS is part of the 46th Test Group (46 TG), which is a tenant activity at HAFB.

This Programmatic Environmental Assessment (PEA) evaluates all ground-based test and operational activities conducted at the HSTT, except for the Magnetic Levitation Sled Track Operations, which is covered under a separate environmental assessment. Through the analysis of test and operational activities and environmental, safety, and health issues associated with those requirements, activities that meet 46 TG and 846 TS requirements while protecting and enhancing environmental, safety, and health considerations (management actions and best management practices) are identified. The results of the PEA and the Finding of No Significant Impact (FONSI) will be incorporated into the Holloman AFB Integrated Natural Resources Management Plan (INRMP) and will be used for managing the natural resources associated with operation of the HSTT. Activities that are consistent with the analysis in this PEA can be categorically excluded without further National Environmental Policy Act (NEPA) evaluation, subject to analysis based on AF Form 813.

1.2. Summary of the Proposed Action

Because of the increasing complexity and rising costs incurred in the development of weapons and flight systems, flight simulation using high-speed rocket sleds is a widely used ground test method for reducing technological risk, safety hazards, and exorbitant costs involved in proceeding from laboratory-type tests immediately to actual flight tests. Track testing fills the gap in ground testing by providing the missing link between laboratory-type tests and simulations and full-scale flight tests. Track tests allow new weapons systems program managers to rigorously define and repeat specific test environments and performance, to recover the test specimen after test completion for evaluation, and to eliminate crew safety hazards while avoiding delays and high costs inherent in testing flight-rated experimental weapons system hardware.

The HSTT is located in the Tularosa Basin in southeastern New Mexico, approximately 15 miles west of the city of Alamogordo. It extends along the eastern edge of the gypsum (white sand) dunefields in a near north-south direction over a total length of 50,788 feet. The HSTT is located along the far northwestern edge of HAFB.

1.3. Scope of Decisions

This PEA, prepared pursuant to NEPA, evaluates environmental, safety and health effects associated only with ground-based test and operational activities of the HSTT at HAFB, as currently implemented and with proposed changes. It evaluates effects of the current program as currently implemented (no action alternative), and identifies and evaluates the effects of the program as foreseen to meet HSTT client requirements now and in the future, and to ensure sustainability of HSTT operations through environmental protection.

The analysis of the tests using specific simulants at each test site, including the HSTT, is included in the *Programmatic Environmental Assessment for the Theater Missile Defense Lethality Program, U.S. Army Space and Strategic Defense Command*, Huntsville AL, August 1993 (FONSI signed 27 July 93). The U.S. Army examined additional simulants not evaluated in their PEA, but narrowed the appropriate simulants to those evaluated in the PEA. No other simulants are expected to be used for HSTT tests. Therefore, no additional analysis regarding simulants is included in this PEA.

This PEA also does not include analysis and decisions for the Magnetic Levitation System which has been evaluated in *Environmental Assessment – Magnetic Levitation System Installation and Operation at Holloman High Speed Test Track, Holloman AFB, New Mexico*, (FONSI signed 26 Jan 96).

This PEA has no termination date. It provides the basis for natural resources management integrated into the long-term operation of the HSTT at HAFB as long as:

- The testing is conducted in a similar manner as actions described in Chapter 2, including the management actions and best management practices described for each resource in Chapter 4 of the PEA, and
- The actual impacts associated with operations remain within the range of impacts identified in Chapter 4 of the PEA for the proposed action.

All of the proposed facilities described in Section 2.2 would be either additions to existing buildings located in the developed administrative area at the south end of the HSTT, to the Track itself, or new buildings within the developed area. Although additional impacts are not expected for these proposed facilities, each facility would undergo scrutiny through AF Form 332 and AF Form 813, and the appropriate NEPA documentation prepared, as details are not available at this time. Therefore, the impacts of these proposed facilities are not included within the environmental impact analyses in this chapter.

HSTT operations and test requirements proposed in the future will be evaluated by 49 CES/CEV against the descriptions of the existing tests and operations described in Sections 2.1 and 2.2, the best management practices and management actions and processes outlined for each issue in Sections 4.1 through 4.14, and environmental impacts predicted in Chapter 4 of this PEA. If the proposed actions are consistent with the test descriptions, best management practices & actions & predicted impacts and have no extraordinary circumstances, then the actions can be categorically excluded under Categorical Exclusion A2.3.11 (AFI 32-7061) as documented on AF Form 813:

> *"Actions similar to other actions which have been determined to have an insignificant impact in a similar setting as established in an EIS or EA resulting in a FONSI. The EPF must document application of this CATEX on AF Form 813, specifically identifying the previous Air Force approved environmental document which provides the basis for this determination."*

If any future proposed tests or track operations have issues or extraordinary circumstances which are not evaluated in this PEA, the proposed tests or operations cannot be categorically excluded under Categorical Exclusion A2.3.11. These proposed activities, as well as any new information or circumstances having environmental relevance, such as additional species listed under the Endangered Species Act, shall be evaluated in a supplement to this PEA (40 CFR 1502.9), unless the proposed action can be categorically excluded in its own right (based on the AF Form 332 and site-specific evaluation). Any supplement for a particular activity or changed circumstance will not affect the analysis of any other activity evaluated in this PEA.

2. Alternatives Considered in this PEA

The alternatives considered in this Programmatic Environmental Assessment are:

- **No Action Alternative.** The No Action Alternative (Section 2.1 of the PEA) includes all current tests and operations of the HSTT that might cause adverse environmental impacts at HAFB. This includes over 14 types of tests conducted using combinations of different facilities at the HSTT site. Many of these types of tests use large quantities of water and involve extremely high speeds and explosions. Some of these tests create sonic booms. Two static tests requiring compliance with the Clean Air Act have also been conducted.
- **Proposed Action.** The 46 TG proposes to continue the operations of the HSTT as described under Section 2.2 of the PEA. However, operations would be modified with proposed new facilities and additional best management practices and management actions as standard operating procedures identified in Sections 4.1 through 4.14. Static tests using large rocket motors having substantial air emissions could result in HAFB becoming a "major source" under the Clean Air Act and are not included in this PEA. The proposed action incorporates the description of current operations and tests as described in Section 2.1 and describes additional proposed activities, best management practices and management actions to protect the environment. Additional modifications to existing facilities are identified. All best management practices and management actions were developed using the interdisciplinary approach involving cooperation and concurrence of 13 HSTT personnel (846 TS, 46 TG, and support contractors) and 13 resource managers and community planners from HAFB (Section 5 of the PEA). No other alternatives were necessary for this EA, consistent with Section 102(2)(E) of NEPA.

3. Decisions

3.1. Selection of Alternative

Pursuant to 40 CFR 1508.9(a)(2), environmental assessments may be used for evaluating and selecting alternatives.

Based on the information and analyses provided by this PEA, I select the Proposed Action: Current Operations of the HSTT as modified with best management practices and management actions to protect the environment as described in Section 2.2, and described and evaluated in Sections 4.1 through 4.14 of the PEA.

I select this alternative because this alternative and its associated best management practices and management actions were developed using a systematic, comprehensive, and interdisciplinary approach. The management actions identified in Sections 4.1 through 4.14 of the PEA will be effective in long-term management and protection of the natural resources at the HSTT, while supporting present and future HSTT mission and sustainability. This alternative is consistent with NEPA, the HAFB INRMP, and Air Force policy. The best management practices and management actions will be immediately available for implementation upon approval of this FONSI and incorporated into the INRMP.

3.2. FONSI Analysis

The FONSI provides the rationale for why the actions described and evaluated in this PEA are not "major federal actions" having significant impacts, pursuant to the National Environmental Policy Act (NEPA; 40 CFR 1508.18 and 40 CFR 1508.27), and, therefore, why an Environmental Impact Statement (EIS) is not being prepared.

The evaluation of lack of impact significance documented here is based on the criteria identified at 40 CFR 1508.27.

3.2.1. Impacts on Health and Safety

The PEA identified best management practices and management actions that best manage chemicals for noxious plant and overall weed control, consistent with the INRMP, and protect HSTT personnel from rattlesnakes using non-lethal actions. The HSTT is currently operated using tested safety policies and management actions. Access to the HSTT, as part of the DoD MRTFB, is restricted to authorized personnel only.

No significant adverse impacts on health or safety are therefore foreseen.

3.2.2. Unique Geographic Characteristics, Degree of Environmental Controversy, and Degree of Highly Uncertain Effects or Unique or Unknown Risks

All unique areas and special habitats at the HSTT were evaluated for potential adverse impacts on erosive soils, sensitive plants and animals and their habitat, wetlands, historical and archaeological sites, and other unique characteristics. Management actions in Chapter 4 of the PEA implement specific protections for these unique areas and resources consistent with necessary operations of the HSTT and the INRMP. As

4

described in detail in Chapter 4, no significant adverse impacts to unique areas are foreseen.

All best management practices and management actions identified in Chapter 4 of the PEA have proven effective for their intended uses. A high degree of confidence is placed in the resultant analyses documented in Chapter 4. No environmental controversy or unique or unknown risks are therefore foreseen.

3.2.3. Setting a Precedent for Future Actions

No action within this analysis would set a precedent for future actions that themselves have the potential for significant environmental impacts, individually or cumulatively. All best management practices and management actions identified in Chapter 4 of the PEA were identified using the systematic interdisciplinary approach (HAFB and HSTT personnel working together) and are consistent with operation and mission of the HSTT, with the INRMP, and Air Force policy.

3.2.4. Potential for Adverse Cumulative Environmental Impacts

No actions are foreseen to set a precedent for future actions which would themselves have the potential for causing significant environmental impacts, either individually or cumulatively. The environmental analyses in Chapter 4 of the best management practices and the management actions described in Chapter 4 of the PEA indicate that no significant adverse cumulative impacts would be caused by implementation of the proposed action. Overall, water use at the HSTT is consistent with the annual water use on HAFB, and is substantially less than that used by other base facilities, such as the golf course and Military Family Housing. Control of noxious weeds at the HSTT is consistent with that identified in the INRMP base-wide, and would protect native vegetation and reduce the use of herbicides and pesticides.

3.2.5. Potential to Adversely Affect Historic or Archaeological Resources, or Threatened or Endangered Species and Critical Habitat

Based on the analysis in Chapter 4, no adverse impacts would occur to any historic or archaeological resources with the implementation of identified best management practices and management actions. No threatened or endangered species would be adversely impacted. Identified best management practices and management actions would protect the White Sands Pupfish, burrowing owls, and sensitive vegetation communities. None of these species are protected under the Endangered Species Act.

3.2.6. Potential to Violate Federal, State, or Local Environmental Law

The subject matter experts carefully considered the requirements of the laws and Executive Orders identified in Section 1.5 of the PEA, and ensured that the best management practices and management actions complied with the requirements. Please see Section 4 of this FONSI for compliance with the General Conformity Rule pursuant to the Clean Air Act Amendments of 1990.

4. General Conformity Rule Determination Pursuant to the Clean Air Act Amendments of 1990

Due to the attainment status of HAFB with regard to criteria air pollutants, a formal Air Conformity Determination is not required. Pursuant to Title III of the Clean Air Act, proposed static tests of rocket motors will be evaluated on a case-by-case basis, as each test is different and cannot be evaluated in this PEA, to determine the potential for exceedance of Federal and State air quality standards and appropriate actions pursuant to Federal and State law taken prior to testing. Any test that would have an adverse effect on air quality regulated by Federal and New Mexico Regulations would not be approved by 49 CES/CEV or would have to undergo the permitting process for air quality required by the State of New Mexico.

5. FONSI Conclusion

Based on this PEA conducted in accordance with the requirements of NEPA, its implementing regulations at 40 CFR 1500-1508, and AFI 32-7061, I conclude that the environmental effects associated with implementing the proposed action for long-term management and operation of the HSTT are not significant effects. Implementation of the proposed action and associated best management practices and management actions would improve the quality and management of natural resources at the HSTT, consistent with mission and the HAFB INRMP, and meet Federal law and requirements and Air Force policy. These actions would also contribute to long-term sustainability of HSTT operations. Therefore an EIS will not be prepared.

JEFFREY L. HARRIGIAN
Colonel, USAF
Commander

31 Oct 08
Date

Appendix D. Memoranda of Agreement and Cooperative Agreements

Reaffirming participation in the:

MEMORANDUM
OF
UNDERSTANDING

For

Coordinated Resource Management (CRM)

For New Mexico.

"Purpose:

To facilitate on the ground results, this New Mexico Memorandum of Understanding (MOU) for Coordinated Resource Management (CRM) may be used to promote the exchange of ideas and management strategies to address locally driven issues. CRM provides a mechanism for government agencies, non-governmental organizations, and local, affected interests to foster communications, cooperation and coordination in developing and implementing sound resource management and conservation programs where objectives of mutual concern are identified."

The expiration date is extended indefinitely.

DAVE Goldfein 27 OCT 06

Brigadier General L. David Goldfein
Commander, 49th Fighter Wing
Holloman Air Force Base, New Mexico

Date

Background Information, Coordinated Resource Management (CRM) Memorandum Of Understanding (MOU)

In 2003, Holloman AFB was invited to sign a multi-agency MOU for Coordinated Resource Management (CRM) in New Mexico. This CRM MOU was originally initiated by the Southwest Strategy Initiative. The purpose of this MOU was:

"To facilitate on the ground results, this New Mexico Memorandum of Understanding (MOU) for Coordinated Resource Management (CRM) may be used to promote the exchange of ideas and management strategies to address locally driven issues. CRM provides a mechanism for government agencies, non-governmental organizations, and local affected interests to foster communication, cooperation and coordination in developing and implementing sound resource management and conservation programs where objectives are of mutual concern are identified."

In short, this MOU provides for interagency cooperation/collaborative work in managing Natural Resources (including Cultural and other resources) that cross political boundaries and are of mutual management interest to respective agencies having resource management responsibilities within the state of New Mexico.

Holloman AFB attended the signing ceremony and the affiliated follow-on executive-level training on 5 Jun 2003. Lt Col Thelen was the designated representative for Holloman AFB at that ceremony, and signed the CRM MOU.

The next annual CRM meeting was held on 12 Jan 2005 in Albuquerque, NM. Discussions held at the meeting resulted in proposing that the termination CRM MOU (originally having a termination date of 1 Jan 05) was eliminated, with no further changes to the MOU. Additional topics covered in the meeting covered examples of successful interagency partnerships, common issues crossing political boundaries, and the need for a centralized location (potentially web-based) for CRM information. Ms. Jeanne Dye, 49 CES/CEV, represented Holloman AFB at this meeting.

Ms. Dye is available to attend the CRM meeting scheduled for 9 Nov 2006 in Albuquerque, NM.

MEMORANDUM OF UNDERSTANDING

for
Coordinated Resource Management (CRM)
in New Mexico

Memorandum of Understanding

FOREST SERVICE (USFS)
NATIONAL PARK SERVICE (NPS)
BUREAU OF RECLAMATION (BOR)
FISH AND WILDLIFE SERVICE (USFWS)
BUREAU OF LAND MANAGEMENT (BLM)
ARMY CORPS OF ENGINEERS (ACE)
CANNON AIR FORCE BASE (CAFB)
HOLLOMAN AIR FORCE BASE (HAFB)
KIRTLAND AIR FORCE BASE (KAFB)
WHITE SANDS MISSILE RANGE (WSMR)
FORT BLISS MILITARY RESERVATION (FBMR)
BUREAU OF INDIAN AFFAIRS, SOUTHWEST REGION (BIA)
BUREAU OF INDIAN AFFAIRS, NAVAJO REGION
ALL INDIAN PUEBLO COUNCIL (AIPC)
ZUNI TRIBAL COUNCIL (ZTC)
NAVAJO NATION
UTE MOUNTAIN TRIBAL COUNCIL (UMTC)
JICARILLA APACHE TRIBAL COUNCIL (JATC)
MESCALERO APACHE TRIBAL COUNCIL (MATC)
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)
NEW MEXICO ASSOCIATION OF RESOURCE CONSERVATION AND DEVELOPMENT COUNCILS (NMARC&D)
NEW MEXICO ASSOCIATION OF CONSERVATION DISTRICTS (NMACD)
FARM SERVICE AGENCY (FSA)
U.S. GEOLOGICAL SURVEY (USGS)
AGRICULTURAL RESEARCH SERVICE (ARS)
JORNADA EXPERIMENTAL RANGE
ENVIRONMENTAL PROTECTION AGENCY (EPA)

For Coordinated Resource Management (CRM) in New Mexico

NM STATE UNIVERSITY COOPERATIVE EXTENSION SERVICE (CES)
NEW MEXICO STATE LAND OFFICE (SLO)
NEW MEXICO ENVIRONMENT DEPARTMENT (NMED)
NEW MEXICO DEPARTMENT OF AGRICULTURE (NMDA)
NEW MEXICO GAME AND FISH DEPARTMENT (NMGFD)
NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT (NMSHTD)
NM ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT (EMNRD)
NEW MEXICO DEPARTMENT OF TOURISM (NMDT)
NEW MEXICO SOIL AND WATER CONSERVATION COMMISSION

PURPOSE

To facilitate on the ground results, this New Mexico Memorandum of Understanding (MOU) for Coordinated Resource Management (CRM) may be used to promote the exchange of ideas and management strategies to address locally driven issues. CRM provides a mechanism for government agencies, non-governmental organizations, and local affected interests to foster communication, cooperation and coordination in developing and implementing sound resource management and conservation programs where objectives are of mutual concern are identified.[1] [2]

Definitions applicable to this MOU can be found in Appendix I.

To facilitate CRM, for reference purposes, the rolls and responsibilities of the participating state and federal agencies are listed in Appendix II.

STRATEGIES

1. Recognize that the lands and natural resources administered by the parties to this agreement are part of larger ecosystems that transcend management responsibilities and ownership boundaries.

2. Recognize that effective management of New Mexico's lands, natural resources and ecosystems requires cooperation between many federal and state agencies, conservation districts, tribes and pueblos, local governments, and private landowners.

3. Acknowledge the significance of local objectives and resource concerns in the management and use of resources.

4. Promote collaborative decision-making where land ownership, resource management responsibilities and technical assistance responsibilities are intermingled, or where coordination is essential

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[1] This MOU is intended to supplement existing MOUs between and among agencies, tribes and pueblos, conservation districts and local governments for coordination of resource management in New Mexico.

[2] This MOU supplements the national CRM MOU dated July 1987, between the Extension Service; Soil Conservation Service; Forest Service (USFS), United States Department of Agriculture (USDA); and the Bureau of Land Management (BLM), United States Department of Interior. This MOU supercedes the New Mexico MOU of 1985, which added the Commissioner of Public Lands, who oversees the New Mexico State Land Office. This MOU also supercedes the Supplemental MOU, dated June 1990, among the State Director, Bureau of Land Management; State Conservationist, Soil Conservation Service; Regional Forester, Southwestern Region Forest Service; Commissioner of Public Lands, State of New Mexico; and Extension Service Director, State of New Mexico.

to develop and implement sound resource management (See Appendix II for roles and responsibilities of each signatory to the MOU).

5. Recognize that an affected interest may request agencies to work together on resource planning decision-making and issues management.

6. Encourage agencies to work together on resource planning, decision-making and issue management to promote complimentary policies, procedures and methodologies where possible.

7. Encourage coordination of methods in data collection and monitoring and the use of resource information for making scientifically based adaptive management decisions.

8. Encourage collaboration and communication among agencies, landowners, land users and other stakeholders before decisions are made which may affect the use and management of lands and resources.

IMPLEMENTATION

The following groups and their respective responsibilities are established to implement CRM in New Mexico:

EXECUTIVE GROUP

1. The Executive Group is made up of participating signatory agency executives (or their designee with full authority) who are responsible for administering the resource management activities for their agency in New Mexico.

2. The Executive Group is responsible for insuring that cooperation among agencies and other groups exists for the benefit of New Mexico's natural resources. They are responsible for insuring that personnel at all levels of their organizations are knowledgeable of, and adhere to, the purpose, objectives and scope of this agreement.

3. The Executive Group will meet at least annually and, at a minimum, review accomplishments and strategies for information sharing. Each annual meeting will be set and

hosted as mutually agreed by the participants of the previous meeting.

4. The Executive Group will be supportive and responsive to the Field Groups and any designated Special Working Groups by acting upon and providing timely feedback to submitted reports, requests for assistance and proposed actions.

FIELD GROUPS

1. Field Groups are established on the basis of locally-defined and/or time-limited opportunities, issues, or needed projects.

2. Any affected interest may request the initiation of a Field Group to address a natural resource issue or problem of mutual concern to the stakeholders.

3. Upon their determination of a CRM issue, the agency(ies) having management authority over the issue will establish the Field Group. Field Groups are made up of stakeholders such as: field staff from appropriate agencies, conservation districts, private landowners, tribes and pueblos, land users and other affected interests within a project area. Participants involved in each Field Group will vary depending on land ownership, administrative responsibilities and interests.

4. Field Groups will formally meet, as needed.

5. Field Groups will report on the status of their projects and activities at the annual meeting of the Executive Group.

SPECIAL WORKING GROUPS

1. When a State-wide or long-term issue is identified, the Executive Group may establish and appoint representatives of their respective agencies to a Special Working Group. The Executive Group may invite others to participate in the Special Working Group as appropriate.

2. The Special Working Group will address resource related issues and problems involving the need for a process of conflict resolution and public involvement at the field level, which are beyond the traditional scope of the Field Groups.

3. The Special Working Group will keep the Executive Group informed of progress and recommendations as they are developed.

MODIFICATIONS TO THIS AGREEMENT

This agreement can be modified in writing upon the consent of all parties.

DURATION OF THIS AGREEMENT

This MOU expires January 1, 2005, at which time it will be subject to review, revision, renewal, or expiration. The continued participation of any party to this agreement is subject to cancellation at any time, upon written notification.

FINANCING

Any projects undertaken as the result of this MOU and any amendment thereto will be subject to the laws, policies and funding provisions governing these parties.

Nothing herein shall be construed as obligating the parties to expend funds, or be involved in any contract to other obligation for the future payment of money in excess of legal appropriations which are authorized and allocated for these purposes.

AUTHORITIES

Federal agencies that are parties of this agreement, are required by the policies of the National Environmental Policy Act (NEPA) to ensure that environmental impacts receive full consideration during the planning process. Procedures for environmental assessment and preparation of environmental documents required for compliance with NEPA, where applicable have been developed by each agency.

The program conducted will be in compliance with the Endangered Species Act (ESA) and related implementation regulations. Nothing in this MOU precludes the Military Services to address emerging complex or controversial resources management issues at the major command or Headquarters levels. These issues may include the ESA Section 7 informal and formal consultations, listing of new threatened and endangered species, and the designation of new critical habitat

The program conducted will be in compliance with the nondiscrimination provisions as contained in the Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination in Employment Act (ADEA) of 1967, as amended, and in accordance with regulations of the Secretary of Agriculture (7 CFR-15, Subparts A & B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, gender, religion, marital status, or handicap be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity, receiving federal financial assistance from any agency hereof. Under Authorization: Article XV, Section 1 of the New Mexico Constitution and New Mexico statutes 76-1-1 through 76-1-3 NMSA 1978, authorizes the Director of New Mexico Department of Agriculture to represent agricultural interests in New Mexico.

Nothing in this MOU shall be construed as:

1. Limiting or affecting in any way the authority or legal responsibility of the signatories, or as binding either the state or the federal agencies, other organizations or individuals entering into this MOU, to perform beyond the respective authority of each, or to require any of the parties to assume or expend any sum in excess of appropriations or monies available.

2. Precluding signatories from exempting information considered confidential.

3. Precluding individual ranch or farm operators from requesting additional state participation, or participation by other parties.

Each provision of this MOU is subject to the laws and regulations of the State of New Mexico, and the laws of the United States and the regulations of each of the various departments and agencies signed hereto.

Amendments to this MOU may be proposed by any party, and shall become effective upon approval by a majority of the parties having signed this Memorandum.

APPENDIX I

DEFINITIONS

Affected Interests - individuals that will be impacted by proposed decisions or projects.

Agencies - an administrative division of a government, federal, state, or tribal.

Landowner - possessor of land whether governmental or private.

Land User - Individuals that use federal, tribal, state, county or municipal land such as lessees or permittees.

Private Landowner - possessor of fee simple title land.

Participants - signatories and those who participate in Field Group undertakings.

Participating Agency - governmental bodies that are signatories of this agreement.

Project Area - the particular scope of operation of a Field Group undertaking.

Signatories - a signer bound with others by a signed agreement.

Stakeholder - those who have an interest in an undertaking of a Field Group.

APPENDIX II

ROLES AND RESPONSIBILITIES

The roles and responsibilities of participating agencies may include but are not limited to the following:

1. The US Forest Service (USFS) manages the national forests and national grasslands to provide a sustainable supply of water, wood, forage, minerals, wildlife habitat, and outdoor recreation experience for the American people. The USFS also conducts research, assumes a leadership role in protecting the nation's forests from wildfire, insects, and disease, and provides technical and financial assistance to state and private forestry agencies.

2. The National Park Service promotes and regulates the use of the national parks, whose purpose is to conserve the scenery, the natural and historic objects, and the wild life therein, and to provide for the enjoyment of the same, in such a manner and by such means, as will leave them unimpaired for the enjoyment of future generations.

3. The Bureau of Reclamation manages water related resources west of the Mississippi River. Their mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

4. The U.S. Fish and Wildlife Service is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the 94-million-acre National Wildlife Refuge System, which encompasses more than 535 national wildlife refuges, thousands of small wetlands and other special management areas. It also operates 70 national fish hatcheries, 64 fishery resource offices and 78 ecological services field stations. The agency enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

5. The Bureau Land Management (BLM) is responsible for managing the nation's public lands and natural resources. It is the mission of the BLM to

sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations.

6. The Department of Defense (DOD) mission is to support the military readiness of the United States armed forces, improve the quality of life for military personnel, and comply with environmental laws to protect human health and the environment. The base commanders of Cannon Air Force Base (AFB), Holloman AFB, Kirtland AFB, White Sands Missile Range, and Fort Bliss Military Reservation are each responsible for carrying out the DOD mission within the jurisdiction of their respective commands. The Army Corps of Engineers is responsible for managing flow levels of New Mexico's navigable streams, and specifically the land and water resources related to Abiquiu Lake and reservoir.

7. The Bureau of Indian Affairs has a trust responsibility emanating from treaties and other agreements with federally recognized Indian tribes to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of Indian tribes.

8. The Natural Resources Conservation Service (NRCS) is a federal agency that works in partnership with the American people to conserve natural resources on private lands, and other non-federal lands, through scientific and technical expertise, and through partnerships with conservation districts and others.

9. The New Mexico Association of Resource Conservation and Development Councils (NMARC&D) are nonprofit organizations that utilize the skills and resourcefulness of their members to provide leadership and support for efforts intended to improve and conserve the state's natural resources, and to enhance the standard of living for citizens of New Mexico.

10. The New Mexico Association of Conservation Districts (NMACD) represents the soil and water conservation districts in New Mexico, which are legal subdivisions of the state of New Mexico. Conservation districts provide locally led leadership and assist agencies, farms, ranches, and private individuals in determining priorities for conservation work.

11. The Farm Service Agency mission is to stabilize farm income, help farmers conserve land and water resources, provide credit to new or disadvantaged farmers and ranchers, and help farm operations recover from the effects of disaster.

12. The U.S. Geological Survey provides the nation with, reliable, impartial information to describe and understand the earth, to minimize loss of life and property, manage water, biological, energy, and mineral resources, enhance and protect the quality of life, and contribute to wise economic and physical development.

13. The Agricultural Research Service (ARS) is the research arm of the USDA. The ARS provides access to agricultural information and develops new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority. The Jornada Experimental Range is a field station of the ARS and operates in cooperation with New Mexico State University.

14. The Environmental Protection Agency mission is to protect human health and to safeguard the natural environment. Their purpose is to ensure clean air, clean water, safe food, pollution prevention, and better waste management.

15. The Cooperative Extension Service works to enhance agriculture, the environment, the natural resource base, family and youth well being and the development of local communities. They accomplish this mission by the integration, dissemination, and application of knowledge in agricultural and life sciences.

16. The New Mexico State Land Office mission is to be the nation's model for state trust land management, providing current and future revenues to our beneficiaries, and ensuring the long-term health and productivity of the state trust lands for future generations of beneficiaries.

17. The New Mexico Environment Department's (NMED) mission is to provide the highest quality of life throughout the state by promoting a safe, clean, and productive environment. NMED is responsible for air quality, water quality, and waste management in New Mexico for present and future generations.

18. The New Mexico Department of Agriculture is a regulatory agency charged with the implementation of over 30 laws passed to serve the agricultural industry and to provide consumer service. The department is under the jurisdiction of the New Mexico State University Board of Regents and as an agent of the board, fulfills responsibilities assigned to the department by the legislature. Headquarters for the department are located on the New Mexico State University campus in Las Cruces, NM. The director/secretary of the department is a member of the Governor's Cabinet and is designated by statute as the Secretary of Agriculture.

19. The New Mexico Game and Fish Department works to provide and maintain an adequate supply of wildlife and fish within the state of New Mexico by utilizing a flexible management system that provides for their protection, propagation, regulation, conservation and for their use as public recreation and food supply.

20. The New Mexico Highway and Transportation Department mobilizes its resources to plan, develop, maintain, improve and otherwise facilitate a high quality state transportation network. The department recognizes the importance of mobility for New Mexicans and visitors alike. Transportation is a key element in enhancing the quality of life for all citizens and is an essential ingredient in the economic development process. Highways, railroads, public transportation and aviation are all identified as unique but complementary components of the state transportation network.

21. The mission of the Energy, Minerals and Natural Resources Department (EMNRD) is to provide leadership in protection, conservation, management, and responsible development of New Mexico's renewable and non-renewable natural resources:

    a. The Mining and Minerals Division administers coal and hard rock mining related programs.

    b. The Forestry and Resources Conservation Division (FRCD) encourages multiple use concepts of natural resource management, protection and preservation of unique ecosystems and endangered species, and wildfire management on all lands except those owned by federal agencies, or located within municipal boundaries.

    c. The Oil Conservation Division (OCD) regulates almost every aspect of the oil and gas industry in the state.

    d. The Parks and Recreation Division (PRD) maintains, manages and supervises 32 state parks and recreation areas. The Park and Recreation Division's public service obligations include law enforcement, boating safety, facility construction and maintenance, water treatment and utility services for a large visitor population. PRD also supervises concessionaires operating businesses with the parks, administers a lease lot program and encourages and stimulates community interest for the parks.

e. The Energy Conservation and Management Division plans, administers, reviews, provides technical assistance, maintains records and monitors state and federal energy conservation and alternative energy technology programs.

f. The Youth Conservation Corps (YCC), which is administratively attached to this department, was created in 1992 to provide a program to employ young persons in public projects that conserve New Mexico's natural resources and provide community benefits of lasting value.

22. The mission of the New Mexico Department of Tourism is to promote New Mexico as a travel destination domestically and abroad. It accomplishes this through several promotional programs.

23. The New Mexico Soil and Water Conservation Commission provides the primary responsibility of administrative, financial, education and other assistance to soil and water conservation districts.

APPROVED

6/5/03

Harv Forsgren, Regional Forester Southwestern Region — Date
Forest Service

for Karen Wade, Director-Intermountain Region — Date
National Park Service

6/5/03

for Ken Maxey, Manager, Upper Colorado River — Date
Bureau of Reclamation

6/5/03

H. Dale Hall, Regional Director, Region 2 — Date
US Fish and Wildlife Service

10/13/04

Linda Rundell, New Mexico State Director — Date
Bureau of Land Management

Dana, Hurst, LTC District Engineer — Date
US Army Corps of Engineers, Albuquerque District

June 5, 2003

Robert Perry, President — Date
New Mexico Association of Resource
Conservation and Development Councils

5 June 2003

Eddie Vigil, President — Date
New Mexico Association of Conservation Districts

June 5, 2003

Rick Lopez, Executive State Director — Date
Farm Service Agency

Larry Ludke, Regional Biologist — Date
U.S. Geological Survey

June 5, 2003

Kris Havstad, Director-Jornada Experimental Range — Date
Agricultural Research Service

11 June 2003

for Lawrence Starfield, Acting Regional Administrator — Date
Environmental Protection Agency

Colonel Robert Yates — Date
Cannon Air Force Base

5 JUN 2003

Brigadier ~~General~~ (Sel) James P. Hunt — Date
Holloman Air Force Base

5 June 2003

for Colonel Kathleen D. Close — Date
Kirtland Air Force Base

Ronnie J. Hickok, Garrison Manager — Date
White Sands Missile Range

5 June 03

Colonel Thomas Trumps, Garrison Commander — Date
Fort Bliss Military Reservation

5 June 03

for Rob Baracker, Regional Director — Date
Bureau of Indian Affairs, Southwest Region

Elouise Chicharello, Regional Director — Date
Bureau of Indian Affairs, Navajo Region

06.05.03

Bill Richardson, Governor
New Mexico

Date

6-5-03

Robert O. Coppedge, NMSU Interim Associate Dean
and Director New Mexico Cooperative Extension Service

Date

Patrick H. Lyons

6/5/03

Patrick H. Lyons, Commissioner
New Mexico State Land Office

Date

Frank A. DuBois, Director/Secretary
New Mexico Department of Agriculture

Date

5 Jun '03

Chairman
New Mexico Soil and Water Conservation Commission

Date

Amadeo Shije, Chairman — Date
All Indian Pueblo Council

Arlen Quetawki Sr., Governor — Date
Zuni Tribal Council

Joe Shirley, President — Date
Navajo Nation

Harold D. Cuthair, Vice-Chairman — Date
Ute Mountain Tribal Council

Claudia Vigil-Muniz, President — Date
Jicarilla Apache Tribal Council

Sara Misquez, President — Date
Mescalero Apache Tribal Council

June 3, 2003

Rosendo Trevino, III, State Conservationist — Date
Natural Resources Conservation Service

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
U.S. DEPARTMENT OF DEFENSE
AND THE
U.S. FISH AND WILDLIFE SERVICE
TO PROMOTE THE CONSERVATION OF MIGRATORY BIRDS

This Memorandum of Understanding (MOU) is entered into between the U.S. Department of Defense (DoD) and the U.S. Fish and Wildlife Service (FWS) (hereinafter "the Parties").

A. Purpose and Scope

Pursuant to Executive Order 13186 (January 17, 2001), Responsibilities of Federal Agencies to Protect Migratory Birds, this MOU outlines a collaborative approach to promote the conservation of migratory bird populations.

This MOU does not address incidental take during military readiness activities, which is being addressed in a rulemaking in accordance with section 315 of the National Defense Authorization Act for Fiscal Year 2003 (Pub. L. 107-314, 116 Stat. 2458).

This MOU specifically pertains to the following categories of DoD activities:

(1) Natural resource management activities, including, but not limited to, habitat management, erosion control, forestry activities, agricultural outleasing, conservation law enforcement, invasive weed management, and prescribed burning;

(2) Installation support functions, including but not limited to, the maintenance, construction or operation of administrative offices, military exchanges, road construction, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, non-tactical equipment, laundries, morale, welfare, and recreation activities, shops, landscaping, and mess halls;

(3) Operation of industrial activities;

(4) Construction or demolition of facilities relating to these routine operations; and

(5) Hazardous waste cleanup.

This MOU identifies specific activities where cooperation between the Parties will contribute substantially to the conservation of migratory birds and their habitats. This MOU does not authorize the take of migratory birds.

B. Authorities

The Parties' responsibilities under the MOU are authorized by provisions of the following laws:

Alaska National Interest Lands Conservation Act of 1980 (16 USC 410hh-3233)
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)
Fish and Wildlife Act of 1956 (16 U.S.C. 742 et seq.)
Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911)
Fish and Wildlife Coordination Act (16 U.S.C. 661-667)
Migratory Bird Conservation Act (16 U.S.C. 715-715d, 715e, 715f-715r)
Migratory Bird Treaty Act (16 U.S.C. 703-711)
National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347)
Sikes Act Improvement Act of 1997 (16 USC 670a-670o)
Agreements to limit encroachments and other constraints on military training, testing, and operations (10 U.S.C. § 2684a)

C. Background

The Parties have a common interest in the conservation and management of America's natural resources. The Parties agree that migratory birds are important components of biological diversity and that the conservation of migratory birds will both help sustain ecological systems and help meet the public demand for conservation education and outdoor recreation, such as wildlife viewing and hunting opportunities. The Parties also agree that it is important to: 1) focus on bird populations; 2) focus on habitat restoration and enhancement where actions can benefit specific ecosystems and migratory birds dependent upon them; and 3) recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations.

The DoD mission is to provide for the Nation's defense. DoD's conservation program works to ensure continued access to land, air, and water resources for realistic military training and testing while ensuring that the natural and cultural resources entrusted to DoD's care are sustained in a healthy condition.

The DoD is an active participant in international bird conservation partnerships including Partners in Flight (PIF) and the North American Bird Conservation Initiative (NABCI). Military lands frequently provide some of the best remaining habitat for migratory bird species of concern, and DoD plans to continue its leadership role in bird conservation partnerships.

Through the PIF initiative, DoD works in partnership with numerous Federal and State agencies and nongovernmental organizations for the conservation of migratory and resident birds and to enhance migratory bird survival. Through DoD PIF, a list of species of concern (see Definitions) has been developed for each Bird Conservation Region where DoD facilities occur, thus improving DoD's ability to evaluate any migratory bird conservation concerns on respective DoD lands.

Integrated Natural Resources Management Plans (INRMPs) offer a coordinated approach for incorporating habitat conservation efforts into installation management.

INRMPs are a significant source of baseline conservation information and conservation initiatives used when preparing National Environmental Policy Act (NEPA) documents for all DoD management activities. This linkage helps to ensure that appropriate conservation and mitigation measures are identified in NEPA documents and committed to, when appropriate, in final decision documents.

The DoD PIF program provides a framework for incorporating landbird, shorebird and waterbird habitat management efforts into INRMPs. DoD's strategy focuses on inventorying and long-term monitoring to determine changes in migratory bird populations on DoD installations. Effective on-the-ground management may then be applied to those areas identified as having the highest conservation value. DoD's PIF goal is to support the military's training and testing mission while being a vital and supportive partner in regional, national, and international bird conservation initiatives. DoD strives to implement cooperative projects and programs on military lands to benefit the health and well-being of birds and their habitats, whenever possible. The Department of Defense implements bird inventories and monitoring programs in numerous ways including Monitoring Avian Productivity and Survivorship (MAPS) and Next Generation Radar (NEXRAD) for studying bird movements in the atmosphere. DoD also maintains an integrated pest management (IPM) program designed to reduce the use of pesticides to the minimum necessary.

The mission of the FWS is to work with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The FWS is legally mandated to implement the provisions of the Migratory Bird Treaty Act (MBTA), which include responsibilities for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulation development and enforcement. The FWS also promotes migratory bird conservation through its coordination and consultation efforts with other entities.

Many FWS programs are involved in bird conservation activities, including:

1. The Division of Migratory Bird Management and Regional Migratory Birds and Habitat Programs serve as focal points in the United States for policy development and strategic planning, developing and implementing monitoring and management initiatives that help maintain healthy populations of migratory birds and their habitat, and providing continued opportunities for citizens to enjoy bird-related recreation.

2. The Division of Bird Habitat Conservation is instrumental in supporting habitat conservation partnerships through the administration of bird conservation grant programs and development of Joint Ventures that serve as major vehicles for implementing the various bird conservation plans across the country.

3. Ecological Services Field Offices across the country serve as the primary contacts for environmental reviews that include, when requested, projects developed by local military installations and DoD regional offices involving migratory bird issues. The Field Offices coordinate with the Regional Migratory Bird Offices, as necessary, during these reviews regarding permits

and overall migratory bird conservation coordination for DoD activities.

4. The Office of Law Enforcement is the principal FWS program that enforces the legal provisions of the MBTA.

The Parties agree this MOU shall be implemented to the extent permitted by law and in harmony with agency missions, subject to the availability of appropriations and budgetary limits.

D. **Responsibilities**

1. **Each Party shall:**

a. Emphasize an interdisciplinary, collaborative approach to migratory bird conservation in cooperation with other governments, State and Federal agencies, and non-federal partners within the geographic framework of the NABCI Bird Conservation Regions.

b. Strive to protect, restore, enhance, and manage habitat of migratory birds, and prevent or minimize the loss or degradation of habitats on DoD-managed lands, by:

(1) Identifying and avoiding management actions that have the potential to adversely affect migratory bird populations, including breeding, migration, or wintering habitats; and by developing and implementing, as appropriate, conservation measures that would avoid or minimize the take of migratory birds or enhance the quality of the habitat used by migratory birds.;

(2) Working with partners to identify, conserve, and manage Important Bird Areas, Western Hemisphere Shorebird Reserve Network sites, and other significant bird conservation sites that occur on DoD-managed lands;

(3) Preventing or abating the pollution or detrimental alteration of the habitats used by migratory birds;

(4) Developing and integrating information on migratory birds and their habitats into outreach and education materials and activities; and

(5) Controlling the introduction, establishment, and spread of non-native plants or animals that may be harmful to migratory bird populations, as required by Executive Order 13112 on Invasive Species.

c. Work with willing landowners to prevent or minimize the loss or degradation of migratory bird habitats on lands adjacent or near military installation boundaries. This cooperative conservation may include:

(1) Participating in efforts to identify, protect, and conserve

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important migratory bird habitats or other significant bird conservation sites and ecological conditions that occur in landscapes or watersheds that may be affected by activities on DoD lands;

(2) Developing and integrating information on migratory bird resources found on DoD lands into other partners' outreach and education materials and activities; and

(3) Using available authorities to enter into agreements with other Federal agencies, States, other governmental entities, and private conservation organizations to conserve and enhance habitat in a compatible manner so military operations are not restricted.

d. Promote collaborative projects such as:

(1) Developing or using existing inventory and monitoring programs, at appropriate scales, with national or regional standardized protocols, to assess the status and trends of bird populations and habitats, including migrating, breeding, and wintering birds;

(2) Designing management studies and research projects using national or regional standardized protocols and programs, such as MAPS, to identify the habitat conditions needed by applicable species of concern, to understand interrelationships of co-existing species, and to evaluate the effects of management activities on habitats and populations of migratory birds;

(3) Sharing inventory, monitoring, research, and study data for breeding, migrating, and wintering bird populations and habitats in a timely fashion with national data repositories such as Breeding Bird Research and Monitoring Database (BBIRD), National Point Count Database, National Biological Information Infrastructure, and MAPS;

(4) Working in conjunction with each other and other Federal and State agencies to develop reasonable and effective conservation measures for actions that affect migratory birds and their natural habitats;

(5) Participating in or promoting the implementation of existing regional or national inventory and monitoring programs such as Breeding Bird Survey (BBS), BBIRD, Christmas Bird Counts, bird atlas projects, or game bird surveys (e.g., mid-winter waterfowl surveys) on DoD lands where practicable and feasible.

(6) Using existing partnerships and exploring opportunities for expanding and creating new partnerships to facilitate combined funding for inventory, monitoring, management studies, and research.

e. Provide training opportunities to DoD natural resources personnel on migratory bird issues, to include bird population and habitat inventorying,

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monitoring methods, and management practices that avert detrimental effects and promote beneficial approaches to migratory bird conservation.

f. Participate in the Interagency Council for the Conservation of Migratory Birds to evaluate implementation of this MOU.

g. Promote migratory bird conservation internationally, as it relates to wintering, breeding and migration habitats of birds that breed on DoD lands.

h. Promote and undertake ecologically sound actions to curb the introduction in the wild of exotic or invasive species harmful to migratory birds.

2. **The Department of Defense Shall:**

a. Follow all migratory bird permitting requirements for non-military readiness activities that are subject to 50 CFR Parts 21.22 (banding or marking), 21.23 (scientific collecting), 21.26 (special Canada goose permit), 21.27 (special purposes), or 21.41 (depredation). No permit is required to take birds in accordance with Parts 21.43 - 21.47 (depredation orders).

b. Encourage incorporation of comprehensive migratory bird management objectives in the preparation of DoD planning documents, including Integrated Natural Resource Management Plans, Pest Management Plans, Installation Master Plans, NEPA analyses, and non-military readiness elements of Bird Aircraft Strike Hazard documents. Comprehensive planning efforts for migratory birds include PIF Bird Conservation Plans, the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan and associated regional plans where available.

c. Incorporate conservation measures addressed in Regional or State Bird Conservation Plans in INRMPs.

d. Consistent with imperatives of safety and security, allow the FWS and other partners reasonable access to military lands for conducting sampling or survey programs such as MAPS, BBS, BBIRD, International Shorebird Survey, and breeding bird atlases.

e. Prior to starting any activity that is likely to affect populations of migratory birds:

(1) Identify the migratory bird species likely to occur in the area of the proposed action and determine if any species of concern could be affected by the activity;

(2) Assess and document, through the project planning process, using NEPA when applicable, the effect of the proposed action on species of concern. Use best available demographic, population, or habitat

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association data in the assessment of effects upon species of concern;

(3) Engage in early planning and scoping with the FWS relative to potential impacts of a proposed action, to proactively address migratory bird conservation, and to initiate appropriate actions to avoid or minimize the take of migratory birds.

f. Manage military lands and activities other than military readiness in a manner that supports migratory bird conservation, giving consideration to the following factors:

(1) Habitat protection, restoration, and enhancement. Military lands contain many important habitats for migratory birds. Some unique, sensitive, endangered and/or declining habitat types that may require special management attention include:

(a) Grasslands. Many native grassland communities require intensive management to maintain and restore vigor and species diversity and to provide habitat for migratory birds and other wildlife dependent on native grasslands. Grassland management and restoration tools include controlled burning, mowing, grazing, native species planting, and exotic plant removal. Many grasslands have evolved with a natural fire regime, and the management activities often emulate this fire regime.

(b) Riparian and wetland habitats. Military lands contain riparian and wetland habitats that may be critical for migratory birds. DoD will strive to prevent the destruction or degradation of wetlands and riparian vegetation, and also restore those habitats, when feasible, where they have been degraded.

(c) Coastal beach, salt marsh, and dune habitats. Military lands support some of the best remaining undisturbed coastal habitats. DoD will strive to protect, restore and prevent the destruction of coastal and island habitats that are important to breeding, migrating and wintering shorebirds, salt marsh land birds and colonial water birds.

(d) Longleaf pine ecosystem. Some of the best remaining examples of the longleaf pine ecosystem occur on military lands. Such habitats benefit from prescribed fire and other management measures which DoD regularly implements on thousands of acres in the Southeast. The DoD manages and will continue to manage this ecosystem to benefit and promote migratory bird conservation.

(2) Fire and fuels management practices. Fire plays an important role in shaping plant and animal communities and is a valuable tool in restoring habitats altered by decades of fire suppression. Fire management may include fire suppression, but also involves fire

prevention and fuels treatment, including prescribed burning and monitoring, to protect communities and provide for healthy ecosystems. Fire management planning efforts will consider the effects of fire management strategies on the conservation of migratory bird populations.

(3) Invasive Species and Aquatic Nuisance Species management practices. Invasive Species and Aquatic Nuisance Species are a threat to native habitats and wildlife species throughout the United States, including military lands. Efforts to control/contain these species must take into account both the impacts from invasive species and the effects of the control efforts on migratory bird populations. Invasive Species and Aquatic Nuisance Species that can threaten migratory birds and their habitats include, but are not limited to, exotic grasses, trees and weeds, terrestrial and aquatic insects and organisms, non-native birds, and stray and feral cats.

(4) Communications towers, utilities and energy development. Increased communications demands, changes in technology and the development of alternative energy sources result in impacts on migratory birds. DoD will review wind turbine and powerline guidelines published by FWS and the Avian Power Line Interaction Committee, respectively, and consult with FWS as needed, in considering potential effects on migratory birds of proposals for locating communications towers, powerlines or wind turbines on military lands. Construction of new utility and energy systems and associated infrastructure should be designed to avoid and minimize impacts on migratory bird populations. Existing utilities may also be considered for retrofitting to reduce impacts.

(5) Recreation and public use. The demand for outdoor recreational opportunities on public lands is increasing. Impacts on migratory birds may occur both through direct and indirect disturbances by visitors and through agency activities associated with providing recreational opportunities to visitors and installation personnel and morale facilities (e.g., facilities construction). DoD provides access to military lands for recreation and other public use, such as Watchable Wildlife and bird watching, where such access does not compromise security and safety concerns or impact migratory birds, other species, or their habitats.

Many conservation measures have been developed to benefit a variety of migratory bird species and their associated habitats. Some of these conservation measures may be directly applicable to DoD activities other than military readiness related activities; however, the appropriateness and practicality of implementing any specific conservation measure may have to be determined on a case-by-case basis. The FWS will work cooperatively with DoD in providing existing conservation measures and developing new ones as needed. Examples of some conservation measures may be found at http://www.partnersinflight.org/pubs/BMPs.htm for landbird species.

g. Develop and implement new and/or existing inventory and monitoring programs, at appropriate scales, using national standardized protocols, to evaluate the effectiveness of conservation measures to minimize or mitigate take of migratory birds, with emphasis on those actions that have the potential to significantly impact species of concern.

h. Advise the public of the availability of this MOU through a notice published in the Federal Register.

i. In accordance with DoD INRMP guidance, promote timely and effective review of INRMPs with respect to migratory bird issues with the FWS and respective state agencies. During the INRMP review process, evaluate and coordinate with FWS on any potential revisions to migratory bird conservation measures taken to avoid or minimize take of migratory birds.

3. **The Fish and Wildlife Service Shall:**

a. Work with DoD by providing recommendations to minimize adverse effects upon migratory birds from DoD actions.

b. Through the Division of Migratory Bird Management, maintain a Web page on permits that provides links to all offices responsible for issuing permits and permit application forms for take of migratory birds.

c. Provide essential background information to the DoD when requested to ensure sound management decisions. This may include migratory bird distributions, status, key habitats, conservation guidelines, and risk factors within each BCR. This includes updating the FWS publication of ***Birds of Conservation Concern*** at regular intervals so it can be reliably referenced.

d. Work to identify special migratory bird habitats (i.e., migration corridors, stop-over habitats, ecological conditions important in nesting habitats) to aid in collaborative planning.

e. Through the Ecological Service Field Offices, provide to DoD, upon request, technical assistance on migratory bird species and their habitats.

f. In accordance with FWS Guidelines for Coordination with DoD and Implementation of the 1997 Sikes Act (2005), work cooperatively with DoD in the development, review and revision of INRMPs.

g. Review and comment on NEPA documents and other planning documents forwarded by military installations.

E. It is Mutually Agreed and Understood That:

1. This MOU will not change or alter requirements associated with the MBTA, Endangered Species Act, NEPA, Sikes Act or other statutes or

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legal authority.

2. The responsibilities established by this MOU may be incorporated into existing DoD actions; however, DoD may not be able to implement some responsibilities identified in the MOU until DoD has successfully included them in formal planning processes. This MOU is intended to be implemented when new actions are initiated as well as during the initiation of new, or revisions to, INRMPs, Pest Management Plans, and activities other than military readiness of addressed within Bird Aircraft Strike Hazard plans. It does not apply to ongoing DoD actions for which a NEPA decision document was finalized prior to, or within 180 days of the date this MOU is signed.

3. This MOU in no way restricts either Party from participating in similar activities with other public or private agencies, governments, organizations, or individuals.

4. An elevation process to resolve any dispute between the Parties regarding a particular practice or activity is in place and consists of first attempting to resolve the dispute with the DoD military installation and the responsible Ecological Services Field Office. If there is no resolution at this level, either Party may elevate the issue to the appropriate officials at the applicable Military Service's Chain of Command and FWS Regional Offices. In the event that there is no resolution by these offices, the dispute may be elevated by either Party to the headquarters office of each agency.

5. This MOU is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement, contribution of funds, or transfer of anything of value between the Parties will be handled in accordance with applicable laws, regulations, and procedures, including those for government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Parties and shall be independently authorized by appropriate statutory authority.

6. The Parties shall schedule periodic meetings to review progress and identify opportunities for advancing the principles of this MOU.

7. This MOU is intended to improve the internal management of the executive branch and does not create any right or benefit, substantive or procedural, separately enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

8. Modifications to the scope of this MOU shall be made by mutual consent of the Parties, through issuance of a written modification, signed and dated by both Parties, prior to any changes.

9. Either Party may terminate this instrument, in whole or in part, at any time before the date of expiration by providing the other Party with a written

statement to that effect.

The principal contacts for this instrument are as follows:

Brian Millsap, Chief Division of Migratory Bird Management US Fish and Wildlife Service 4401 N. Fairfax Drive MS4107 Arlington, VA 22203	L. Peter Boice, Conservation Team Leader Office of the Secretary of Defense 1225 S. Clark St. Suite 1500 Arlington, VA 22202-4336

This MOU is executed as of the last date signed below and expires no later than five (5) years thereafter, at which time it is subject to review and renewal, or expiration.

F. Definitions

Action – a program, activity, project, official policy, rule, regulation or formal plan directly carried out by DoD, but not a military readiness activity.

Breeding Biology Research and Monitoring Database (BBIRD) - national, cooperative program that uses standardized field methodologies for studies of nesting success and habitat requirements of breeding birds (http://pica.wru.umt.edu/BBIRD/).

Breeding Bird Survey (BBS) – a standardized international survey that provides information on population trends of breeding birds, through volunteer observations located along randomly selected roadside routes in the United States, Canada and Mexico (http://www.mbr-pwrc.usgs.gov/bbs/bbs.html).

Bird Conservation Region – a geographic unit used to facilitate bird conservation actions under the North American Bird Conservation Initiative (http://www.manomet.org/USSCP/bcrmaps.html).

Birds of Conservation Concern – published by the FWS Division of Migratory Bird Management, refers to the list of migratory and non-migratory birds of the United States and its territories that are of conservation concern. The current version of the list Birds of Conservation Concern 2002 is available at (http://migratorybirds.fws.gov/reports/bcc2002.pdf).

Comprehensive Planning Efforts for Migratory Birds – includes Partners in Flight, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Western Hemisphere Shorebird Reserve Network, North American Waterbird Conservation Plan, and other planning efforts integrated through the North American Bird Conservation Initiative.

Conservation Measure – an action undertaken to improve the conservation status of one or more species of migratory birds. Examples include surveys and inventories, monitoring, status assessments, land acquisition or protection, habitat restoration, population manipulation, research, and outreach.

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Conservation Planning – strategic and tactical planning of agency activities for the long-term conservation of migratory birds and their habitats.

Council for the Conservation of Migratory Birds – an interagency council established by the Secretary of the Interior to oversee the implementation of Executive Order 13186.

Ecological Condition – the composition, structure, and processes of ecosystems over time and space. This includes the diversity of plant and animal communities, the productive capacity of ecological systems and species diversity, ecosystem diversity, disturbance processes, soil productivity, water quality and quantity, and air quality. Often referred to in terms of ecosystem health, which is the degree to which ecological factors and their interactions are reasonably complete and functioning for continued resilience, productivity, and renewal of the ecosystem.

Effect (adverse or beneficial) – "effects" and "impacts," as used in this MOU are synonymous. Effects may be direct, indirect, or cumulative, and refer to effects from management actions or categories of management actions on migratory bird populations, habitats, ecological conditions and/or significant bird conservation sites.

Important Bird Areas (IBAs) – a network of sites that provide essential habitat for the long-term conservation of birds. In the United States, the IBA network is administered by the American Bird Conservancy and the National Audubon Society. (http://www.audubon.org/nird/iba/)

Integrated Natural Resources Management Plan (INRMP) – an integrated plan based, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management, outdoor recreation) to military mission requirements and other land use activities affecting an installation's natural resources. INRMPs are required for all DoD installations with significant natural resources, pursuant to the Sikes Act Improvement Act.

International Shorebird Survey – a monitoring program started in 1974 to survey shorebirds (sandpipers, plovers, etc.) across the Western Hemisphere. (http://www.manomet.org/programs/shorebirds).

Management Action – an activity by a government agency that could cause a positive or negative impact on migratory bird populations or habitats. Conservation measures to mitigate potential negative effects of actions may be required.

Migratory Bird – any bird listed in 50 CFR §10.13, Code of Federal Regulations.

Military Readiness Activity – all training and operations of the Armed Forces that relate to combat, including but not limited to the adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use.

Monitoring Avian Productivity and Survivorship (MAPS) – a program that uses the banding of birds during the breeding season to track the changes and patterns in the number of young produced and the survivorship of adults and young (http://www.birdpop.org/maps.htm).

National Environmental Policy Act (NEPA) – a Federal statute that requires Federal agencies to prepare a detailed analysis of the environmental impacts of a proposed action and alternatives, and to include public involvement in the decision making process for major Federal actions significantly affecting the quality of the human environment 42 U.S.C. §4321, et. seq.

North American Bird Conservation Initiative (NABCI) – an initiative to align the avian conservation community to implement bird conservation through regionally-based, biologically driven, landscape-oriented partnerships across the North American continent. NABCI includes Federal agencies of Canada, Mexico and the United States, as well as most landbird, shorebird, waterbird, and waterfowl conservation initiatives (http://www.nabci-us.org).

North American Waterbird Conservation Plan – a partnership of Federal and State government agencies, non-governmental organizations, and private interests focusing on the conservation of waterbirds, primarily including marshbirds and inland, coastal, and pelagic colonial waterbirds (www.nacwcp.org/pubs/). The vision of the partnership is that the distribution, diversity and abundance of populations and breeding, migratory, and nonbreeding waterbirds are sustained throughout the lands and waters of North America, Central America, and the Caribbean.

North American Waterfowl Management Plan –a partnership of Federal and State agencies, non-governmental organizations, and private interests focusing on the restoration of waterfowl populations through habitat restoration, protection, and enhancement (http://birdhabitat.fws.gov/NAWMP/nawmphp.htm).

Partners in Flight (PIF) – a cooperative partnership program of more than 300 partners including Federal and State government agencies, non-governmental organizations, conservation groups, foundations, universities and industry focusing on the conservation of landbirds. DoD was an original signatory to the PIF Federal Agencies' MOA. (http://www.partnersinflight.org and http://www.dodpif.org).

Species of Concern – refers to those species listed in the periodic report *Birds of Conservation Concern;* priority migratory bird species documented in the comprehensive bird conservation plans (North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans); species or populations of waterfowl identified as high, or moderately high, continental priority in the North American Waterfowl Management Plan; listed threatened and endangered bird species in 50 CFR. 17.11; and MBTA listed game birds below desired population sizes.

Take – as defined in 50 C.F.R. 10.12, to include pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.

U.S. Shorebird Conservation Plan – an effort undertaken by a partnership of Federal and State government agencies, as well as non-governmental and private organizations to ensure that stable and self-sustaining populations of all shorebird species are restored and protected (http://www.fws.gov/shorebird).

The Parties hereto have executed this agreement as of the date shown below.

Director
US Fish and Wildlife Service

H Dale Hall 7/7/06
Signature Date

Assistant Deputy Under Secretary of
Defense (Environment, Safety and
Occupational Health)
US Department of Defense

Alex Albert Beehler 7/31/06
Signature Date

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MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF DEFENSE

AND

BAT CONSERVATION INTERNATIONAL

PREFACE

1. This agreement establishes a policy of cooperation and coordination between the Department of Defense (DoD) and Bat Conservation International (BCI) to identify, document and maintain bat populations and their habitats on DoD installations.

2. The DoD has a long history of commitment to protection of the environment and the natural resources that have been entrusted to its care while at the same time accomplishing its primary mission of national defense.

3. DoD wishes to receive technical assistance in techniques for improving management of bat populations and their habitats, and to gain access to a nationwide network of compatible data and support that can be used to assess the significance of bat populations and habitat found on DoD lands.

4. BCI was formed to promote conservation, education, and research initiatives involving bats and the ecosystems they serve. BCI provides information and service to scientists, land managers, and the public.

5. Both BCI and the DoD have responsibilities and interests in the management of wildlife and their habitats. Both parties agree that wildlife habitats need to be conserved and managed to protect wildlife and to meet the growing public demand for wildlife conservation and related scientific opportunities. Furthermore, BCI and DoD desire to assist each other in conducting inventories, monitoring, and research; initiating actions which will increase the productivity of bats and enhance their habitats; and educating the public about the roles and values of bats in ecosystems on lands managed or used by the DoD.

PURPOSE

The purpose of this MOU is to establish procedures for planning and conducting cooperative efforts by BCI and DoD on DoD lands. It also establishes policies and procedures for BCI to provide technical assistance to DoD to maintain or increase the productivity of bats and their habitats on DoD lands; to keep once-common bat species from being Federally-listed as threatened or endangered; and to work to recover presently listed species of bats and prevent species extinction.

RESPONSIBILITIES

The Department of Defense and Bat Conservation International do mutually agree that:

1. The DoD will, subject to the availability of resources and under the terms of separately funded subagreements to this MOU, undertake such tasks as:

a. Provide leadership for the planning, implementation, and monitoring of work undertaken pursuant to this agreement and supplemental subagreements.

b. Designate a point of contact for coordination of BCI activities at the Service Headquarters, major command, and/or installation, as deemed appropriate by each Service.

c. Provide BCI representatives at the end of each fiscal year with a summary report of project accomplishments executed supplemental to this agreement.

d. Identify and evaluate appropriate proposed bat conservation proposals and existing projects for possible implementation as partnership initiatives with BCI.

e. Coordinate project planning with appropriate Federal and State agencies to ensure that planned projects are consistent with Federal and State management objectives for bats and other Federal and State legal and statutory requirements.

f. Identify a DoD representative to serve as liaison for any proposal field study.

g. Compensate BCI for their assistance, as mutually agreed upon in supplemental subagreements.

h. Communicate the establishment of this MOU to all Military Departments, major commands, and appropriate installations.

2. Bat Conservation International will, subject to the availability of resources and under the terms of separately funded subagreements to this MOU, undertake such tasks as:

a. Provide expertise, as well as labor, materials, and/or funds for the implementation of agreed-upon inventory, monitoring, and habitat improvement projects; education and public awareness efforts; or research efforts; as feasible and in accordance with BCI policy.

b. Designate a point of contact for coordination of DoD initiatives at BCI, as deemed appropriate.

c. Enter into separate subagreements (e.g. specific collection or donation agreements, volunteer agreements, or contracts) with the DoD to accomplish agreed-upon work developed supplemental to this agreement. Such work may include training, consultation, inventories, monitoring, habitat improvement projects, education, or research projects.

d. Refrain from referring to this MOU in commercial advertising in a manner which states or implies that the activities of the BCI are approved or endorsed by the DoD.

e. Submit for review to the DoD prior to release any proposed releases to the public media which reference this MOU or any employee of the DoD.

f. Communicate the establishment of this MOU to appropriate BCI cooperative units.

g. Make training available for DoD personnel in the survey, inventory and monitoring of bats.

3. DoD and BCI will hold an annual meeting to review progress made under this document and to discuss new project proposals within the purposes of this MOU.

4. Each project requiring a payment of funds by BCI to the DoD will be documented and signed by the responsible organizational unit line officer of the DoD and a BCI representative using an appropriate agreement.

5. Special matching fund projects will be documented via cooperative agreements and signed by the responsible DoD official and BCI representatives.

6. The implementation of this MOU and subsequent supplemental subagreements is subject to required funds being available to both parties of the MOU. Nothing in this MOU shall be construed as obligating the DoD to the expenditure of funds.

7. Nothing herein contained shall be construed as limiting or affecting in any way the delegated authority of the Department of Defense.

8. Nothing herein shall impede the parties from using other mechanisms to accomplish the purposes set out above.

DELEGATION

1. Authorized representatives of BCI and the DoD may execute special use authorizations and enter into supplemental subagreements within the scope of this document

2. Any supplemental subagreement negotiated under the authority of this MOU will remain in full force and effect, unless and until modified or terminated by local signatory parties, per the terms of said supplemental subagreements.

MODIFICATION AND TERMINATION

1. This MOU may be modified or amended upon written request of either party and the written concurrence of the other. The MOU may be terminated with 60-day written notice of either party; however, sufficient attempts should be made to modify, rather than to terminate, the MOU.

2. Five years after signature by both parties, this MOU shall be reviewed and considered for renewal. Signatures must be obtained from both parties to fully execute the renewal.

IMPLEMENTATION

This MOU becomes effective when signed by both parties.

Alex Albert Beehler 10/11/06

Assistant Deputy Under Secretary of Defense Date
(Environment, Safety and Occupational Health)

Mark L. Tuttle 10/2/06

Executive Director Date
Bat Conservation International

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Cooperative Agreement
for
Protection and Maintenance of White Sands Pupfish
between
U.S. Army - White Sands Missile Range
U.S. Air Force - Holloman Air Force Base
National Park Service - White Sands National Monument
U.S. Fish and Wildlife Service
New Mexico Department of Game and Fish

1 May 2006

Whereas, the White Sands pupfish is considered a Species of Concern by the U.S. Fish and

Wildlife Service (USFWS), and is listed as a Threatened Species by the New Mexico Department of Game and Fish (NMDGF); and

Whereas, the White Sands pupfish occurs only in the Tularosa Basin, New Mexico, on public lands administered by the U.S. Army - White Sands Missile Range (WSMR), the U.S. Air Force -

Holloman Air Force Base (HAFB), and the National Park Service - White Sands National Monument (WSNM); and

Whereas, NMDGF has the primary responsibility under the New Mexico Wildlife Conservation Act (WCA) as amended, to provide for the protection and perpetuation of this species; and

Whereas, the USFWS has the responsibility to review the status of species and determine the need to provide protection through the Endangered Species Act of 1973 (ESA), as amended; and,

Whereas, WSMR, HAFB and WSNM have the responsibility to carry out their respective military and land management missions with consideration to the mandates of the National Environmental Policy Act of 1969 (NEPA), ESA, and the Sikes Act, as amended; and

Whereas, WSMR and HAFB have the responsibility to manage hunting, fishing, and trapping in accordance with the Engle Act;

Therefore, the signatory parties to this document agree to cooperate in the management, protection, and conservation of present and future populations of White Sands pupfish and their habitats.

I. PURPOSE

This Cooperative Agreement (Agreement) delineates an effective and cooperative working relationship between its signatories in protecting and maintaining viable populations of the White Sands pupfish (*Cyprinodon tularosa* Miller and Echelle) in its habitats on White Sands Missile Range, Holloman Air Force Base, and White Sands National Monument.

II. AUTHORITIES

New Mexico Wildlife Conservation Act [17-2-37 through 17-2-46 NMSA 1978]
National Environmental Policy Act of 1969 [42 U.S.C. 4321 through 4370d]
Endangered Species Act of 1973, as amended [16 U.S.C. 1531 *et seq*.]
The Sikes Act [16 USC 670 *et seq.*]
The Engle Act [10 USC 2671]

III. OPERATIONS

A. DESCRIPTION OF THE AREA AND GENERAL INTENT

White Sands Pupfish is the only fish endemic to the endorheic Tularosa Basin of south-central New Mexico. It occurs in four disjunct locations on WSMR, HAFB, and WSNM: Salt Creek, Mound Spring, Malpais Spring, and Lost River. The extremely limited distribution and geographic range of White Sands pupfish makes it vulnerable to extinction from natural and anthropogenic causes. Consequently, it is of utmost importance for the signatories to work to protect these populations and habitat as follows.

Essential Habitat is aquatic habitat that is occupied by White Sands pupfish on a perennial or intermittent basis. Essential habitat must be protected from adverse anthropogenic disturbances and to ensure survival of the species. All non-emergency vehicular traffic shall be restricted within Essential Habitat with the exception of use of existing improved and unimproved roads. Likewise, all non-emergency activities shall be restricted within Essential Habitats, unless the responsible WMSR, HAFB, or WSNM official is consulted. In the case of emergency activities that may affect habitats of White Sands pupfish, such as chemical spills, debris recovery from military activities, or carrion removal, NMDGF and USFWS shall be notified and conferred with, as appropriate.

Essential Habitat shall consist of the following occupied or potential White Sands pupfish habitats:

Salt Creek, main channel, with ephemeral, intermittent, or perennial flow and perennial springs from Big Salt Lake south of Range Road 6 north to Range Road 8, including a corridor 200 meters (660 feet) wide, extending 100 meters (330 feet) from either side of the center of the main-stream channel and all land within 100 meters (330 feet) of any tributary spring and Big Salt Lake; Mound Spring complex, including the area within 100 meters (330 feet) of the perimeter of the spring ponds;

Malpais Spring and Malpais Salt Marsh, including:

i. The area within 100 meters (330 feet) of the perimeter of the spring pond,

ii. Its outflow stream, including a corridor 200 meters (660 feet) wide, extending 100 meters (330 feet) from either side of the center of the stream channel; and

iii. The associated wetlands and playas that may be perennially or intermittently occupied by pupfish, including all land within 100 meters (330 feet) of the high-water boundary of the wetlands and playas associated with Malpais Spring;

All stream channels of Malone Draw and Lost River on HAFB, WSNM, and WSMR and a corridor 200 meters (660 feet) wide, extending 100 meters (330 feet) from either side of the center of the stream channel.

In addition to the delineations described above, Essential Habitat shall also include any other areas where White Sands pupfish are found or transplanted by mutual agreement of all signatories as well as a 100-meter (330-foot) buffer around said habitat as demonstrated in the previous delineations, with the exception of the experimental ponds on HAFB and any future exceptions mutual agreement with NMDGF, USFWS, and the party or parties seeking such exceptions.

Limited-Use Areas are lands adjacent to existing habitat where activities must be managed to ensure that degradation of Essential Habitat does not occur through direct or indirect effects such as contaminant runoff and excessive soil erosion. All reasonable precautions shall be taken in coordination with USFWS and NMDGF, as appropriate, to avoid or minimize degradation of Essential Habitat due to activities on Limited-Use Areas.

Areas of Concern shall consist of all watersheds within the topographic drainage basin of Salt Creek, Malpais Spring, Malone Draw-Lost River, and Mound Springs complex, as described above (III.A.2.a, c, d and e). Activities in these Areas of Concern will be considered for their cumulative impacts on White Sands pupfish habitats.

B. AGENCY RESPONSIBILITIES

The signatory agencies jointly agree to:

a. Participate on the White Sands Pupfish Conservation Team, composed of knowledgeable personnel representing each of the cooperating agencies which shall:
    i. Review activities, which might affect White Sands pupfish or its habitat.
    ii. Make recommendations and provide advice and information to the concerned agencies regarding conservation of White Sands pupfish.
    iii. Meet at least annually to discuss pertinent concerns regarding White Sands pupfish and its habitat, exclusive of all other activities.

b. Develop and maintain the White Sands Pupfish Conservation and Recovery Plan (Plan), which shall be the guiding document for White Sands pupfish conservation activities.

c. Provide logistical and financial resources necessary to carry out the responsibilities detailed in this Agreement and the Plan. Subject to the availability of funds, agencies will provide:
    i. Personnel and equipment to at least semi-annually monitor habitats and populations of White Sands pupfish, exclusive of all other Agreement activities.
    ii. Exchange of manpower, equipment, and funds to carry out activities pursuant to this Agreement, exclusive of semi-annual monitoring.

d. Develop and disseminate public information on White Sands pupfish.

e. Participate in professional meetings to apprise the scientific community of the status, biology, and ecology of White Sands pupfish.

2. WSMR, subject to the availability of funds, agrees to:

a. Take reasonable and prudent actions in coordination with the other signatories to protect, manage, and conserve White Sands pupfish habitat on WSMR. This includes, but is not limited to, continuing hydrologic monitoring of the Essential Habitats in regard to the characterization of natural events and the cumulative effects from military activities.

b. Restrict all non-emergency activities, including vehicular traffic, except on existing roads within Essential Habitats and Limited-Use Areas, unless the WSMR Natural Resource Manager is consulted. In the case of emergency activities that may affect habitats of White Sands pupfish, such as chemical spills, debris recovery from military activities, or carrion removal, NMDGF and USFWS shall be notified and conferred with, as appropriate.

c. Prohibit the transport and introduction of any live non-native aquatic organisms to WSMR-controlled aquatic habitats north of Highway 70. Furthermore, aquatic habitats within WSMR north of Highway 70 not currently inhabited by White Sands pupfish shall not be considered for establishment of non-native aquatic organisms and non-native terrestrial flora in the Essential and Limited Use habitats without prior conference and agreement with USFWS and NMDGF.

d. Cooperate with the signatory agencies, as appropriate, in the inventory and removal of non-native fauna in the Essential and Limited Use Habitats to prevent potential contamination of habitats or populations of White Sands pupfish.

e. Cooperate with the signatory agencies in White Sands pupfish recovery activities, including but not limited to the following activities:
    i. Preparing and implementing the necessary documents and actions to create White Sands pupfish refugia with special emphasis on the Malpais Spring pupfish population; and

ii. Preparing and implementing the necessary documents and actions to remove existing obstacles that restrict movement of White Sands pupfish within Essential Habitats, including but not limited to, culverts at RR316 on Salt Creek and construction debris.

iii. Preparing and implementing the necessary documents and actions to remove, if appropriate, military testing debris.

f. Coordinate all military activities proposed for implementation within Essential Habitat with the signatory agencies, as appropriate, to avoid or mitigate negative impacts to White Sands pupfish or its habitat and review current project activities for potential impacts. Monitor all military activities within Essential Habitats and Limited-Use Areas on WSMR for potential impacts.

g. Develop and implement incident response programs for accidental chemical spills, impacts from debris due to military activities, vehicle accidents, and coordinate the resolution of any unforeseen perturbation to White Sands pupfish or its habitats with signatory agencies as soon as reasonably possible upon detection or advisement of such event(s).

h. Develop a customer orientation package to provide all WSMR mission customers and their agents with written procedures for ensuring their project activities are carried out in accordance with the Plan.

i. With reasonable advance notice and as military activities and applicable WSMR security policies allow, permit unescorted access to the area designated as Essential Habitat and Limited-Use Areas on WSMR (III.A.2.a, b, c and e; III.A.3), as appropriate, for representatives of the signatory agencies.

j. Provide in-briefing for non-WSMR Conservation Team personnel outlining scheduling, safety, and security principles and practices.

k. With reasonable advance notice and as military activities and current WSMR polices allow, provide the Conservation Team with optics permits and military transportation authorizations (flight orders).

l. Coordinate with NMDGF concerning suspected violations of the WCA.

3. HAFB agrees to:

a. Protect, manage, and enhance habitats of White Sands pupfish within Essential Habitat and Limited Use Areas on HAFB, in coordination with the signatory agencies.

b. Restrict all non-emergency activities, including vehicular traffic, except on existing roads, with the exception of natural and cultural resource management, conservation and research (to include, but not be limited to pupfish monitoring, research and conservation activities), within Essential Habitat, with consultation of HAFB Natural Resource Managers. In the case of emergency activities that may affect habitats of White Sands pupfish, such as chemical spills, debris recovery from military activities, or carrion removal, NMDGF and USFWS shall be notified and conferred with, as appropriate.

c. Prohibit the transport and introduction of any live non-native aquatic organisms to aquatic habitats on HAFB. Furthermore, aquatic habitats within HAFB not currently inhabited by White Sands pupfish shall not be considered for establishment of non-native aquatic organisms without prior conference and consent by USFWS and NMDGF.

d. Cooperate with the signatory agencies in the inventory and removal of specifically identified populations of non-native fauna within HAFB to prevent the potential contamination of habitats or populations of White Sands pupfish.

e. Coordinate all unclassified activities proposed for implementation within Essential Habitat and Limited Use Areas with the signatory agencies to prevent negative impacts to White Sands pupfish or its habitat and review current project activities to ensure that no potential negative impacts to the species or its habitat are impending. Monitor all unclassified activities within Essential Habitat and Limited Use Areas on HAFB to ensure that no negative impacts occur.

f. Evaluate all classified project activities that may affect the White Sands pupfish or its habitat and ensure that no negative impacts to the species or its habitat will occur. Monitor all classified activities within Essential Habitat and Limited Use Areas on HAFB to ensure that no negative impacts occur.

g. Implement, and review and update as necessary, incident response programs for accidental chemical spills, impacts from airborne debris, vehicle accidents, etc. and coordinate the resolution of any unforeseen perturbation to the White Sands pupfish or its habitats with signatory agencies immediately upon detection or advisement of such event(s).

h. Develop a public information program to educate the base community about White Sands pupfish, and affiliated restrictions and procedures in accordance with the Plan.

i. Allow unescorted Conservation Team access to the area designated as Essential Habitat on HAFB.

j. Provide the Conservation Team with optics permits.

k. Coordinate with NMDGF concerning suspected violations of the New Mexico Wildlife Conservation Act.

4. WSNM agrees to:

   a. Protect, manage, and enhance habitats of the White Sands pupfish within Essential Habitat and Limited Use Areas on WSNM, in coordination with the signatory agencies.

   b. Restrict all non-emergency activities, including vehicular traffic, except on existing roads, with the exception of natural and cultural resource management, conservation, and research (to include, but not be limited to pupfish monitoring, research and conservation activities), within Essential Habitat, in consultation with WSNM Natural Resource Managers. In the case of emergency activities that may affect habitats of White Sands pupfish, such as chemical spills, debris recovery from military activities, or carrion removal, NMDGF and USFWS shall be notified and conferred with, as appropriate.

   c. Prohibit the transport of any live non-native aquatic organisms to or in the vicinity of White Sands pupfish habitat. Furthermore, aquatic habitats within WSNM not currently inhabited by White Sands pupfish shall not be considered for establishment of non-native aquatic organisms without prior conference and consent by USFWS and NMDGF.

   d. Cooperate with the signatory agencies in the chemical or mechanical removal of specifically identified populations of non-native fishes within WSNM to prevent the potential contamination of habitats or populations of White Sands pupfish.

   e. Coordinate all activities proposed for implementation within Essential Habitat and Limited Use Areas with the signatory agencies to prevent negative impacts to White Sands pupfish or its habitat and review current project activities to ensure that no potential negative impacts to the species or its habitat are impending. Monitor all activities within Essential Habitat and Limited Use Areas on WSNM to ensure that no negative impacts occur.

   f. Coordinate the resolution of any unforeseen perturbation to the population of White Sands pupfish or its habitat with signatory agencies immediately upon detection or advisement of such event(s).

   g. Allow Conservation Team access to the area designated as Essential Habitat on WSNM.

   h. Coordinate with NMDGF concerning suspected violations of the New Mexico Wildlife Conservation Act.

5. USFWS agrees to:

   a. Participate in protection, management, enhancement, research, and monitoring of habitats and populations of White Sands pupfish.

b. Coordinate with WSMR, HAFB, and WSNM on all activities that may impact habitats or populations of White Sands pupfish.

c. Provide WSMR and HAFB, through the respective sponsor, with written request for unescorted access to uprange areas for each of its Conservation Team personnel. Included in the request will be a listing of personal specifications for each individual. Changes in badged, visiting Conservation Team personnel shall also be implemented by written request and coordinated with WSMR and HAFB representatives.

d. Have USFWS Conservation Team representatives sign hold harmless agreements releasing WSMR and HAFB from liability in case of personal injury while on WSMR or HAFB property.

e. Provide enforcement, at WSMR's, HAFB's, or WSNM's request, of any violations of Federal fish and wildlife statutes (e.g. Lacey Act and Black Bass Act), as appropriate.

6. NMDGF agrees to:

a. Participate in protection, management, enhancement, research, and monitoring of habitats and populations of White Sands pupfish.

b. Coordinate with WSMR, HAFB, and WSNM on all activities that may impact habitats or populations of White Sands pupfish.

c. Coordinate the development and implementation of the White Sands Pupfish Conservation and Recovery Plan with the signatory agencies, in accordance with the WCA.

d. Provide WSMR and HAFB, through the respective sponsor, with written request for unescorted access to up range areas for each of its Conservation Team personnel. Included in the request will be a listing of personal specifications for each individual. Changes in badged, visiting Conservation Team personnel shall also be implemented by written request and coordinated with WSMR and HAFB representatives.

e. Have NMDGF Conservation Team representatives sign hold-harmless agreements releasing WSMR and HAFB from liability in case of personal injury while on WSMR or HAFB property.

f. Provide enforcement of violations of the New Mexico Wildlife Conservation Act, as appropriate.

g. Coordinate and assemble an annual report summarizing the activities of the Conservation Team, White Sands pupfish monitoring program, and other projects concerning the species.

h. Issue State of New Mexico permits to signatories for research or management activities as necessary to support the conservation and recovery of White Sands pupfish.

C. OTHER PROVISIONS

1. Safety, Security, and Scheduling

To engage in Plan activities on WSMR, HAFB, and WSNM, Conservation Team members of the signatory agencies shall abide by the following stipulations:

a. All applicable military and National Park Service rules, policies, and regulations will be observed.

b. When entering WSMR, relevant rules and regulations will be presented to non-WSMR personnel during the in-briefing process. Conservation Team access may be suspended at any time by WSMR for military purposes.

c. Conservation Team personnel will obtain proper permits for entry into HAFB. All field activities will be scheduled with the Natural Resources Manager prior to entry to HAFB and HAFB Security will be notified of monitoring activities (505) 572-7171.

d. Conservation Team personnel will schedule all entries into WSNM with the Superintendent or his representative and will obtain proper permits to conduct work on WSNM.
    i. Schedule requests will be submitted one week prior to proposed entry, or as soon as possible.
    ii. All research and monitoring activities must be conducted under an approved National Park Service collection permit. No research, sampling or collecting will be initiated on WSNM without an approved permit.
    iii. Various portions of WSNM are periodically subject to evacuation in support of WSMR operations. During evacuations, Conservation Team personnel will not be permitted access to effected areas.
    iv. Conservation Team members will not be permitted to stay on WSNM property overnight without prior notification to, and approval from, the Superintendent or his representative.

e. Conservation Team personnel will schedule all entries into WSMR up range areas with the appropriate WSMR offices and activities and the WSMR Conservation Team sponsor.
    i. Schedule badge requests for new Team Personnel and renewal of expired badges at least 4 weeks prior to the proposed date of entry. The WSMR does not guarantee a minimum of 4 weeks, pending required by other WSMR offices beyond the control of the WSMR Team sponsor.

ii. Schedule requests for previously badged Team personnel will be submitted at least one week prior to proposed entry.
iii. Team members will advise the appropriate WSMR offices and activities up to the day before access of any required changes or cancellations. Conservation Team access may be suspended at any time by WSMR for military purposes.

f. For approved daily use of WSMR, Conservation Team personnel shall coordinate with the appropriate WSMR offices and activities and the WSMR Conservation Team sponsor prior to entry into, and upon exit from, WSMR land or airspace to:
   i. Verify entry and ensure that no interference with military operations occurs.
   ii. Provide the precise areas of operations and entry/exit points and times for all field activities.
   iii. Advise when Conservation Team personnel depart WSMR property.

g. The Conservation Team will not be permitted to stay on WSMR property overnight without prior notification to the WSMR Conservation Team sponsor and approval from the appropriate WSMR offices and activities and the Conservation Team sponsor. WSMR up range facilities may be used by field personnel on an "as-needed" basis following coordination through the appropriate WSMR offices and activities and the WSMR Conservation Team sponsor, if available. Reservations and use may be suspended or changed by WSMR for military activity requirements.

h. Although the Conservation Team personnel may be issued WSMR and HAFB optics permits, all photography will pertain only to White Sands pupfish and its habitats. No other photographs will be permitted. All digital photographic media, slides, prints, and negatives must be declassified and cleared through the normal WSMR and HAFB Operations and Security process prior to public dissemination. Further rules and regulations on photography on WSMR and HAFB will be presented to non-WSMR and non-HAFB Conservation Team members during their in-briefing.

i. All military activities on WSMR and HAFB will take precedence over White Sands pupfish investigation activities, both on the ground and in the air, if conflicts arise that cannot be resolved through the scheduling process. Such determinations shall be at the sole discretion of WSMR and HAFB.

2. Progress Reports

Copies of all interim reports and an annual report will be provided to all signatories to this Agreement.

3. Conditions

a. This Agreement takes effect upon signature of the parties to this Agreement, and shall be reviewed at least every five years. Unless terminated as described below (3.b), this Agreement will continue indefinitely.

b. This Agreement may be terminated by any signatory agency upon 30 days of written notice to all signatory parties. Upon termination of this Agreement, the remaining parties are not bound by terms of the Agreement.

c. This instrument is neither a fiscal nor a funds obligation document. Nothing in this Agreement shall obligate any party to obligate or transfer any funds. Any endeavor involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures, including those for applicable Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by appropriate representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive award to any cooperators of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.

d. This Agreement is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by a party against the State of New Mexico or the United States, its agencies, its officers, or any person.

e. This Agreement in no way restricts the signatory parties from participating in similar activities or agreements with other public or private agencies, organizations, and individuals.

f. Any information provided to a Federal agency under this Agreement is subject to the Freedom of Information Act (5 U.S.C. 552) or the New Mexico Inspection of Public Records Act, unless otherwise provided by law or existing court order.

g. NMDGF will participate in the above Agreement to the extent authorized under New Mexico laws, particularly the New Mexico Wildlife Conservation Act. NMDGF will attempt to undertake only those actions within this Agreement that are in compliance within the laws and regulations of the State of New Mexico.

h. The terms of this Agreement are contingent upon sufficient appropriations being available to the signatory agencies for the performance of this Agreement. The signatory agencies’ decision as whether sufficient appropriations are available shall be accepted by all signatory agencies in this Agreement, and shall be final.

Signatory Agencies

5/25/06

Thomas R. Berard, SES
Director, White Sands Missile Range

Date

White Sands Pupfish Cooperative Agreement

8 May 06

Donald E. Gentry, Colonel, U.S. Army
Garrison Commander, White Sands Missile Range

Date

White Sands Pupfish Cooperative Agreement

COL, USAF 29 AUG 2006

FOR DAVID L. GOLDFEIN
Colonel, USAF
Commander, 49th Fighter Wing

Date

5/4/06

Cliff Spencer   Date
Superintendent, White Sands National Monument, National Park Service

Benjamin N. Tuggle 5/9/06

ACTING Benjamin N. Tuggle
Regional Director, Region 2, U.S. Fish and Wildlife Service

Date

Bruce C. Thompson 28 April 2006

Bruce C. Thompson, PhD. Date
Director, New Mexico Department of Game and Fish

MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF DEFENSE AND THE U.S. FISH AND WILDLIFE SERVICE AND THE ASSOCIATION OF FISH AND WILDLIFE AGENCIES FOR A COOPERATIVE INTEGRATED NATURAL RESOURCE MANAGEMENT PROGRAM ON MILITARY INSTALLATIONS

A. PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to further a cooperative relationship between the U.S. Department of Defense (DoD), U.S. Department of the Interior – Fish and Wildlife Service (FWS), and state fish and wildlife agencies (states) acting through the Association of Fish and Wildlife Agencies (AFWA) (hereafter referred to as the Parties) in preparing, reviewing, revising, updating and implementing Integrated Natural Resource Management Plans (INRMPs) for military installations.

B. BACKGROUND

In recognition that military lands have significant natural resources, Congress enacted the Sikes Act in 1960 to address wildlife conservation and public access on military installations. The 1997 amendments to the Sikes Act require the DoD to develop and implement an INRMP for each military installation with significant natural resources. A 2012 amendment to the Sikes Act now authorizes the preparation of INRMPs for state-owned National Guard installations used for training pursuant to chapter 5 of title 32 of the United States Code. DoD must prepare all INRMPs in cooperation with the FWS and states. Each INRMP must reflect the mutual agreement of the Parties concerning conservation, protection, and management of fish, wildlife, plants and their habitats on military lands.

INRMPs provide for the management of natural resources, including fish and wildlife and their habitats. To the maximum extent practicable, they incorporate ecosystem management principles, and describe procedures and projects that manage and maintain the landscapes necessary to sustain military-controlled lands for mission purposes. INRMPs also allow for multipurpose uses of resources, including public access appropriate for those uses, provided such access does not conflict with military land use, security requirements, safety, or ecosystem needs, including the needs of fish and wildlife resources. Effective communications and coordination among the Parties, initiated early in the planning process at national, regional, and the military installation levels, is essential to developing, reviewing, and implementing comprehensive INRMPs. When such partnering involves the participation and coordination of all Parties regarding existing FWS and state natural resources management plans or initiatives, such as threatened and endangered species recovery plans or State Wildlife Action Plans, the mutual agreement of all Parties is achieved more easily. INRMPs provide for the conservation and rehabilitation of natural resources on military lands in ways that help ensure the readiness of the Armed Forces. Thus, a clear understanding of land use objectives for military lands should enable the Parties to have a common understanding of DoD's land management requirements.

This MOU addresses the responsibilities of the Parties to facilitate optimum management of natural resources on military installations. It replaces a DoD-FWS-AFWA MOU for *Cooperative Integrated Natural Resources Management Program on Military Installations* dated January 31, 2006, which expired January 31, 2011.

C. AUTHORITIES

This MOU is established under the authority of the Sikes Act, as amended, 16 U.S.C. 670a-670f, which requires the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations in cooperation with the FWS and states. The DoD's primary mission is national defense. DoD manages approximately 28 million acres of land and waters under the Sikes Act to support sustained military activities while conserving and protecting biological resources.

The FWS manages approximately 150 million acres of the National Wildlife Refuge System, and administers numerous fish and wildlife conservation and management statutes and authorities, including the: Fish and Wildlife Coordination Act, Migratory Bird Treaty Act of 1918, Endangered Species Act, Marine Mammal Protection Act, Bald and Golden Eagle Protection Act, Anadromous Fish Conservation Act, Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, Federal Noxious Weed Act, Alien Species Prevention Enforcement Act of 1992, North American Wetland Conservation Act, and Coastal Barrier Resources Act.

The states in general possess broad trustee and police powers over fish and wildlife within their borders, including – absent a clear expression of Congressional intent to the contrary – fish and wildlife on federal lands within their borders. Where Congress has given federal agencies certain conservation responsibilities, such as for migratory birds or species listed as threatened or endangered under the Endangered Species Act, the states, in most cases, have cooperative management responsibilities.

The Sikes Act (16 U.S.C. 670c-1) allows the Secretary of a military department to enter into cooperative agreements with the states, local governments, Indian tribes, nongovernmental organizations, and individuals to provide for the maintenance and improvement of natural resources, or to benefit natural and historic research, both on and off DoD installations.

The Sikes Act (16 U.S.C. 670a(d)(2) also encourages the Secretary of Defense, to the greatest extent practicable, to enter into agreements to use the services, personnel, equipment, and facilities, with or without reimbursement, of the Secretary of the Interior or states in carrying out the provisions of this section.

The Economy Act (31 U.S.C. 1535 and 1536) allows a federal agency to enter into an agreement with another federal agency for services, when those services can be rendered in a more convenient or cost effective manner by another federal agency.

D. RESPONSIBILITIES

The Parties to this agreement hereby enter into a cooperative program of INRMP development, review, and implementation with mutually agreed-upon fish and wildlife conservation objectives to satisfy Sikes Act goals.

1. **The DoD, the FWS and AFWA (Parties) mutually agree:**

a. To meet at least annually at the headquarters' level to discuss implementation of this MOU. The DoD and FWS will alternate responsibilities for coordinating this annual meeting and any other meetings related to this MOU. Proposed amendments to the MOU should be presented in writing to the parties at least 15 days prior to the annual meeting. The terms of this MOU and any proposed amendments may be reviewed at the annual meeting. The meeting may also review mutual Sikes Act research and technology needs, accomplishments, and other emerging issues.

b. To participate in a Sikes Act Tripartite Core Group consisting of representatives from the Parties. This Core Group will meet at least quarterly, coordinated by the DoD, to discuss and develop projects and guidance to help prepare and implement INRMPs and to discuss Sikes Act issues of national importance.

c. To engage in sound management practices for natural resource protection and management pursuant to this MOU with full consideration for military readiness; native fish and wildlife; threatened, endangered and at-risk species; and the environment.

d. To promote the sustainable multipurpose use of natural resources on military installations – including hunting, fishing, trapping, and non-consumptive uses such as wildlife viewing, boating, and camping – in ways that are consistent with DoD's primary military mission and to the extent reasonably practicable.

e. To develop and implement supplemental Sikes Act MOUs or other agreements, as needed, at the regional and/or state level.

f. To recognize the most current DoD and FWS Sikes Act Guidance as the guidance for communication and cooperation of the Parties represented by this MOU.

g. To post current DoD, FWS, and state Sikes Act guidance documents within 14 days of completion on the following sites:

    i. For DoD: https://www.denix.osd.mil/nr

    ii. For FWS:

    http://www.fws.gov/habitatconservation/sikes_act.html

    iii. For the states: http://www.fishwildlife.org

h. To cooperatively prepare and conduct full reviews of all new INRMPs in a timely manner.

i. To require the DoD Components and appropriate FWS and state offices to conduct a review for operation and effect of each INRMP no less often than every five years, as required by the Sikes Act, and to document these reviews. As a means of facilitating and streamlining this statutory requirement, use the annual progress review of each INRMP as conducted by each DoD Component per DoD policy.

j. To encourage collaboration in annual progress reviews between representatives from each military installation with an INRMP and appropriate representatives from the other Parties.

    i. The Parties shall discuss the performance of each military installation in meeting relevant DoD Natural Resources Focus Area metrics, and potential improvements to INRMP implementation, such as new projects or management practices.

    ii. Meetings may be in person or by another mutually acceptable means.

    iii. The Parties shall discuss methods and projects that the FWS and states can implement that support INRMP goals and objectives.

k. To streamline and expedite the review of INRMP updates or revisions, and to effectively address review for critical habitat exclusions based on the INRMP conservation benefit, when feasible:

    i. DoD and the FWS will develop and implement a streamlined review process within six months of signature of this MOU that will allow for expedited review and approval (new signatures) of updated sections of each INRMP.

    ii. DoD will provide a means of easily identifying all changes to each updated or revised INRMP when forwarding it for review.

    iii. FWS will focus review on those parts of updated INRMPs that reflect changes from the previously reviewed version.

iv. FWS and the appropriate states will review all INRMPs with major revisions (e.g., changes required by mission realignments, the listing of new species or other significant action that has the potential to affect military operations or readiness).

v. DoD, FWS, and the states (acting through AFWA) will continue to seek opportunities to make INRMP review processes more efficient while sustaining and enhancing INRMP conservation effectiveness.

vi. The DoD Components may submit to the USFWS, a priority INRMP list to address those installations seeking critical habitat exclusions to facilitate coordination with USFWS Endangered Species office.

vii. To ensure consistency, the Parties accept the following definitions:

a) Compliant INRMP: An INRMP that has been both approved in writing, and reviewed, within the past five years, as to operation and effect, by authorized officials of DoD, DOI, and each appropriate state fish and wildlife agency.
b) Review for operation and effect: A comprehensive, joint review by the parties to the INRMP, conducted no less often than every five years, to determine whether the plan needs an update or revision to continue to address adequately Sikes Act purposes and requirements.
c) INRMP update: Any change to an INRMP that, if implemented, is not expected to result in consequences materially different from those in the existing INRMP and analyzed in an existing NEPA document. Such changes will not result in a significant environmental impact, and installations are not required to invite the public to review or to comment on the decision to continue implementing the updated INRMP.
d) INRMP revision: Any change to an INRMP that, if implemented, may result in a significant environmental impact, including those not anticipated by the parties to the INRMP when the INRMP was last approved and/or reviewed as to operation and effect. All such revisions require approval by all parties to the INRMP, and will require a new or supplemental NEPA analysis.

l. That none of the Parties to the MOU is relinquishing any authority, responsibility, or duty established by law, regulation, policy, or directive.

m. To designate the officials listed below, or their delegates to participate in the activities pursuant to this MOU.

i. DoD: Deputy Director, Natural Resources Conservation Compliance, ODUSD (I&E) ESOH

ii. FWS: National Sikes Act Coordinator, Fish and Aquatic Conservation

iii. AFWA: Director, Government Affairs

2. DoD agrees to:

a. Communicate the establishment of this MOU to all DoD Components.

b. Take the lead in developing policies and guidance related to INRMP development, updates, revisions, and implementation, and to ensure the involvement, as appropriate, in these processes of the FWS and state fish and wildlife agencies.

c. Ensure distribution of the DoD and FWS Sikes Act Guidance to all appropriate DoD Components.

d. Encourage DoD Components to invite appropriate FWS and state fish and wildlife agency offices to participate in annual INRMP reviews. All such invitations should extended at least 15 business days in advance of the scheduled review to facilitate meaningful participation by all three Parties. Meetings may be in person or by other mutually agreed upon means.

e. Encourage DoD Components to take full advantage of FWS and state fish and wildlife agency natural resources expertise through the use of Economy Act transfers and cooperative agreements. Encourage DoD Components and FWS to explore the use of the Fish and Wildlife Coordination Act for technical assistance, fish stocking, and other conservation projects. Priority should be given to projects that:

i. Sustain the military mission.

ii. Effectively apply ecosystem management principles.

iii. Consider the strategic planning priorities of the FWS and the state fish and wildlife agency.

f. Encourage DoD Components to give priority to INRMP requirements that:

i. Sustain military mission activities while ensuring conservation of natural resources.

ii. Provide adequate staffing with the appropriate expertise for updating, revising, and implementing each INRMP within the scope of DoD Component responsibilities, mission, and funding constraints.

g. Encourage DoD Components to discuss with the FWS and state fish and wildlife agencies all issues of mutual interest related to the protection, conservation, and management of fish and wildlife resources on DoD installations.

h. Subject to mission, safety, security, and ecosystem requirements, provide public access to military installations to facilitate the sustainable multipurpose use of its natural resources.

i. Identify natural resource research needs, and develop research proposals with input from the Parties.

j. Identify opportunities to work with the DoD Components to facilitate:

    i. Cooperative regional and local natural resource conservation partnerships and initiatives with FWS and state fish and wildlife agency offices.

    ii. Natural resources conservation technology transfer and training initiatives between the DoD Components, federal land management agencies, and state fish and wildlife agencies.

k. Provide law enforcement support to protect fish, wildlife, and plant resources on military installations consistent with jurisdiction and authority.

3. FWS agrees to:

a. Communicate the establishment of this MOU to each FWS Regional Office and appropriate field offices in close proximity to military installations.

b. Distribute the DoD and FWS Sikes Act Guidelines to each FWS Regional Office and appropriate field office in close proximity to military installations.

c. Designate regional and field office FWS liaisons to develop partnerships and help DoD implement joint management of ecosystem-based natural resource management programs, and provide a list of those liaisons to the DoD as needed.

d. Provide technical assistance with the appropriate expertise to the DoD in managing its resources within the scope of FWS responsibilities and funding constraints.

e. Encourage field offices to coordinate current and proposed FWS natural resource initiatives and research efforts with those that may relate to DoD installations, and to provide applicable installations with new and relevant information pertaining to distribution and/or research regarding listed and candidate species and species at-risk.

f. Inform DoD Components and affected installations regarding upcoming and reasonably foreseeable proposed listing and critical habitat designations that may potentially affect military installations in a timely manner before publication of such proposals in the Federal Register.

g. Encourage regional and field offices to expedite pending INRMP reviews that may affect foreseeable proposed listing of threatened and endangered species and critical habitat designations.

h. Provide law enforcement support as appropriate to protect fish, wildlife, and plant resources on military installations within the jurisdiction of the FWS.

i. Identify FWS refuges and other potential federal management areas in close proximity to military installations, and, where appropriate, participate in the joint management of ecosystem-based natural resource management projects that support INRMP and other planning goals, objectives, and implementation.

4. AFWA agrees to:

a. Communicate the establishment of this MOU to each state fish and wildlife agency director and appropriate personnel.

b. Distribute the DoD and FWS Sikes Act Guidelines to each state fish and wildlife agency director and appropriate staff.

c. Facilitate and coordinate with the states to encourage them to:

    i. Participate in developing, reviewing, updating, revising, approving and, as appropriate implementing INRMPs in a timely way upon request by military installation personnel.

    ii. Designate state liaisons to help develop partnerships and to help DoD installation staff implement natural resource conservation and management programs.

    iii. Identify state wildlife management areas in close proximity to military installations and, where appropriate, participate in the joint management of ecosystem-based natural resources projects that support INRMP goals, objectives, and implementation.

    iv. Provide technical assistance to DoD installation staff in adaptively managing natural resources within the scope of state responsibilities, funding constraints, and expertise.

    v. Identify state personnel needs to develop, review, update/revise, approve, and implement INRMPs, and facilitate the identification of funding opportunities to address the fulfillment of state priorities.

    vi. Coordinate current and proposed state natural resources research efforts with those that may relate to DoD installations.

    vii. Coordinate with DoD installations to develop new, and implement existing, conservation plans and strategies, including, but not limited to State Wildlife Action Plans; the National Fish, Wildlife and Plants

Climate Adaptation Strategy; goals or initiatives of the North American Bird Conservation Initiative (NABCI) and/or Partners in Amphibian and Reptile Conservation (PARC); and the National Fish Habitat Action Plan.

E. STATEMENT OF NO FINANCIAL OBLIGATION

This MOU does not impose any financial obligation on the part of any signatory.

F. ESTABLISHMENT OF COOPERATIVE AGREEMENTS

The Parties are encouraged to enter into cooperative or interagency agreements to coordinate and implement natural resource management on military installations. If fiscal resources are required, the Parties must develop a separately funded cooperative or interagency agreement. Such cooperative or interagency agreements may also be entered into under the authority of the Sikes Act (16 U.S.C. 670c-l). Interagency agreements may be entered into under the authority of the Economy Act (31 U.S.C. 1535 and 1536). The Parties should also explore opportunities to utilize the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-666c) to facilitate agreements for FWS technical assistance, fish stocking, and other conservation activities. Each funded cooperative or interagency agreement shall include a work plan and a financial plan that identify goals, objectives, and a budget and payment schedule. A cooperative or interagency agreement to accomplish a study or research also will include a study design and methodology in the work plan. It is understood and agreed that any funds allocated via these cooperative or interagency agreements shall be expended in accordance with its terms and in the manner prescribed by the fiscal regulations and/or administrative policies of the party making the funds available.

G. AMENDMENTS

This MOU may be amended at any time by mutual written agreement of the Parties.

H. TERMINATION

Any party to this MOU may remove itself upon sixty (60) days written notice to the other parties.

I. EFFECTIVE DATE AND DURATION

This MOU will be in effect upon date of final signature, and will continue for ten years from date of final signature. The parties will meet six (6) months prior to the expiration of this MOU to discuss potential modifications and renewal terms.

____

Date John Conger
Acting Deputy Under Secretary of Defense
(Installations and Environment)
U.S. Department of Defense

____

Date Dan Ashe
Director
Fish and Wildlife Service
U.S. Department of Interior

____

Date Ron Regan
Executive Director
Association of Fish and Wildlife Agencies

MEMORANDUM OF UNDERSTANDING

between

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

and

U.S. DEPARTMENT OF DEFENSE

Purpose:

This Memorandum of Understanding (MOU) is entered into between the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and the U.S. Department of Defense (DoD). The purpose of the MOU is to:

a. Promote cooperative conservation between NRCS and DoD, and where appropriate, partnerships with other Federal agencies, states, local governments, non-governmental organizations, and private landowners. NRCS and DoD will:

   1. Assist private landowners in retaining productive and viable working lands that help to sustain agricultural productivity and environmental quality while supporting continued economic viability and military preparedness.

   2. Encourage the establishment of buffers adjacent to military installations to preserve, enhance, or protect habitat and working lands; prevent or eliminate restrictions that inhibit military testing and training, and/or limit incompatible development in the vicinity of military installations.

   3. Support the development of various land management practices that meet state water quality objectives.

b. Cooperate in such a manner as to raise the public understanding of the missions of both agencies.

c. Establish a coordination process that fosters cooperation at every level of both agencies.

Background:

a. In order to sustain military testing and training, DoD's Sustainable Ranges Initiative promotes the twin imperatives of military readiness and sound stewardship. The loss of open space near military installations threatens to limit DoD's ability to use its lands for mission-essential testing and training. The Readiness and Environmental Protection Initiative (REPI), enacted by Congress, authorizes the Military Departments to enter into agreements with private conservation organizations or with state and local governments. These agreements allow the ranges and installations to cost-share the long-term protection of land from willing sellers as a way to preserve, enhance, or protect high-value habitat and limit incompatible development around ranges and installations.

b. The Southeast Partnership for Planning and Sustainability (SERPPAS) is a pilot effort to develop an effective working regional partnership between DoD, the Southeast states (Florida, Georgia, North Carolina, South Carolina, and Alabama), and other stakeholders. SERPPAS has agreed to focus on developing tools for more effective regional planning to sustain natural environments and resources critical to military test and training and, specifically, to explore regional opportunities that help to sustain important habitat and access to critical test and training areas. Opportunities exist for NRCS and DoD to cooperate in support of these SERPPAS objectives by identifying relevant complementary programs in each agency that provide appropriate financial and technical assistance for the protection and conservation of high value lands and water resources within mutually agreed-to project boundaries, in a manner complementary to the military's test and training requirements.

c. NRCS has a history of working with private landowners, on a voluntary basis, to promote sound stewardship on private lands. NRCS has established sound stewardship programs by working with other Federal, state and local agencies, private organizations groups, and individuals at the grass-roots level. NRCS grass-roots working relationships and conservation programs can be complementary to the successful implementation of REPI.

d. Under Section 303(d) of the Clean Water Act, states are required to establish maximum point source and non-point source pollutant loadings to impaired waters within their state. Many DoD installations are required to comply with these limits. Opportunities exist with NRCS to establish conservation practices and systems that meet various state water quality objectives.

Scope:

The provisions of this MOU extend to those programs and activities of NRCS and DoD that have the potential to complement mission-specific requirements of both agencies. This MOU is intended to better institutionalize collaboration between both agencies and to identify specific projects or actions that may be implemented consistent with the identified purposes under Section 1. In addition, it is expected that both agencies will continually evaluate current and future actions for possible inclusion under the scope and content of this MOU. Specific projects to be initiated and/or expanded under this MOU include (but are not limited to):

a. Identification and implementation of joint REPI and NRCS conservation programs.
b. NRCS involvement in project specific efforts under SERPPAS.
c. Collaboration between NRCS and DoD on the Texas Conservation Credit Initiative in support of Fort Hood, recovery issues associated with the Golden-cheeked Warbler, and associated habitat and watershed improvements in Central Texas.
d. Development of partnerships, through the Army Compatible Use Buffer program and other Military Department regional conservation efforts, for securing buffer lands that meet the goals and objectives of both NRCS and DoD near and/or adjacent to specific installations, including:
    1. Fort Riley
    2. Fort Sill
    3. Fort Campbell
    4. U.S. Army Garrison Hawaii
    5. Fort Stewart

e. Development of implementation plan for joint collaboration under the Peaks to Prairie initiative in Colorado.
f. Identification of appropriate collaboration with NRCS and DOD conservation partners and the identification of appropriate mechanisms to highlight the mutual benefits of collaborative endeavors.
g. Explore and implement market-based strategies to assist in implementing REPI and NRCS conservation programs, and state water quality trading programs.

Responsibilities:

a. NRCS agrees to:
    1) Advise NRCS state and field offices of the existence of this MOU, and of the opportunity for assisting DoD military installations in the coordination and implementation of REPI.
    2) Provide DoD with technical and program information as it relates to the implementation of REPI and the preservation, protection, restoration, and enhancement of significant land and water resource values in a manner that preserves habitat and land use that will assist to relieve, prevent or eliminate restrictions that inhibit military testing and training, or limits incompatible development in the vicinity of military installations.

b. DoD agrees to:
    1) Advise DoD Components of this MOU and the opportunities for cooperative conservation with NRCS.
    2) Request DoD Components to identify, based on mission needs, appropriate priority areas for cooperative conservation.
    3) Coordinate appropriate budget levels with DoD Components to provide appropriate funding to NRCS on a reimbursable basis.

c. It is mutually agreed that NRCS and DoD will pursue the identification of other partnership and collaboration opportunities that will include:

1) Market-based approaches for the protection, restoration and enhancement of water quality natural resources.
2) Sharing of non-sensitive information such as aerial photography, soil surveys, and other appropriate data.

This MOU is neither a fiscal nor funds obligating document. Any endeavor by either party that involves the reimbursement or contribution of funds, or transfer of anything of value between the parties, will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors shall be outlined in separate agreements, made in writing by representatives of both parties, and shall be independently authorized by appropriate statutory authority. This MOU does not provide such authority.

This MOU shall become effective the date of the last signature and continue in effect for a period of five years or until modified or terminated. This MOU may be modified or amended upon written consent of both parties. This MOU may be terminated with a 30-day written notice from either party.

By: Merlyn Carlson Date: 11/02/2006

Merlyn Carlson
Deputy Under Secretary for
Natural Resources and Environment
U.S. Department of Agriculture

By: Alex A. Beehler Date: 11/02/2006

Alex A. Beehler
Assistant Deputy Under Secretary of Defense
(Environment, Safety and Occupational Health)
U.S. Department of Defense

MEMORANDUM OF UNDERSTANDING
DATED AS OF DECEMBER 3,1990
among the

DEFENDERS OF WILDLIFE
THE IZAAK WALTON LEAGUE OF AMERICA, INC
NATIONAL AUDUBON SOCIETY
NATIONAL WILDLIFE FEDERATION

and

BUREAU OF LAND MANAGEMENT
NATIONAL PARK SERVICE,
U.S. FISH AND WILDLIFE SERVICE
BUREAU OF RECLAMATION
DEPARTMENT OF THE AIR FORCE
DEPARTMENT OF THE ARMY
DEPARTMENT OF THE NAVY
FOREST SERVICE

and

INTERNATIONAL ASSOCIATION OF
FISH AND WILDLIFE AGENCIES

I. BACKGROUND

Various studies have shown that more than half of the American public enjoys observing, studying or photographing wildlife. Appreciative uses of wildlife are important aspects of American outdoor life, enjoyed by families and individuals of all ages and abilities. The President's Commission on Americans Outdoors recommended, in its 1986 Report and Recommendations to the to President, that educators make the environment an integral part of children's basic education. The Commission recommended that Federal natural resource agencies engage in educational activities to bring school children to the resource, where such activities are not harmful to the watchable wildlife resource. Moreover, President Bush's "America the Beautiful" initiative charges Federal land management agencies to restore, protect and enhance the natural resources and outdoor recreation opportunities found on the lands and waters entrusted to their care. This program is also supported by President Bush's concept of a "thousand points of light," as well as a number of other educational and environmental initiatives, such as "Take Pride in America," "Volunteers and Partnerships," and "Excellence in Education."

II. PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to provide a framework for cooperative activities necessary to develop, implement, maintain, and enhance a Watchable Wildlife Program on Federal and State lands, and to assist private landowners. The MOU will also specify the respective roles and responsibilities of the cooperating organizations and agencies. Such a cooperative arrangement has many benefits, including enhanced educational opportunities, increased public participation, and increased availability of resources. This agreement will enhance continuing efforts of public agencies and private individuals to conserve our valuable wildlife heritage.

III. AUTHORITY

This MOU is made and entered into by and among DEFENDERS OF WILDLIFE, The IZAAK WALTON LEAGUE OF AMERICA, INC., NATIONAL AUDUBON SOCIETY, and NATIONAL WILDLIFE FEDERATION, hereinafter referred to as Defenders, IWLA, NAS, and NWF, respectively; and the BUREAU OF LAND MANAGEMENT, BUREAU OF RECLAMATION, DEPARTMENT OF THE AIR FORCE, DEPARTMENT OF THE ARMY, DEPARTMENT OF THE NAVY, FOREST SERVICE, NATIONAL PARK SERVICE, and U.S. FISH AND WILDLIFE SERVICE, hereinafter referred to as BLM, BR, DOAF, DOA, DON, FS, NPS, and FWS, respectively; and the INTERNATIONAL ASSOCIATION OF FISH AND WILDLIFE AGENCIES, hereinafter referred to as IAFWA, under the provisions of the:

1. BLM: Federal Land Policy and Management Act of 1976, 43 U.S.C. _5 1701-1782 (1988); and Act approved Oct. 24, 1984, Pub. L. No. 98-340, 98 Stat. 2718;

2. BR: Water Resources Research Act of 1984, 42 U.S.C. 10302 (1988);

3. FWS: Fish and Wildlife Act of 1956, 16 U.S.C. _ 742f (1 988); Refuge Recreation Act, 16 U.S.C. g 460k-2 (1988), Fish and Wildlife Conservation Act of 1980, 16 U.S.C. __ 2901 et seq (1988); and Fish and Wildlife Coordination Act, 16 U.S.C. _661 (1988);

4. NPS: National Park Service Organic Act of 1916, 16 U.S.C. _1 (1988); _ General Authorities Act of 1970, 84 Stat. 825 (codified as amended at __ 16 U.S.C. __ 1a-1, 1a-2, Ic (1988)); Outdoor Recreation Act of 1963, 16 U.S.C. __ 4601 to 4601-3 (1988), and National Historic Preservation Act of 1980, 16 U.S.C. 9_ 470 to 470w-6 (1988);

5. FS: Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. __528-531 (1988); and Cooperative Funds Act of June 30, 1914, 16 U.S.C. _ 498 (1988);

6. DOA (Civil Works): Flood Control Act of 1944, 16 U.S.C. 760d (1988); and Federal Water Project Recreation Act of 1965, 16 U.S.C. 4601-12 to 4601-21 (1988), and

7. DOA (Installations, Logistics and Environment), DOAF and DON: Sikes Act, as amended, 16 U.S.C. __ 670a-670f (1988).

IV. INTRODUCTION

The participating parties to this agreement have responsibilities or interests in enhancing opportunities for all members of the public, including the physically impaired, to observe native North American wildlife species in natural settings. The parties agree that increased effort should be made to: identify and publicize wildlife viewing opportunities on Federal lands; cooperate in providing facilities; provide interpretation of wildlife biology and management; and ensure access to such sites, where such activities are not harmful to wildlife or other resources. The parties further recognize and agree that a cooperative approach should be followed whenever practical to enhance watchable wildlife programs.

The participating State and Federal agencies have a variety of responsibilities in managing their diverse lands. Among these are the responsibilities to manage important habitats for a myriad of wildlife species within the United States and to ensure the abundance and diversity of wildlife and their habitats. Even though these agencies have different mandates and policies, many opportunities exist on lands managed by the participating agencies to support the concept of the Watchable Wildlife Program.

One of the many conservation objectives of Defenders, NAS, NWF, and IWLA is to help perpetuate populations of wildlife on suitable lands, both public and private, for the enjoyment of the American people. These organizations, therefore, desire to participate with cooperating State and Federal agencies by assisting In the development and implementation of Watchable Wildlife Programs on Federal and State lands.

The IAFWA represents the interests of State wildlife agencies, each of which has responsibility for and interests in promoting Watchable Wildlife opportunities within their respective States. The Association desires to cooperate in this initiative to further ensure a partnership approach with the States to establish a Watchable Wildlife Program.

In summary, it is the mutual belief of the signatories that implementation of the MOU will:

* Provide enhanced opportunities to enjoy wildlife on Federal lands;
* Promote learning about wildlife and its habitat needs;
* Enhance active support of wildlife resource conservation by the American public,
* Enhance Federal and State wildlife management programs; and
* Help protect wildlife habitat and help prevent depletion of any fish and wildlife species.

NOW, THEREFORE, in consideration of the above premises, the parties agree as follows:

V. DEFENDERS, NAS, NWF, and IWLA:

1. Shall designate a national representative from each organization to meet at least annually with representatives of each participating agency and organization to discuss and identify watchable wildlife objectives and activities to meet the purposes of this agreement.

2. May enter into site-specific agreements or other appropriate agreements individually or collectively with the participating agencies to provide assistance or otherwise accomplish the agreed-upon work

that will be developed pursuant to this agreement, including establishment and maintenance of Watchable Wildlife facilities.

VI. The IAFWA:

1. Shall act as liaison for State wildlife agencies in coordination with Federal agencies and conservation organizations concerning Watchable Wildlife activities and programs.

2. Shall designate a national-level representative to facilitate coordination of Watchable Wildlife activities among various State wildlife agencies and meet annually with Federal agencies and conservation organizations to discuss Watchable Wildlife accomplishments to meet the purposes of this agreement.

VII. THE BLM, BR, DOA, DOAF, DON, FS, NPS, and FWS:

1. Shall make available, where appropriate, Federal lands for the furtherance of this program, subject to applicable Federal laws, regulations, policies, and land use and activity plans for the affected area, and subject to approval by an authorized official of the agency administering the area involved.

2. Shall provide leadership for the planning, implementation, and monitoring of work 6dertaken pursuant to this agreement and supplemental to this agreement.

3. Shall designate a representative for each agency and meet annually with representatives of participating agencies and organizations to discuss and seek to reach agreement on program proposals to meet the purposes of this agreement. The responsibility for organizing the meeting will be rotated on an annual basis among the cooperating parties.

4. Shall provide to the cooperating organizations an annual summary of program accomplishments.

5. Shall assume operation and maintenance and other management costs and responsibilities upon establishment of Watchable Wildlife areas located on respective agency lands or may enter into agreements with appropriate organizations for such operation and maintenance.

6. May enter into site-specific agreements or other appropriate agreements, individually or collectively, with other parties to accomplish agreed-upon work that will be developed pursuant to this agreement.

7. Shall coordinate planning for the Watchable Wildlife Program with appropriate State agencies.

8. Shall monitor to the extent practicable the effects of public use of Watchable Wildlife sites. Public use will be modified accordingly to avoid any unacceptable impacts to wildlife or other resources.

VIII. IT IS MUTUALLY AGREED AND UNDERSTOOD BY AMONG THE SAID PARTIES THAT:

1. This national-level agreement provides a policy framework for development of State and local-level agreements with participating organizations and agencies to accomplish specific Watchable Wildlife Program actions for the observation of native North American Wildlife species.

2. Assistance to be provided by Defenders, NAS, NWF and/or IWLA to any of the participating agencies will be set forth in separate written agreements that specify the terms and conditions of such assistance.

These agreements will be signed by the responsible agency official and the authorized organizational representative of the cooperating organization.

3. Assistance provided by the private organization(s) is intended to supplement State and Federal funding or services and this MOU does not, in any way, exclude Federal land management agencies from any requirements or responsibilities for management of Federal lands.

4. Unless otherwise stated, all improvements placed on Federal agency lands as a result of this cooperative initiative shall become the property of the United States and shall be subject to the same regulations and administration of those lands as all other Federal improvements of a similar nature.

5. The binoculars symbol (Wildlife viewing area sign RG-210) will be used to enhance nationwide visual recognition of designated Watchable Wildlife areas.

6. This agreement in no way restricts the cooperating agencies and organizations from participating with other public and private agencies, organizations, and individuals; or from accepting contributions and gifts for the improvement, development, administration, operation, and maintenance of Watchable Wildlife areas; or from developing Watchable Wildlife areas on their own appropriate lands; or from using the binoculars symbol in wildlife viewing areas developed outside the context of this MOU.

7. Nothing in this agreement shall be construed as obligating the United States to expend, contract for, or otherwise commit to the future payment of money.

8. Nothing in this agreement shall be construed as obligating the participating nongovernmental parties to expend funds or provide resources or be involved in any obligation for future payment of money or providing or resources, except wherein provided by separate agreement as per this MOU.

9. The Government's liability shall be governed by the provisions of the Federal Tort Claims Act (28 U.S.C. 2671-80)

10. This agreement may be revised as necessary, by mutual consent of all parties and by the issuance of a written amendment signed and dated by all parties.

11. Any party may terminate participation under this agreement by providing 60 days written notice. Unless terminated by written notice of all parties, this agreement will remain in force for a period of 5 years but may be extended by participating parties.

12. The parties shall not discriminate on the grounds of race, color, creed, sex, or national origin in the selection of participants for any work or program undertaken pursuant to this Agreement.

IX. EFFECTIVE DATE

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the date first written above.

DEPARTMENT OF THE INTERIOR

///signed///	12/3/90
Director	Date

Bureau of Land Management

///signed///	12/3/90
Commissioner	Date
Bureau of Reclamation	

///signed///	12/3/90
Director	Date
National Park Service	

///signed///	12/3/90
Director	Date
U.S. Fish and Wildlife Service	

DEPARTMENT OF AGRICULTURE

///signed///	12/3/90
Chief	Date
Forest Service	

DEPARTMENT OF DEFENSE

///signed///	12/3/90
Acting Assistant Secretary of the Army	Date
(Civil Works)	

///signed///	12/3/90
Assistant Secretary of the Air Force	Date
(Manpower, Reserve Affairs, Installations and Environment)	

///signed///	12/3/90
Assistant Secretary of the Army	Date
(Installation, Logistics, and Environment)	

///signed///	12/3/90
Assistant Secretary of the Navy	Date
(Installations and Environment)	

ORGANIZATIONS

///signed///	12/3/90
President	Date
Defenders of Wildlife	

///signed///	12/3/90

President Date
International Association of Fish and Wildlife Agencies

///signed/// 12/3/90
Executive Director Date
The Izaak Walton League of America, Inc.

///signed/// 12/3/90
President Date
National Audubon Society

///signed/// 12/3/90
President Date
National Wildlife Federation

INTERAGENCY AGREEMENT
BETWEEN
U.S. DEPARTMENT OF INTERIOR
THE BUREAU OF LAND MANAGEMENT
AND THE
UNITED STATES AIR FORCE 49TH FIGHTER WING
HOLLOMAN AIR FORCE BASE

CONCERNING

CENTENNIAL BOMBING RANGE OPERATIONS
AT HOLLOMAN AIR FORCE BASE, NEW MEXICO
ON THE MCGREGOR RANGE

I. PURPOSE

It is the desire of the Bureau of Land Management and the United States Air Force 49th Fighter Wing that this Interagency Agreement (IA) serves as the basis for a cooperative and coordinated effort to maintain and enhance the environment and resources in which they share a joint interest. In particular, this IA focuses on the activities related to the Air Force's Centennial Bombing Range operations at Holloman AFB, New Mexico on the United States Army's McGregor Range, New Mexico. This IA documents the commitments of both agencies to a continued and productive relationship with respect to each agency's authorized activities on McGregor Range and respective management responsibilities. Its purpose is to describe and provide greater focus and detail to those commitments generally described in the Environmental Impact Statement Record of Decision for the Air Force Proposed Expansion of German Air Force Operations at Holloman AFB, New Mexico and subsequently discussed by the agency representatives.

This IA amends the previous Memorandum of Understanding between the Bureau of Land Management and the United States Air Force Air Combat Command dated May 26, 1998 which was developed to address activities related to the initial expansion of the Air Force's German Air Force Operations at Holloman AFB, New Mexico on the United States Army's McGregor Range, New Mexico.

II. AUTHORITIES

Military Lands Withdrawal Act of 1999 (P.L. 106-65),
National Environmental Policy Act (P.L. 91-90, 42 U.S.C. Section 4321 et seq.),
Federal Land Policy and Management Act (P.L. 94-579, 43 U.S.C. Section 1701 et seq.),
Title 10 U.S.C. Sections 2394, 2689, 2483, 2857, 2671, and
Economy Act of 1932, 31 U.S.C. Section 1535

III. PROCEDURES

A. BLM and Public Access: All access to McGregor Range is coordinated through Range Control. Access permitting procedures are outlined in the existing Memorandum of Agreement (MOA) between the U.S. Army at Fort Bliss and the BLM. The Air Force and BLM are resolved to facilitate BLM and public access to multiple use activities. The 49th Fighter Wing agrees to the following:

1 Schedule Centennial Bombing Range Operations to facilitate BLM and public access on weekends from 1:00 pm Friday through Sunday 9:00 pm.
2. The need to conduct high priority missions on the weekends will be coordinated and approved by the BLM.
3. Schedule Centennial Bombing Range Operations to facilitate access 24 hours before and after New Mexico Fish and Game scheduled big game hunts.
4. Provide the BLM with a daily schedule of operations to facilitate scheduling of BLM administrative access.

B. Grazing Program Management: The Air Force and BLM will work together to ensure continuation of an effective grazing program. The 49th Fighter Wing agrees to the following:

1. Coordinate range closings for cleanup/cattle work.
2. Restrict operations as necessary to meet BLM maintenance requirements.
3. Reimburse, replace, repair BLM range improvements damaged as a result of USAF activities on the range.
4. Agree to discuss the possibility of additional technology devices which may be added if necessary to assist BLM with grazing program management.

C. Wildlife: The BLM and the Air Force desire to continue to facilitate an effective wildlife management program. The 49th Fighter Wing will:

1. Be responsible for compliance with Federal and State laws affecting endangered, threatened, candidate or sensitive plants and animals.
2. Continue to cooperate with other federal and state agencies to implement a long-term plan to monitor and survey selected threatened and endangered species as outlined in the multi-agency Memorandum of Understanding dated December 22, 1998.
3. Support BLM management programs for federal candidate, proposed, state-listed, and BLM sensitive species.
4. Where possible and practicable, work cooperatively with other federal and state agencies to facilitate wildlife management activities and address other natural resource issues.

D. Cultural Resources: The BLM and the Air Force are concerned about National Historic and Cultural Preservation. The 49th Fighter Wing will:

1. Comply with Section 106 of the Historic Preservation Act and 36 CFR Section 800 for those undertakings for which the USAF is the proponent.
2. Will be the lead agency for permits required by the Archaeological Resources Protection Act (ARPA) for survey, for research/excavation/data recovery, and for other cultural resources for which the USAF is the proponent.
3. Will mitigate the effects caused to historic resources by USAF activities.
4. Will make available to BLM research proposals, survey reports, mitigation plans and other field project reports for which USAF is the proponent.

E. Areas of Critical Environmental Concern (ACEC): The Air Force and BLM desire to protect the resources within the ACECs. The 49th Fighter Wing will:

1. Allow for scheduled activities consistent with the MOU between New Mexico State University, Fort Bliss, and BLM.
2. Monitor impacts of USAF activities to the ACECs within the safety buffer zone in accordance with the Fort Bliss Integrated Natural Resources Management Plan.

F. Culp Canyon Wilderness Study Area (WSA): The Air Force and BLM are concerned about the natural aesthetic value of the WSA. The 49th Fighter Wing will:

1. Design flight patterns to avoid over flights of the Culp Canyon WSA.
2. Avoid low level (below 2000 feet AGL) over flights of Culp Canyon WSA except in the case of aircraft emergencies.

G. Wildfire: The Air Force and BLM are concerned with the impacts of wildfires caused by military flight operations. The 49th Fighter Wing will:

1. Cease military operations on range to allow for fire suppression.
2. Notify Fort Bliss and BLM of any fire start at the earliest opportunity and will provide lat/long of fire location and current fire behavior.
3. Arrange for air-space use for fire suppression aircraft during a fire emergency.
4. Repair fire damage in accordance with the Fort Bliss Integrated Natural Resource Management Plan.
5. Conduct an annual assessment of fire breaks on Centennial Range together with BLM during the month of October. BLM will notify USAF as to the need to conduct an annual assessment. If it is determined by BLM and USAF that the fire break needs to be burned, the BLM will prepare the appropriate burn plans and determine project cost. BLM will determine the appropriate time for burning and coordinate burning operations with Fort Bliss and the 49th Fighter Wing, providing 2 weeks advanced notice.

H. Payment: The 49th Fighter Wing will be responsible for the cost of annual burn operations and will reimburse the BLM through the IPAC process. BLM contact and billing information are as follows:

BLM Las Cruces District
Fire Management Officer
1800 Margquess
Las Cruces, NM 88005
575-525-4300

ALC: 14-11-0008
DUNS: 614053387

I. Road Maintenance and Up Grades: The Air Force 49th Fighter Wing will:

1. Be responsible for road upgrades and maintenance of the road from State road 506 to the Centennial Bombing Range and all roads within the bombing range.

IV. ADMINISTRATION

A. TERMS OF AGREEMENT

Both parties understand and agree that to the degree that any of the terms of this agreement are inconsistent with the existing Memorandum of Agreement (MOA) between the U.S. Army at Fort Bliss and the BLM, US Fish and Wildlife Service Biological Opinions or any other existing Agency to Agency or Government to Government agreements, the terms of these existing agreements shall prevail and be considered incorporated by reference into this agreement. Further, it is understood that any agreement contained herein applies only to the United States Air Force and its operations under the referenced EIS and that the Air Force is without authority to bind or speak for the United States Army or in any way limit Army operations on McGregor Range.

Additionally, both parties agree that in the event any of the terms of this agreement lead to or would result in a violation of federal law, those terms would be void and not binding on either agency.

B. PERIODIC REVIEW

The participants will review this IA at least once every five years to determine its adequacy, effectiveness, and need for updating.

C. AMENDMENTS

Either participant may propose changes to this IA during its term. Any change will be in the form of an amendment and will not take effect until both participants have agreed and signed the amendment

D. RENEWAL

Renewal of this IA is governed by the guidelines for renewal and continued use of the military withdrawal lands in Section 3016 of Public Law 106-65 and further outlined in the existing Memorandum of Agreement (MOA) between the U.S. Army at Fort Bliss and the BLM.

E. CANCELLATIONS

Cancellation of this IA is governed by the guidelines for cancellations or relinquishments of the military withdrawal lands in Section 3016(d) of Public Law 106-65 and further outlined in the existing Memorandum of Agreement (MOA) between the U.S. Army at Fort Bliss and the BLM.

F. PRINCIPAL CONTACTS

BLM Las Cruces District Manager, 1800 Marquess, Las Cruces, NM 88005, (575) 525-4300

Range Management Office, 700 Delaware Ave., Suite 133, Holloman AFB 88330, (575) 572-5074

G. DISPUTE RESOLUTION

In any and all disputes, the participants in this IA shall exercise good faith and shall endeavor to resolve all problems amicably and quickly. In the event of any unresolved conflicts the next higher agency/headquarters shall attempt resolution. Final resolution rests with the Secretary of Interior and Secretary of the Air Force.

H. RESERVATION OF RIGHTS

This IA does not waive any rights or responsibilities the BLM or Air Force may have except as provided by this IA.

I. BINDING EFFECTS

This IA is binding on BLM and Air Force and their agents, successors and assigns.

J. NONDISCRIMINATION

During the performance of this IA, participants agree to abide by the terms of Executive Order 11246 and will not discriminate against any person because of race, color, religion, sex, or national origin.

K. OFFICIALS

No member or delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement, or to any benefit that may arise there from, but this provision shall not be construed to extend to this IA if made with a corporation for its general benefit.

L. EFFECTIVE DATE

This IA shall take effect on the date when all parties have signed and will continue for a period of 20 years, unless terminated as described in Sections D. and E. of this IA.

APPROVED:

By Linda S.C. Rundell Date 12/2/09

Linda S.C. Rundell, State Director
Bureau of Land Management
New Mexico

APPROVED:

By [signature] Date 1/4/09

Michael P. Stapleton
Colonel, USAF
Commander

Appendix E. Categorical Exclusion for the INRMP

REQUEST FOR ENVIRONMENTAL IMPACT ANALYSIS

Report Control Symbol
RCS: HAFB EPF # 20180310

INSTRUCTIONS: *Section I to be completed by Proponent; Sections II and III to be completed by Environmental Planning Function. Continue on separate sheets as necessary. Reference appropriate item number(s).*

SECTION I - PROPONENT INFORMATION

1. TO *(Environmental Planning Function)*	2. FROM *(Proponent organization and functional address symbol)*	2a. TELEPHONE NO.
49 CES/CEI	49 CES?CEIE	572-3931

3. TITLE OF PROPOSED ACTION
Implement the 2018 Integrated Natural Resources Management Plan (INRMP) for Holloman Air Force Base (HAFB).

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*
The purpose is to guide and manage HAFB agencies' interactions with the environment. The need is to protect and preserve natural resources IAW DODI 4715.03, AFPB 32-70 and Air Force Instruction 32-7064.

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES *(DOPAA) (Provide sufficient details for evaluation of the total action.)*
Implement the 2018 HAFB INRMP, hereby included by reference, to meet national and local intent to care for the environment. The are no feasible alternatives.

6. PROPONENT APPROVAL *(Name and Grade)*	6a. SIGNATURE	6b. DATE
RAMON ACEVEDO-CRUZ, GS-11	Ramon Acevedo Cruz	20180629

SECTION II - PRELIMINARY ENVIRONMENTAL SURVEY *(Check appropriate box and describe potential environmental effects Including cumulative effects.) (+ = positive effect; 0 = no effect; − = adverse effect; U= unknown effect)*

	+	0	−	U
7. AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE *(Noise, accident potential, encroachment, etc.)*	☐	☒	☐	☐
8. AIR QUALITY *(Emissions, attainment status, state implementation plan, etc.)*	☐	☒	☐	☐
9. WATER RESOURCES *(Quality, quantity, source, etc.)*	☒	☐	☐	☐
10. SAFETY AND OCCUPATIONAL HEALTH *(Asbestos/radiation/chemical exposure, explosives safety quantity-distance, bird/wildlife aircraft hazard, etc.)*	☐	☒	☐	☐
11. HAZARDOUS MATERIALS/WASTE *(Use/storage/generation, solid waste, etc.)*	☐	☒	☐	☐
12. BIOLOGICAL RESOURCES *(Wetlands/floodplains, threatened or endangered species, etc.)*	☒	☐	☐	☐
13. CULTURAL RESOURCES *(Native American burial sites, archaeological, historical, etc.)*	☐	☒	☐	☐
14. GEOLOGY AND SOILS *(Topography, minerals, geothermal, Installation Restoration Program, seismicity, etc.)*	☐	☒	☐	☐
15. SOCIOECONOMIC *(Employment/population projections, school and local fiscal impacts, etc.)*	☐	☒	☐	☐
16. OTHER *(Potential impacts not addressed above.)*	☐	☒	☐	☐

SECTION III - ENVIRONMENTAL ANALYSIS DETERMINATION

17. ☒ PROPOSED ACTION QUALIFIES FOR CATEGORICAL EXCLUSION (CATEX) # A2.3.6 ; OR
☐ PROPOSED ACTION DOES NOT QUALIFY FOR A CATEX; FURTHER ENVIRONMENTAL ANALYSIS IS REQUIRED.

18. REMARKS
Preparing and implementing the proposed 2018 HAFB INRMP is exactly described as: "Preparing, revising, or adopting regulations, instructions, directives, or guidance documents that implement -without substantial change- the regulations, instructions, directives, or guidance documents from higher headquarters or other Federal agencies with superior subject matter jurisdiction.", and thus IAW 32 CFR 989 Appendix B Subpart A2.3.6. is Categorically Excluded from further emvironmental analysis, and may proceed.

19. ENVIRONMENTAL PLANNING FUNCTION CERTIFICATION *(Name and Grade)*	19a. SIGNATURE	19b. DATE
ANDREW R GOMOLAK, JR, GS-11	AR Gomolak JR	20180629

AF IMT 813, 19990901, V1 THIS FORM CONSOLIDATES AF FORMS 813 AND 814. PREVIOUS EDITIONS OF BOTH FORMS ARE OBSOLETE. PAGE 1 OF 1 PAGE(S)

Appendix F. Biocontrol of Salt cedar using Diorabdha spp. leaf beetles: associated documents

APHIS Animal and Plant Health Inspection Service

Plant Protection & Quarantine

United States Department of Agriculture
Animal and Plant Health Inspection Service
4700 River Road
Riverdale, MD 20737

Permit to Move Live Plant Pests and Noxious Weeds

Intrastate Movement

Regulated by 7 CFR 330

This permit was generated electronically via the ePermits system

PERMITTEE NAME:	Dr. David C Thompson	**PERMIT NUMBER:**	P526P-07-06966
ORGANIZATION:	New Mexico State University	**APPLICATION NUMBER:**	P526-060731-049
ADDRESS:	Box 30003, MSC 3BE Skeen Hall #N220 Las Cruces, NM 88003-8003	**FACILITY NUMBER:**	N/A
MAILING ADDRESS:	Box 30003, MSC 3BE Skeen Hall #N220 Las Cruces, NM 88003-8003	**HAND CARRY:**	Yes
		DATE ISSUED:	11/05/2007
PHONE:	(505) 646-2740		
FAX:	(505) 646-8782	**EXPIRES:**	**11/05/2010**
DESTINATION:	Holloman Air Force Base, 49 CES/CEVN , 550 Tabosa Ave, HAFB, NM 88330-8458		
RELEASE:	Holloman Air Force Base, NM 88330-8458		

Under the conditions specified, this permit authorizes the following:

Article Category: Biocontrol Organisms - Invertebrate Herbivores of Weeds

Regulated Article	Life Stage(s)	Intended Use	Shipment Origins	Originally Collected	Culture Designation
Diorhabda elongata	Any	Release - BiocontrolNM		Originally Collected from Outside North America	Crete/Posidi
Diorhabda elongata	Any	Release - BiocontrolNM		Originally Collected from Outside North America	Fukang/Turpan

Permit Number P526P-07-06966

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Lena C. Soileau Lena Soileau	11/05/2007

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

Page 1 of 2

APHIS Animal and Plant Health Inspection Service

Plant Protection & Quarantine

PERMIT CONDITIONS

This permit is issued to Dr. David Thompson, New Mexico State University, Box 30003, MSC 3BE, Skeen Hall, Number N220, Las Cruces, New Mexico and authorizes the intrastate movement of the biological control organism, Diorhadba elongata (Fukang and Crete strains), from the Quarantine Laboratory at New Mexico State University to release sites on the Holloman Air Force Base in the closed Tularosa Basin.

1. Plant feeding biocontrol agents and natural enemies of plant pests are regulated by USDA under the authority of the Plant Protection Act of 2000. This permit authorizes the interstate movement of organisms listed on the PPQ Form 526 (henceforth referred to as approved organisms) to the designated state for release into the environment.
2. Approved organisms are to be shipped in sturdy escape-proof containers.
3. No seeds or propagative host plant parts are to be included in the shipments of approved organisms.
4. All host material accompanying approved organisms in shipments must be destroyed or sterlized prior to disposal.
5. This permit does not relieve the permittee of the obligation to comply with regulations of other state and Federal agencies.
6. Issuance of this permit constitutes neither a certification nor an endorsement by USDA/APHIS of the quality, efficacy or any other potential product claim related to the commercial value or effectiveness of products derived from issuing this permit.
7. Permittee moving field collected organisms must take all precautions to prevent shipping of unidentified species and diseased or parasitized individuals to prevent the movement of contaminant organisms.
8. Annual report of research results and immediate notification of unexpected events are to be provided to US Fish and Wildlife Service as described in the attached USFWS letter of May 21, 2007 that approves this release.

END OF PERMIT CONDITIONS

Permit Number P526P-07-06966

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Lena C. Soileau Lena Soileau	11/05/2007

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

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Appendix G. Approved Landscape Plants

From Appendix 8. 2018 Holloman AFB Design Compatibility Standards
Revised 28 August 2018

Trees		
Common Name/ Botanical Name	**Description**	**Culture**
Whitethorn acacia, Viscid acacia, Catclaw acacia, Guajillo, Acacia; Acacia constricta, A. neovernicosa, A. greggii, A. berlandieri, Acacia sp.	Small tree to large shrub. Most have small ball-shaped flowers in spring or summer. Select species that are cold hardy.	Cold hardiness: varies Soil Type: Adaptable Light: full sun Water: Moderate to low
Sweet acacia; Acacia farnesiana	Small deciduous tree 15-30' high. Spreading branches, stems armed with paired straight thorns. Yellow ball-like flowers in Spring.	Cold hardiness: to 20 °F Soil Type: Adaptable Light: full sun Water: Moderate to low
Netleaf hackberry; Celtis reticulata	Small- to medium-sized deciduous tree, to 30' tall and similar width.	Cold hardiness: to –10 °F Soil type: well drained Light: partial shade to full sun Water: moderate to low
Blue palo verde, Little leaf palo verde, Texas palo verde; Cercidium floridum, C. microphyllum, C. texanum	Small deciduous tree, to 25' tall and similar spread. Yellow flowers in summer.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: moderate to low
Desert willow; Chilopsis linearis	Deciduous shrub to 25' tall and 15' wide, can be trimmed up to tree shape. Lavender, pink or white flowers, April through September.	Cold hardiness: to 10 °F Soil type: well drained, adaptable Light: full sun Water: moderate to low
Chitalpa; Chitalpa tashkentensis;(Chilopsis X catalpa);	Small- to medium-sized deciduous tree, to 25' tall and 25'wide. White, pink or lavender flowers May to November.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: low to moderate
Arizona cypress; Cupressus arizonica	Large evergreen tree, to 50' with 45' spread. Nice shape with good shade. NOTE: This plant can produce large quantities of pollen during several months, which should be considered prior to selecting for planting.	Cold hardiness: to 0 °F Soil type: well drained, alkaline adaptable Light: full sun Water: moderate to low
Eucalyptus (Forman's); Eucalyptus formanii	Small evergreen tree, 15' to 25' tall, with 10' to 15' spread.	Cold hardiness: to 15 °F Soil type: well drained Light: partial shade to full sun Water: low
New Mexico olive, New Mexico privet; Forestiera neomexicana	Deciduous shrub 6-8' tall and 8' wide. Fast growing and low maintenance once established.	Cold hardiness: to 0 °F Soil type: adaptable Alkaline tolerant Light: partial sun to full sun Water: low
Fragrant ash; Fraxinus cuspidata	Small deciduous tree to 20' High. Slender tree, with dark green leaves. Clusters of fragrant white flowers in spring.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: low
Gregg ash; Fraxinus greggii	Small tree to 25' high, or clump-forming shrub. Olive-green leaves.	Cold hardiness: to 0 °F Soil type: well drained, adaptable Light: full sun to partial shade Water: low
Texas Ash, Arizona Ash; Fraxinus texensis, Fraxinus arizonicus	Deciduous tree, 25' to 40' in height, and 25' to 35' crown.	Cold hardiness: to -20 °F Soil type: well drained Light: full sun Water: low to moderate
Honey locust (non-thorned); Gleditsia triacanthos var. inermis;	Large tree, 40' tall and 40' wide. Attractive shade tree, with fairly open canopy. Round to irregular canopy form. Only use the thornless variety of honey locust.	Cold hardiness: to –20 °F Soil type: well drained, adaptable Fairly salt tolerant Light: full sun Water: low to moderate
Golden ball lead tree; Leucaena retusa	Small- to medium-size tree, 15' to 25' tall and about as wide. Flowers in spring with yellow golden puffball-like flowers. Often has multiple trunks, but can be trimmed to a single main trunk.	Cold hardiness: to 5 °F Soil type: adaptable Light: full sun Water: low to none

Trees		
Common Name/ Botanical Name	**Description**	**Culture**
Arroyo Sweetwood; Myrospermum sousanum	Small- to medium sized tree, 15' to 25' tall, and about as wide. Cream colored flowers in spring.	Cold hardiness: to 9 °F Soil type: adaptable Light: full sun Water: low to moderate
Ironwood; Olneya tesota	Small tree to 25' tall and 25' wide. Showy lavender colored flowers in late spring. For use in a very sheltered location, such as a courtyard, only.	Cold Hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low
Palo verde "Desert Museum"; Parkinsonia aculeataXmicrop	Small tree to 25' tall and 25' wide. Has green bark and yellow flowers. Thornless variety.	Cold Hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low
American pistachio, ;Texas pistache; Pistacia texana	Small, semi-evergreen tree, 25' in height and 25' in width. Green leaves often will have bronze tips.	Cold hardiness: to –10 °F Soil type: well drained, adaptable, salt and alkaline tolerant Light: full sun to partial sun Water: low
Texas ebony, Mexican ebony; Pithecellobium flexicaule, P. mexicanum	Semi-evergreen, small tree to 20' tall and 20' wide. Dark green foliage with yellow to cream colored flowers in summer. Should be planted against south or west facing areas to catch reflected warmth in winter.	Cold hardiness: to 18 °F Soil type: well drained, alkaline adapted Light: full sun Water: moderate to low
Mesquite (various species); Prosopis sp.	Deciduous tree or large shrub. Most have flower spikes spring or summer, fruit pods summer through fall May need to trim lower branches to achieve tree form. Select cold hardy species.	Cold hardiness: varies Soil type: well drained Light: full sun Water: moderate to low
Honey mesquite; Prosopis glandulosa	Deciduous tree or large shrub. Can achieve 25' high and 30' wide, though commonly smaller. Yellow flower spikes April and May, fruit pods summer through fall. May need to trim lower branches to achieve tree form.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Screwbean mesquite; Prosopis pubescens	Deciduous tree or large shrub, to 25' high and 25' spread. Spikes of greenish-white flowers, 1½ to 3-inches long.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: low
Velvet mesquite; Prosopis velutina	Deciduous tree or large shrub to 20' high and 30' wide, though commonly smaller. Yellow flower spikes spring and summer, fruit pods summer through fall. May need to trim lower branches to achieve tree form.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: moderate to low
Common hoptree; Ptelea trifoliata	Deciduous small tree, to 15' tall and 15' wide. Small white flowers.	Cold hardiness: -30 °F Soil type: well drained Light: full sun Water: moderate to low
Bur Oak; Quercus macrocarpa	Large deciduous tree, 40' to 70' in height and 35'to 60' wide. Excellent yard tree.	Cold hardiness: to -30 °F Soil type: well drained Light: full sun to part shade Water: moderate to low
Mexican blue oak; Quercus oblongifolia	Semi-evergreen, small tree or large shrub, to 25' tall and 25' wide. Bluish foliage color.	Cold hardiness: to 0 °F Soil type: well drained, alkaline Light: full sun Water: low
Mexican elder; Sambucus mexicana	Medium, semi-evergreen tree, 15-25' tall with a spreading canopy. Clusters of white or cream colored flowers in summer.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: moderate
Western soapberry; Sapindus drummondii	Deciduous tree, 25-30' high and 20-25' wide. Nice shade and good fall color (golden).	Cold hardiness: to –5 °F Soil type: adaptable Light: full sun Water: low

Trees		
Common Name/ Botanical Name	**Description**	**Culture**
Texas mountain laurel; Sophora secundiflora	Small tree, to 15’ in height and 15’ in width. Has evergreen, dark glossy leaves and showy wisteria-like clusters of fragrant, purple flowers in spring. Should not be planted in housing areas, as the seeds are poisonous if ingested.	Cold hardiness: to 10 °F Soil type: well drained, alkaline adapted Light: full sun to partial shade Water: low
Mexican buckeye; Ungnadia speciosa	Small deciduous tree, 15’ high and 10’ wide. Dark green foliage with golden yellow fall color. Profuse showy rosy-pink flowers in spring.	Cold hardiness: to 10 °F Soil type: adaptable Alkaline tolerant Light: partial sun to partial shade Water: low
Chaste tree; Vitex agnus-castus	Small tree, to 15’ tall and similar spread. Lilac or white flowered varieties available.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: low to moderate

CACTI, ACCENTS, AND OTHER SUCCULENTS		
Common Name/ Botanical Name	**Description**	**Culture**
Lechuguilla; Agave lechuguilla	Clumping succulent rosette, to 18” tall and 2’ wide. Mature plants (many years old) will send up a flowering stalk, to 14’ tall, with yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the ‘parent’ plant.	Cold hardiness: to 0 °F Soil type: well drained Light: partial sun to full sun Water: none to low
New Mexico agave, Parry agave; Agave neomexicana; Agave parryi	Clumping succulent rosette, to 2 ½” tall and 3’ wide. Mature plants (more than 20 years old) will send up a flowering stalk, to 15’ tall, with orange or yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the ‘parent’ plant.	Cold hardiness: to -20 °F Soil type: well drained Light: full sun Water: none to low
Agave (many available); Agave sp.	Clumping succulent rosettes. Mature plants (many years old) will send up a flowering stalk, most over 10’ tall, with yellow flowers. Central (flowering) plant will die-back at that point, but young offsets (pups) will have sprouted at the base of the ‘parent’ plant.	Cold hardiness: to 0 °F Soil type: well drained Light: partial sun to full sun Water: none to low
Jelly Palm; Butia capitata	Feather palm, to 15’ tall.	Cold hardiness: to 10 °F Soil type: well drained, sandy Light: partial shade to full sun Water: moderate
Sotol; Dasylirion wheeleri, Dasylirion sp.	A member of the Agave family. Leaves to 4’ tall and 5’ wide. A central flower stalk is put up every year.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: low
Cholla; Cylindropuntia sp.	Cacti closely related to prickly pear, growing upright as a shrub 3-8’ tall, with elongated pads. Fuschia flowers in spring and summer, yellow fruit buds in summer. Many varieties and species.	Cold hardiness: to –5 °F Soil type: well drained Light: full sun Water: low
Hedgehog cactus, Rainbow cactus, or Claret-cup cactus; Echinocereus sp.	Low growing, clump forming or single columnar cactus, to 16” tall. Large, showy flowers in many colors in spring.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: low

CACTI, ACCENTS, AND OTHER SUCCULENTS		
Common Name/ Botanical Name	**Description**	**Culture**
Fishhook barrel cactus; Ferocactus wislizeni	Solitary barrel shaped cactus, to 6' tall and 21" diameter, or more. NOTE: Barrel cactus must have documentation proving nursery grown or salvage origin.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: low to none
Ocotillo; Fouquieria splendens	Unusual deciduous shrub, to 20' tall and 15' spread. Bright reddish-orange flowers at tops of stems in spring and early summer.	Cold hardiness: to 0 °F Soil type: well drained, rocky soil preferred Light: full sun Water: low to none
Texas false-agave; Hechtia texensis	Rosette-forming plant, to about 6" tall and 8" wide, eventually developing offsets with clumps to 18" wide. Medium green leaves, turning reddish in fall. Similar in appearance to true agaves.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low
False red yucca, Texas yucca, Coahuilan hesperaloe; Hesperaloe parviflora, H. funifera, Hesperaloe sp.	Resembles true yuccas, with narrow leaves, to 3' tall and 5' wide. Attractive red flowers on a tall stalk. (Yellow cultivars also available.)	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Mammillaria cactus; Mammillaria sp.	Low growing cacti, most less than 1' high. Showy flowers spring or summer. Nice accent plant.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low
Spice lily, Manfreda; Manfreda maculosa	Low growing member of the yucca family, to <6" tall and 1' wide with fleshy leaves. Flower stalk to 2' tall with cream colored flowers.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: Moderate
Beargrass (or sacahuista); Nolina sp.	Grass-like shrub, to 5' tall and Evergreen. Sends up a spike of yellowish flowers late spring.	Cold hardiness: to –5 °F Soil type: well drained Light: full sun Water: low to none
Prickly pear; Opuntia sp.	Cacti with flattened pads, 2-6' tall and 3-15' wide clumps. Showy flowers in many colors, spring and summer. Red to purple fruits summer to fall. Many species are available.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Banana yucca; Yucca baccata	Low growing shrub, stemless rosette to 4'tall and 4' wide.	Cold hardiness: to –5 °F Soil type: well drained Light: full sun Water: low
Soaptree yucca; Yucca elata	Tree like succulent, to 20' and 10' wide. Flowers from May to July.	Cold hardiness: 0 °F Soil type: well drained Light: full sun Water: low
Yucca species; Yucca sp.;	Many species of yucca are suitable for this area. NOTE: Tree forming yuccas must have documentation proving nursery grown or salvage origin.	Cold hardiness: 10 °F Soil type: well drained Light: full sun Water: low

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Catclaw acacia; Acacia greggii	Large, spreading shrub to 30' high. Covered with curved thorns. Creamy yellow clusters of flowers in summer.	Cold hardiness: to 0 °F Soil type: Adaptable Light: full sun Water: low to none

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Bee brush, Oreganillo, Spicebush; Aloysia gratissima, A. wrightii	Deciduous shrub, 5' to 8' in height and 5' to 8' in width. Leaves are very fragrant, with small fragrant white flowers spring through fall.	Cold hardiness: to 15 °F Soil Type: adaptable Light: full sun to partial sun Water: low
Triangle-leaf bur-sage; White bur-sage; Ambrosia deltoidea, A. dumosa	Deciduous shrubs 18" to 2' tall and 2' to 3' wide. Leaves are grey-green or white, with small yellow-green flowers blooming from late winter to spring, and occasionally fall.	Cold hardiness: to 20 °F Soil type: adaptable Light: full sun Water: moderate to low
Desert honeysuckle, Flame Anisacanthus; Anisacanthus thurberi, Anisacanthus sp.	Deciduous shrub, 3-6' high and 4-5' wide. Showy orange. Flowers in summer.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Sand sage; Artemisia filifolia	Evergreen shrub, 3-6' high, 4-6' wide. Leaves are grey-green with a pleasant fragrance.	Cold hardiness: to -10 °F Soil type: well drained Light: full sun Water: moderate to low
Wormwood, Sagebrush, White sage; Artemisia sp	Low growing to moderate size shrubs, 1-4' high. Most have inconspicuous flowers, with green to grey-green foliage.	Cold hardiness: most to –10 °F Soil type: well drained Light: full sun Water: moderate to low
Four-wing saltbush; Atriplex canescens	Evergreen shrub to 6' tall, 4-8'spread. Inconspicuous flowers. Showy seeds through winter.	Cold hardiness: to –10 °F Soil type: adaptable Alkaline and salt tolerant Light: sun to partial shade Water: low
Desert broom; Baccharis sarothroides	Evergreen shrub, 3-9' high. Female shrubs have showy fruits, fall through winter, a nice 'smoky' appearance.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Chihuahuan orchid tree; Bauhinia congesta	Small semi-deciduous tree, or large deciduous shrub, to 8' tall and 12' spread. Showy lavender to white blossoms.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: moderate
Red barberry, Algerita; Berberis haematocarpa; Berberis trifoliolata; (Mahonia haematocarpa, M. trifoliolata)	Evergreen spiny-leaved shrub 3-10' tall. Red fruits ripen in fall, attract birds.	Cold hardiness: to 20 °F Soil type: well drained Light: sun to partial shade Water: low
Woolly butterfly-bush; Buddleja marrubiifolia	Low shrub 3-10' tall. Thick and velvety grey-green leaves. Small orange to yellow flowers.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: moderate to low
Mexican bird-of-paradise; Caesalpinia mexicana	Small to medium sized evergreen shrub, to 10' tall and 6' wide. Yellow flowers, spring through fall. Can be trimmed to keep compact.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun to partial shade Water: low (infrequent deep watering)
Red bird-of-paradise; Caesalpinia pulcherrima	Small- to medium-sized shrub to 6' tall and 6' wide, with many bright red and yellow flowers in summer to fall. Plant will likely freeze in winter, so best to cut back to ground-level in late fall (November).	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: low (infrequent deep watering)
Fairy duster; Calliandra eriophylla	Semi-evergreen shrub, to 3' high and 4' wide. Red to purplish feathery flowers.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Spiny hackberry, Desert hackberry; Celtis pallida	Densely branched evergreen shrub, 4-15' tall. Small, spring flowers, greenish white, attract pollinators and fruits attract birds.	Cold hardiness: to 10 °F Soil type: adaptable Light: full sun Water: moderate to low

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Winterfat; Ceratoides lanata; Krascheninnikovia lanata, Eurotia lanata	Evergreen shrub, to 4' tall and 3' wide. Foliage is greyish-green, with seeds having dense cottony appearance at ends of branches in fall.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun to partial shade Water: low
Fernbush; Chamaebatiaria millefolium	Deciduous shrub, 4' to 6' in height and 5' wide. Olive-green fern-like foliage with showy white blooms in mid-summer.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Desert willow; Chilopsis linearis	Deciduous shrub to 25' tall and 15' wide, can be trimmed up to tree shape. Lavender, pink or white flowers, April through September.	Cold hardiness: to 10 °F Soil type: well drained, adaptable Light: full sun Water: moderate to low
Damianita; Chrysactinia mexicana	Low growing evergreen shrub to 2' tall, 2' spread. Showy yellow flowers.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: low
Rabbitbrush, Chamisa; Chrysothamnus nauseosus; (Ericameria nauseosus)	Low growing evergreen shrub, to 3' tall and 4' wide. Leaves are grey-green with yellow flowers covering entire plant in fall.	Cold hardiness: to –10 °F Soil type: well drained Light: full sun Water: low to none
Texas olive; Cordia boissieri	Deciduous shrub, to 10' tall and 10' wide. Large showy white flowers.	Cold hardiness: to 18 °F Soil type: well drained Light: full sun Water: low
Little leaf cordia; Cordia parvifolia	Deciduous shrub, to 6' tall and 6' wide. Showy white flowers in spring and fall.	Cold hardiness: to 18 °F Soil type: well drained Light: full sun Water: low
Rock cotoneaster; Cotoneaster horizontalis	Low growing evergreen to semi-deciduous shrub, to 2' tall and 15' spread. Light pinkish white flowers followed by red fruits.	Cold hardiness: to -10 °F Soil type: well drained Light: full sun Water: low
Cliffrose; Cowania mexicana, Purshia stansburiana	Large shrub, to 8' tall and 6' wide. Fragrant yellow blooms during summer. Feathery plumes form after flowering and persist into winter. Tolerant of reflected light and heat.	Cold hardiness: to -10 °F Soil type: well drained Light: full sun Water: low
Feather indigo bush; Dalea formosa	Low growing, semi-evergreen shrub, 3' high and 3' wide. Small violet flowers with yellow throats, Mar through Sept.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Black dalea; Dalea frutescens	Mostly deciduous shrub, 3' tall and 4' wide. Brilliant rose-purple flowers late summer to fall. Attracts butterflies.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Indigo Bush; Dalea pulchra	Evergreen shrub, to 5' tall and 5' wide. Clusters of purple, pea-shaped flowers in spring.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Indigobush; Dalea versicolor	Perennial, mostly evergreen shrub, to 3' tall and 4' wide. Purple flowers in spring.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low to moderate
Dicliptera, Hummingbird plant; Dicliptera resupinata; (Justicia resupinata)	Perennial subshrub, to 2' tall and 4' wide. Shade-loving, with lavender colored flowers all summer.	Cold hardiness: to 20 °F Soil type: well drained Light: full shade to partial shade Water: moderate
Florida hopbush; Dodonaea viscosa	Erect evergreen shrub to 10' tall and 6' wide. Leaves are bright green, with ornamental winged fruits in late summer.	Cold hardiness: to 15 °F Soil type: adaptable Light: full sun to partial shade Water: low

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Joint-fir, Mormon tea; Ephedra sp.	Medium-size, evergreen shrubs, usually from 3' to 5' tall and similar width.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: low
Turpentine bush; Ericameria laricifolia	Low growing evergreen shrub, to 2' tall and 3' wide. Covered in yellow flowers in fall.	Cold hardiness: to 5 °F Soil Type: well drained Light: full sun Water: low to none
Apache plume; Fallugia paradoxa	Clump forming shrub to 8' tall. White flowers in spring and summer, with showy plumes following flowers through fall. Leaves turn yellow in fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Cliff fendler-bush; Fendlera rupicola	Deciduous to semi-evergreen shrub to 6' tall. Showy white flowers.	Cold hardiness: to –10 °F Soil type: well drained Light: sun to partial shade Water: moderate
Tarbush; Flourensia cernua	Densely branched, evergreen shrub, to 3' tall and 3' wide. Flowers from September through December. Stems often appear blackish.	Cold hardiness: to 10 °F Soil type: adaptable Light: full sun Water: low
New Mexico olive, New Mexico privet; Forestiera neomexicana	Deciduous shrub 6-8' tall and 8' wide. Fast growing and low maintenance once established.	Cold hardiness: to 0 °F Soil type: adaptable Alkaline tolerant Light: partial sun to full sun Water: low
California buckthorn, Beech-leaf buckthorn, Sawleaf buckthorn; Frangula (Rhamnus) californica, Frangula (Rhamnus) betulifolia, ;Rhamnus serrata	Evergreen shrubs, to 10' tall and similar spread. Clusters of small greenish-white flowers late spring and early summer.	Cold hardiness: to 15 °F Soil type: adaptable Light: partial sun to full sun Water: moderate to low
Mexican silktassel, wright silktassel; Garrya ovata, G. wrightii;	Evergreen shrub, 5-11' tall and 6' wide. Dark green leathery leaves. Showy catkins on male and female plants. Mature plants can be dense and wide.	Cold hardiness: to 10 °F Soil type: well drained Light: sun to partial shade Water: moderate
Soapbush, Guayacan, Texas lignumvitae; Guaiacum angustifolium, G. coulteri	Evergreen shrub or small tree, to 15' tall and 10' wide. Branches tend to have a gnarled appearance. Flowers are blue-purple and fragrant.	Cold hardiness: to 25 °F Soil type: well drained Light: full sun to partial sun Water: low to moderate
Snakeweed; Gutierrezia sarothrae	Semi-evergreen subshrub, to 18" tall and 2' wide. Bright green resinous leaves and clusters of tiny yellow flowers covering the plant June through October.	Cold hardiness: to 0 °F Soil type: adaptable Light: full sun Water: low to none
Rose of Sharon; Hibiscus syriacus	Deciduous shrub, to 10' tall and 6' wide. Showy flowers, available in many colors.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate
Creosote bush; Larrea tridentata	Spindly evergreen shrub, to 8' tall and 6' wide. Small yellow flowers spring through fall. Pleasant scent, especially after rainfall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Chihuahuan sage; Leucophyllum laevigatum	Evergreen shrub, to 6' tall and 5' wide. Covered with ½-1" purple flowers summer through fall. ;	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: low
Texas sage, Texas ranger, silver cloud, green cloud; Leucophyllum sp.	Evergreen shrub, 4-6' tall and 5' wide. Foliage green to grey-green in color. Showy magenta, blue, or purple flowers all summer and fall.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: low
Wolfberry, thornbush; Lycium sp.	Deciduous shrubs, 6' to 10' in height and 5' to 8' wide. Purple to white flowers in spring. Some species densely spinose.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun to partial shade Water: low

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Mariola, Guayule; Parthenium incanum, P. argentatum	Low growing evergreen shrub, to 3' tall and 4' wide. The leaves are grey-green, with small pale-yellow flowers.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun to partial sun Water: low
Desert rosemary mint, Mexican rosemary mint; Poliomintha incana, Poliomintha sp.	Semi-evergreen shrub, to 3' tall and 4' wide. Small, fragrant, purple flowers spikes.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low to moderate
Western Sand Cherry; Prunus besseyi	Deciduous shrub, 3' to 6' in height and equal spread. White flowers in spring followed by edible purple-black fruits.	Cold hardiness: to -20 °F Soil type: well drained Light: part shade to full sun Water: moderate to low
Desert scrub oak; Quercus turbinella	Slow-growing evergreen shrub, to 8' tall and 12' wide. Leaves are leathery grey-green.	Cold hardiness: to 12 °F Soil type: adaptable Light: full sun Water: low to moderate
Littleleaf sumac; Rhus microphylla	Heavily branched shrub, 3-10' tall. Leaves deciduous. Can be grown into a hedge.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low
Sugar bush; Rhus ovata	Large evergreen shrub, to 15' tall and 15' wide. Large white flower clusters in spring. Excellent attractant for birds and butterflies.	Cold hardiness: -10 °F Soil type: adaptable Light: full sun Water: moderate
Skunkbush sumac; Rhus trilobata	A deciduous shrub, to 6' tall. Nice fall foliage (red, copper and yellow).	Cold hardiness: to –20 °F Soil type: well drained Light: full sun Water: moderate to low
Autumn amber/Grow low sumac; Rhus trilobata 'Autumn Amber'; R. trilobata 'Grow Low'	Deciduous, low-growing shrub, to 3' tall and 10' wide. Nice fall foliage colors, can be utilized as a shrubby ground cover.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun Water: moderate to low
Evergreen sumac, Chihuahuan leather-leaf sumac; Rhus virens (Rhus choriophylla)	Spreading shrub, 10-12' in height, 15' wide. Leaves turn maroon in winter, then drop right before new leaves grow again.	Cold hardiness: to 10 °F Soil type: well drained Light: partial shade Water: moderate to low
Mexican blue sage; Salvia chamaedryoides	Low growing perennial, to 18" tall and 18" wide. Blue flowers early summer through November.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate
Desert sage; Salvia dorrii var. dorrii	Perennial shrub to 3' tall and 3' wide. Flowers purple, nice contrast with foliage.	Cold hardiness: -10 °F Soil type: well drained Light: full sun Water: moderate to low
Mealy cup sage; Salvia farinacea	Low growing perennial, to 18" tall and 18" wide. Blue flowers early summer to November.	Cold hardiness: to 24 °F Soil type: well drained Light: full sun Water: moderate
Autumn sage; Salvia greggii	Low growing perennial, to 3' tall. Reddish to magenta flowers spring and fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate
Threadleaf groundsel; Senecio flaccidus, S. douglassii	Evergreen perennial subshrub, to 3' tall and 2' wide. Foliage is silvery in color, covered with yellow daisy-like flowers April to October.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Velvet leaf senna, Desert sensitive plant; Senna lindheimeriana, (Cassia lindheimeriana)	Perennial, 3' to 6' in height and 2' to 5' in width. Flowers are yellow-orange and blooms from July to October.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: moderate to low

SHRUBS		
Common Name/ Botanical Name	**Description**	**Culture**
Shrubby senna; Senna wislizeni, (Cassia wislizeni)	Large shrub, 8' tall by 8' wide. Showy yellow flowers in spring.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: moderate to low
Buffaloberry; Shepherdia argentea	Deciduous shrub to 3' tall and 4' wide. Bright red edible berries in fall.	Cold hardiness: to -20 °F Soil type: well drained Light: full sun to part sun Water: low
Jojoba; Simmondsia chinensis	Medium sized evergreen shrub, to 5' tall and 5' wide.	Cold hardiness: to 18 °F Soil type: well drained Light: full sun Water: low
Garrocha, Argentine tecoma; Tecoma garrocha	Large shrub, 10' tall and 6' wide. Semi-deciduous light green leaves with orange, trumpet shaped flowers from summer to fall.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: moderate to low
Yellow trumpet flower; Tecoma stans	Semi-deciduous shrub, to 12' tall and 6' wide. Very showy yellow flowers all season. Also an orange cultivar available.	Cold hardiness: to 10 °F Soil type: well drained Light: sun to partial shade Water: moderate to low
Arizona rosewood, Chisos rosewood, Narrowleaf rosewood; Vauquelinia californica, V. corymbosa	Large evergreen shrub, to 20' tall and 15' wide. Clusters of small, creamy flowers. Attractive foliage.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Slimleaf goldeneye, Skeletonleaf goldeneye; Viguiera stenoloba	Evergreen shrub to 3' tall and 3' spread. Bright green thread-like foliage with yellow daisy-like flowers from spring through fall.	Cold hardiness: to 10 °F Soil type: well drained, adaptable Light: full sun Water: low
Chaste tree; Vitex agnus-castus	Large shrub or small tree, to 15' tall and similar spread. Lilac or white flowered varieties available.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: low to moderate
Lotebush; Ziziphus obtusifolia	Many branched deciduous shrub, to 6' tall and 8' spread. Stems appear greyish with a waxy coating, and the leaves are grey-green. Small black fruits in late fall are food for birds.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low

OTHER FLOWERS		
Common Name/ Botanical Name	**Description**	**Culture**
Moonshine yarrow, western yarrow (many cultivars); Achillea millefolia	Distinctive silver grey foliage on this low growing plant, to 18" to 3' tall and 18" wide. Flowers vary in color from cream to yellow to pink.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun to partial shade Water: moderate
Giant hyssop; Agastache cana	Low growing plant to 2' tall and 2' wide. Rose-pink flower spikes from July through September, with fragrant leaves. Attracts hummingbirds.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun to partial sun Water: moderate to low
Licorice mint hyssop; Agastache rupestris	Low growing plant to 2' tall and 2' wide. Orange flower spikes from July through September, with fragrant threadlike grey-green leaves.	Cold hardiness: to –10 °F Soil type: well drained Light: full sun to partial sun Water: moderate to low
Flattop ageratum, Butterfly mist; Ageratum corymbosum	Low growing perennial, to 18" tall and 4' spread. Blue to lilac flowers that attract butterflies.	Cold hardiness: to 15 °F Soil type: well drained Light: Full sun to partial shade Water: Moderate
Columbine; Aquilegia sp	Attractive fern-like foliage. Showy flowers, many colors available. Grows to 3' tall and 18" wide.	Cold hardiness: to –30 °F Soil type: well drained Light: partial shade Water: moderate to high

OTHER FLOWERS		
Common Name/ Botanical Name	**Description**	**Culture**
Prickly-poppy; Argemone sp.	Short-lived perennial, to 3' tall and 2' wide. Showy white or yellow flowers with crepe paper-like petals. Foliage and stems are covered with yellow stems.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low
Milkweed, Butterfly milkweed; Asclepias sp., A. tuberosa	Perennial, to 2' tall. Clusters of orange, yellow or pink flowers at the top of the plant from spring to fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: moderate to low
Bahia; Bahia absinthifolia	Perennial, to 1' tall and 18" wide. Yellow flowers above silvery foliage. Blooms in spring and fall.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low
Desert marigold; Baileya multiradiata	Short lived perennial, to 12" tall. Bright yellow flowers, spring and summer, with greyish foliage.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low to none
Chocolate flower; Berlandiera lyrata	Attractive perennial, to 20" tall. Yellow flowers with brown centers, scent similar to chocolate.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Sundrops; Calylophus sp.	Perennial wildflower to 18" tall and 18" wide. Profuse bloomer, with yellow flowers spring through summer. Foliage is grey-green. Shear tops of plants off before growing season starts (Feb or Mar).	Cold hardiness: to 10 °F Soil type: well drained, adaptable Light: partial sun to full sun Water: low
Coreopsis, Calliopsis; Coreopsis tinctoria	Upright annual, 2-3' tall. Red and yellow flowers in spring.	Cold hardiness: n/a Soil type: well drained Light: full sun Water: moderate to low
Shrubby dogweed, dogweed; Dyssodia sp.; (Thymophylla sp.)	Herbaceous perennial or subshrub, 6" tall and about 1' wide. Yellow daisy-like flowers from April through October.	Cold hardiness: 10 °F Soil type: adaptable Light: full sun Water: low
Purple coneflower; Echinacea purpurea	Upright perennial, to 3' tall. Purple to white flowers.	Cold hardiness: to –20 °F Soil type: well drained Light: partial shade to full sun Water: moderate
Mexican gold poppy; Eschscholzia mexicana	Low growing perennial or annual. Yellow and cream colored flowers, with grey-green foliage.	Cold hardiness: n/a Soil type: well drained Light: full sun Water: moderate
Blanketflower; Gaillardia sp.	Perennial. Red or orange flower petals with yellow tips, or yellow petals.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun Water: moderate
Gaura; Gaura lindheimeri	Herbaceous perennial, 2' to 4' in height, with 2' to 4' width. White or pink flowers from June through September.	Cold hardiness: to –10 °F Soil type: well drained Light: full sun Water: moderate
Purple verbena, Sand verbena; Glandularia wrightii; Glandularia sp.; Verbena sp.	Low growing perennial. Purple to magenta flowers clusters in summer.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low
Maximillian sunflower; Helianthus maximilianus	Tall plant, to 8' tall, for placement along hedges or edges of yards. Twenty to thirty spikes of 30 or more yellow, daisy-like flowers	Cold hardiness: to –20 °F Soil type: well drained Light: full sun Water: moderate
Angelita daisy; Hymenoxys acaulis	Low growing shrub, to 1' tall. Yellow flowers in summer	Cold hardiness: to 10 °F Soil type: well drained Light: full sun Water: moderate

OTHER FLOWERS		
Common Name/ Botanical Name	**Description**	**Culture**
Perky sue, four-nerve daisy; Hymenoxys argentea, Tetraneuris scaposa	Low growing perennial, to 1' tall. Yellow flowers from April through August.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun to partial shade Water: low
Dotted gayfeather; Liatris punctata	Perennial plant to 2 ½' tall. Rose-purple flowers on a spike summer to fall.	Cold hardiness: to –10 °F Soil type: well drained Light: full sun Water: moderate to low
Blue flax; Linum lewisii	Perennial, to 3' tall. Blue flowers late spring to summer. Trim back each winter.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun to partial shade Water: moderate
Tansy aster; Machaeranthera bigelovii	Low growing plant, 1-3' tall. Bright purple to deep magenta flowers late summer to fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: moderate
Blackfoot daisy; Melampodium leucanthum	Short-lived perennial to 1 ½' tall and 2' wide, mound shape. Has fragrant white flowers, March to November.	Cold hardiness: to 0 °F Soil type: well drained Light: partial shade to full sun Water: moderate to low
Rock rose; Pavonia lasiopetala	Short-lived, deciduous to semi-evergreen, perennial to 3' tall and 3' spread. Rosy pink flower from April to October. Should be cut back annually (to ~4" of base) in late winter (February). Can be allowed to self-seed. Attractive to butterflies.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun to partial shade Water: low to moderate
Beardtongue, Penstemon; Penstemon sp	Perennial plants, 1-3' tall. Many varieties and flower colors available. Most are showy and add good color.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low needs to be heat tolerant.
Wooly paperflower, Paperflower; Psilostrophe tagetina, P. cooperi	Low growing perennial, to 1' tall and 18" spread. Covered with bright yellow flowers March through September.	Cold hardiness: 15 °F Soil type: well drained Light: full sun Water: low
Mexican hat; Ratibida columnaris	Perennial to 2' tall. Brown-orange flower petals with yellow tips late spring to early fall. Cut stems to ground each winter.	Cold hardiness: -30 °F Soil type: well drained Light: full sun Water: moderate to low
Black-eyed susan; Rudbeckia hirta	Biennial or annual plant to 3' tall. Red-orange flower petals with yellow tips summer to fall.	Cold hardiness: to –10 °F Soil type: well drained Light: partial sun Water: moderate
Salvia, Sage; Salvia sp.	Low growing perennial or annual, to varying heights. Most have showy flowers either spring, summer, or fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate
Globe-mallow; Sphaeralcea sp.	Shrubby perennial to 3' tall and 3' wide. Flowers can be shades of orange, red, yellow, or pink.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low
Mt. Lemmon marigold, Copper Canyon daisy; Tagetes lemmonii	Upright perennial shrub, to 3' tall and 4' wide. Golden yellow daisy-like flowers in spring and fall. Very fragrant foliage. Dies back to ground in winter.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate
Dutchman's breeches, Turpentine broom; Thamnosma sp.	Woody perennial to 12" tall and 18" spread. Yellow urn-shaped petals March through May.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low

OTHER FLOWERS		
Common Name/ Botanical Name	**Description**	**Culture**
California trixis, American threefold; Trixis californica	Evergreen subshrub, to 2' tall and 3' wide. Bright green lance-shaped leaves with yellow flowers in spring and fall. Plant can be trimmed to base to rejuvenate in spring or summer, but not fall.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: low to moderate
Goodding verbena; Verbena gooddingii	Fast growing perennial to 2' and 4' wide. Purple blossoms from spring to fall. After flowers fade, cut those stems off to keep from looking straggly.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: moderate
Golden Eye; Viguiera deltoidea	Evergreen shrub to 3' tall and 3' wide. Pale yellow to white flowers with yellow centers.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low
Rain lily; Zephyranthes sp.	Perennial lily, 8" tall and 20" wide. White, pink, peach or yellow flowers that emerge in summer following rainfall.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun to part shade Water: moderate to low
Desert zinnia; Zinnia acerosa	Perennial to 10" tall and 2' wide. White flowers in spring.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: low
Prairie zinnia; Zinnia grandiflora	Perennial to 1' tall. Many bright yellow flowers from late spring to early fall.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun Water: moderate to low

GRASSES		
Common Name/ Botanical Name	**Description**	**Culture**
Sideoats grama; Bouteloua curtipendula	Perennial bunchgrass, to 2' high and 1 ½' wide. Blooms from April to October. Bluish green foliage dries to tan in fall. Rejuvenate by cutting after dried in fall.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: moderate to low
Blue grama; Bouteloua gracilis	Perennial shortgrass, 10-20" high. Forms a light turf grass and is drought tolerant.	Cold hardiness: to –20 °F Soil type: well drained Light: full sun to partial sun Water: low
Buffalo grass; Buchloe dactyloides	A warm-season grass, forming a uniform and attractive turf (sod grass). Grows 8-10" high, but maintains a short appearance. Only cut 2-3 times per year, don't over fertilize. ;	Cold hardiness: to –10 °F Soil type: adaptable Light: full sun Water: low
Plains lovegrass; Eragrostis intermedia	Perennial bunchgrass, to 2' high. Delicate looking seedheads bloom from June to October. Plant has a grey-green to purple-tinged appearance.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
"Regal Mist" muhly; Muhlenbergia capillaris	Perennial bunchgrass to 3' tall and 3' wide. Flowering panicles have a pinkish-red, feathery appearance. Plants should be cut to base in late winter (Jan or early Feb).	Cold hardiness: to 0 °F Soil type: well drained, adaptable Light: full sun Water: low to moderate
Bush muhly; Muhlenbergia porteri	Perennial bunchgrass, to 3' high and 4' wide. Flowers summer to fall.	Cold hardiness: 10 °F Soil type: well drained Light: full sun to partial shade Water: moderate to low
Deer grass; Muhlenbergia rigens	Perennial bunchgrass, to 3' high and 4' wide. Has showy, 1-foot long, flowering spikes from July to October. Cut at ground level to rejuvenate clumps.	Cold hardiness: 10 °F Soil type: well drained Light: full sun Water: moderate to low
Indian ricegrass; Oryzopsis hymenoides	Perennial bunchgrass, 1-2' high and 1' wide. Light-green leaf blades fade to straw color in fall. Nice accent plant.	Cold hardiness: to 10 °F Soil type: well drained Light: full sun to partial shade Water: low

GRASSES		
Common Name/ Botanical Name	**Description**	**Culture**
Little bluestem; Schizachyrium scoparium	Perennial bunchgrass to 2' tall, and less than 1' wide. Leaf blades and dark blue-green, fall flower stems are reddish. In fall entire plant turns rust color.	Cold hardiness: to –15 °F Soil type: well drained Light: full sun Water: moderate to low
Alkali sacaton; Sporobolus airoides	Perennial bunch grass to 3' high and 1 ½' wide. Pale-green leaf blades taper to a long slender tip. Open seedhead panicle from May through October.	Cold hardiness: -10 °F Soil type: heavy, silty or clayey soils are preferred Alkaline tolerant Light: full sun Water: moderate to low
New Mexico feathergrass; Stipa neomexicana	Perennial bunchgrass to 30" tall and 1' wide. Silky awns on seeds are very attractive accents.	Cold hardiness: to –15 °F Soil type: well drained Light: sun to partial shade Water: moderate to low

GROUNDCOVERS		
Common Name/Botanical Name	**Description**	**Culture**
Fringed sage; Artemisia frigida	Low growing groundcover, to 2' high. Leaves are grey-green with a pleasant fragrance.	Cold hardiness: to -20 °F Soil type: well drained Light: full sun Water: moderate
'Centennial' desert broom; Baccharis pilularisXsarothroides	Low growing grey-green shrub, 3' high to 5' wide. Evergreen.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: moderate to low
Winecups; Callirhoe involucrata	Low growing herbaceous perennial, to 2' tall and 2' wide. Flowers are a rich-pinkish red color with a white center. Re-seeds itself and will slowly fill in an area as groundcover.	Cold hardiness: to 10 °F Soil type: adaptable to most soils Light: full sun, can take some reflected light Water: low
Trailing yellow dalea, Trailing indigo bush; Dalea capitata, D. greggii	Low growing shrub, 6" to 1' tall and 3' to 4' wide. Yellow, lemon-scented flowers in late spring and fall.	Cold hardiness: to 5 °F Soil type: well drained Light: full sun Water: low
Creeping juniper; Juniperus horizontalis	Low growing shrub 6" to 12" in height, with a spreading habit. Evergreen.	Cold hardiness: to -20 °F Soil type: well drained Light: full sun Water: low
Drooping lobelia, Loose-flower lobelia; Lobelia laxiflora	Perennial low growing shrub, to 2' tall, spreading by underground runners. Red flowers in spring.	Cold hardiness: to 20 °F Soil type: Well drained Light: full sun Water: low to moderate
Desert four o'clock; Mirabilis multiflora	Low growing herbaceous perennial, to 2' high. Showy, fragrant magenta flowers in summer. Takes on shrub-like appearance. Attracts birds, bees and butterflies.	Cold hardiness: to –10 °F Soil type: adaptable Light: sun to partial shade Water: moderate to low ;
Evening primrose species; Oenothera sp.	Low growing herbaceous perennial, to 1-2' high. Multiple colors of flowers, spring through summer. Attractive to birds, bees and butterflies.	Cold hardiness: to –10 °F Soil type: well drained Light: full sun (some partial shade) Water: moderate
Orange zexmenia, Shortleaf jefea,; San Pedro daisy; Zexmenia sp., Jefea sp., Wedelia sp., Lasianthaea sp.	Low growing shrubby perennial, to 2' high and 3' wide. Yellow to sunflower-like blossoms from spring to fall.	Cold hardiness: to 20 °F Soil type: well drained Light: full sun to partial shade Water: low to moderate

VINES		
Common Name/ Botanical Name	**Description**	**Culture**
Coral vine; Antigonon leptopus	Fast-growing vine, grows to 25' length and 25' width. Leaves are heart-shaped, with pink, red or white flowers midsummer to fall. Can be planted as a fence cover, but not on buildings and other plants.	Cold hardiness: to 20 °F Soil type: adaptable Light: full sun to partial sun Water: moderate to low
Trumpet creeper; Campsis radicans	Vigorous growers, to 30' length and width. Showy red-orange flowers are very attractive to hummingbirds.	Cold hardiness: to -10 °F Soil type: adaptable Light: full sun to shade Water: moderate
Western virgin's bower, old man's beard, Bigelow's leather flower; Clematis ligusticifolia, C. drummondii, C. bigelovii	Native vine, to 20' length and 10' width. White flowers in summer and plumose showy fruits late summer to fall. Can be planted as a fence cover, but not on buildings and other plants.	Cold hardiness: to 0 °F Soil type: well drained Light: full sun Water: low
Purple orchid vine, yellow orchid vine; Mascagnia lilacina, M. macroptera (Callaeum lilacina, C. macroptera)	Vine growing from 6' to 30' length and similar width. Purple flowers or yellow flowers in late spring. Plant as a fence cover, but not on buildings and other plants.	Cold hardiness: to 15 °F Soil type: well drained Light: full sun Water: low to moderate
Little snapdragon vine; Maurandya antirrhiniflora (Maurandella antirrhiniflora)	Delicate vine growing 6' to 10' in length. Small light green leaves with magenta to deep violet snapdragon flowers in summer. Does best when provided a trellis to grow upon.	Cold hardiness: to 20 °F Soil type: well drained, adaptable Light: full sun to partial shade Water: low to moderate
Virginia creeper; Parthenocissus quinquefolia	Large native vine, to 25' in length and 25' in width. Lush green leaves, with fall foliage a deep red color. May need be trimmed regularly. Plant as fence cover, not where it will climb buildings or other plants.	Cold hardiness: to –30 °F Soil type: well drained Light: partial shade to full sun Water: low
American wisteria, Texas wisteria; Wisteria frutescens	Small to medium native vine, 8' to 20' length. Clusters of light purple to violet flowers in spring. May need some regular trimming, plant where it can climb.	Cold hardiness: to -10 °F Soil Type: well drained Light: partial shade to full sun Water: moderate

Appendix H. HAFB Bird Species Inventory

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIF Priority	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season			
													SP	S	F	W
American Avocet (B)	*Recurvirostra americana*										BC2	S4	A	A	A	
American Bittern	*Botaurus lentiginosus*						X				BC1	S3	VGT	VGT	VGT	VGT
American Coot (B)	*Fulica americana*										BC2	S5	A	A	A	C
American Crow	*Corvus brachyrhynchos*											S5	R	R	R	R
American Golden Plover	*Pluvialis dominica*												VGT	VGT	VGT	VGT
American Goldfinch	*Spinus tristis*											S2B/ S5N	VGT	VGT	VGT	VGT
American Kestrel (B)	*Falco sparverius*				X							S5	U	U	U	U
American Pipet	*Anthus rubescens*										BC1	S3B/ S5N	U	O	R	R
American Redstart	*Setophaga ruticilla*												VGT	VGT	VGT	VGT
American Robin	*Turdus migratorius*												R	R	R	
American White Pelican	*Pelecanus erythrorhynchos*												O			
American Wigeon	*Anas americana*												C	O	C	R
Anhinga	*Anhinga*												VGT	VGT	VGT	VGT
Ash-throated Flycatcher	*Myiarchus cinerascens*											S5	U	U		
Baird’s Sparrow	*Ammodramus bairdii*	X	X		X	X	X	X	T		BC1	S1N	VGT	VGT	VGT	VGT
Baird's Sandpiper	*Calidris bairdii*												R	U	U	
Bald Eagle	*Haliaeetus leucocephalus*	X	X	X	X		X	X	T			S1B/ S4N	VGT	VGT	VGT	VGT
Band-tailed Pigeon	*Columba fasciata*										SC2	S3B/ S4N	VGT	VGT	VGT	VGT
Bank Swallow	*Riparia*						X				BC1	S2B/ S5N	R	O	R	
Barn Owl (B)	*Tyto alba*												R	R	R	R
Barn Swallow (B)	*Hirundo rustica*											S5	C	U	C	
Belted Kingfisher (B)	*Megaceryle alcyon*										BC2	S4N	R	O	R	
Bendire's Thrasher	*Toxostoma bendirei*	X	X	X	X	X	X				SC1	S3	VGT	VGT	VGT	VGT

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													SP	S	F	W
Bewick's Wren	*Thryomanes bewickii*											S4	R	O	R	R
Black Phoebe	*Sayornis nigricans*												R	R	R	O
Black Scoter	*Melanitta americana*												VGT	VGT	VGT	VGT
Black Tern	*Chlidonias niger*			X								S3	O	O	R	
Black-bellied Plover	*Pluvialis squatarola*												O		O	
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*												VGT	VGT	VGT	VGT
Black-chinned Hummingbird (B)	*Archilochus alexandri*											S4B/ S4N	R	R	R	
Black-crowned Night Heron	*Nycticorax*												O	O	O	
Black-headed Grosbeak	*Pheucticus melanocephalus*											S5	O			
Black-necked Stilt (B)	*Himantopus mexicanus*												A	A	C	
Black-tailed Gnatcatcher	*Polioptila melanura*										BC1	S3	U	R	U	R
Black-throated Green Warbler	*Setophaga virens*											S4N	VGT	VGT	VGT	VGT
Black-throated Sparrow	*Amphispiza bilineata*												A	A	C	C
Blue Grosbeak	*Passerina caerulea*											S5	R	R	R	
Blue-gray Gnatcatcher	*Polioptila caerulea*												R	O	U	
Blue-winged Teal	*Anas discors*											S3B/ S4N	C	C	A	R
Bonaparte's Gull	*Chroicocephalus philadelphia*												O		O	
Brewer's Blackbird	*Euphagus cyanocephalus*												R		R	
Brewer's Sparrow	*Spizella breweri*				X							S3B/ S4N	C	R	C	U
Broad-tailed Hummingbird	*Selasphorus platycercus*										SC2	S4	R	R	R	
Bronzed Cowbird	*Molothrus aeneus*											S4	VGT	VGT	VGT	VGT
Brown-headed Cowbird	*Molothrus ater*												R	R		
Buff-breasted Sandpiper	*Tryngites subruficollis*		X		X							SNA	VGT	VGT	VGT	VGT

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													SP	S	F	W
Buff-breasted Sandpiper	*Tryngites subruficollis*		X		X							SNA	VGT	VGT	VGT	VGT
Bufflehead	*Bucephala albeola*												R	O	R	U
Bullock's Oriole (B)	*Icterus bullockii*											S4B/ S5N	R	R	R	
Burrowing Owl	*Athene cunicularia*	X	X	X	X		X	X				S3	U	U	U	
Bushtit	*Psaltriparus minimus*										SC2	S5	VGT	VGT	VGT	VGT
Cactus Wren (B)	*Campylorhynchus brunneicapillus*				X						SC2	S5	C	C	C	U
California Gull	*Larus californicus*												VGT	VGT	VGT	VGT
Canada Goose	*Branta canadensis*												O		O	
Canvasback	*Aythya valisineria*										BC2	S4	R	R	R	R
Canyon Towhee	*Melozone fusca*										SC2	S5	O		R	O
Canyon Wren (wf)	*Catherpes mexicanus*													O	O	
Caspian Tern	*Hydroprogne caspia*												VGT	VGT	VGT	VGT
Cassin's Kingbird (B)	*Tyrannus vociferans*											S5	O	O	R	
Cassin's Sparrow (B)	*Peucaea cassinii*	X					X				SC2	S5	U	C	R	
Cattle Egret	*Bubulcus ibis*												O	O		
Cave Swallow	*Petrochelidon fulva*												VGT	VGT	VGT	VGT
Cedar Waxwing	*Bombycilla cedroru*												VGT	VGT	VGT	VGT
Chestnut-collared Longspur	*Calcarius ornatus*	X	X	X		X	X				SC1	S3N			U	U
Chihuahuan Raven (B)	*Corvus cryptoleucus*											S4B/ S5N	U	C	C	C
Chipping Sparrow	*Spizella passerina*										BC2	S4B/ S5N	C	U	A	U
Cinnamon Teal (B)	*Anas cyanoptera*											S3B/ S4N	C	U	C	R
Clark's Grebe	*Aechmophorus clarkii*						X				BC1		VGT	VGT	VGT	VGT
Clay-colored Sparrow	*Spizella pallida*												R		R	

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													SP	S	F	W
Cliff Swallow	*Petrochelidon pyrrhonota*												C	R	R	
Common Goldeneye	*Bucephala clangula*												R		O	R
Common Grackle	*Quiscalus quiscula*												VGT	VGT	VGT	VGT
Common Loon	*Gavia immer*											S4	VGT	VGT	VGT	VGT
Common Merganser	*Mergus merganser*												O		O	O
Common Moorhen	*Gallinula chloropus*												VGT	VGT	VGT	VGT
Common Nighthawk	*Chordeiles minor*				X		X					S4		R		
Common Poorwill	*Phalaenoptilus nuttallii*												VGT	VGT	VGT	VGT
Common Raven	*Corvus corax*											S5	R	R	R	R
Common Tern	*Sterna hirundo*											S4	VGT	VGT	VGT	VGT
Common Yellowthroat (B)	*Geothlypis tichas*											S4	U	U	R	
Cooper's Hawk (B)	*Accipiter cooperii*												R	O	R	O
Cordilleran Flycatcher	*Empidonax occidentalis*												VGT	VGT	VGT	VGT
Crissal Thrasher (B)	*Toxostoma crissale*				X						SC2	S4B/ S5N	R	R	R	R
Curve-billed Thrasher	*Toxostoma curvirostre*												U	U	U	R
Dark-eyed Junco	*Junco hyemalis*															O
Dickcissel	*Spiza americana*				X						BC2	S1B/ S4N	VGT	VGT	VGT	VGT
Double-crested Cormorant	*Phalacrocorax auritus*												O	O	O	
Dunlin	*Calidris alpina*												O		O	
Dusky Flycatcher	*Empidonax oberholseri*												O		O	
Eared Grebe (B)	*Podiceps nigricollis*						X					S3B/ S5N	C	R	C	R
Eastern Meadowlark (B)	*Sturnella magna*				X							S4B/ S5B	C	C	U	R
Eurasian Collard-Dove (B)	*Streptopelia decaocto*											SNA	U	U	U	U

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													SP	S	F	W
Eurasian Wigeon	*Anas penelope*												VGT	VGT	VGT	VGT
European Starling (wf)	*Sturnus vulgaris*											SNA	R	R	R	R
Ferruginous Hawk	*Buteo regalis*	X		X								S2B/ S2N				O
Forster's Tern	*Sterna forsteri*												O	O	O	
Franklin's Gull	*Leucophaeus pipixcan*												U	O		
Fulvous Whistling Duck	*Dendrocygna bicolor*												VGT	VGT	VGT	VGT
Gadwall (B)	*Anas strepera*												A	C	C	U
Gambel's Quail (B)	*Callipepla gambelii*											S5B/ S5N	U	U	U	U
Golden Eagle	*Aquila chrysaetos*	X	X		X							S3B/ S4N	O		O	R
Gray Catbird	*Dumetella carolinensis*											S3B/ S4N	VGT	VGT	VGT	VGT
Great Blue Heron	*Ardea herodias*												R	R	U	
Great Egret	*Ardea alba*												VGT	VGT	VGT	VGT
Great Horned Owl (B)	*Bubo virginianus*											S5B/ S5N	R	R	R	R
Greater Roadrunner (B)	*Geococcyx californianus*											S5B/ S5N	U	U	U	U
Greater Scaup	*Aythya marila*											S4	VGT	VGT	VGT	VGT
Greater Yellowlegs	*Tringa melanoleuca*												R	R	R	R
Great-tailed Grackle (B)	*Quiscalus mexicanus*											S5	C	C	C	U
Green Heron	*Butorides virescens*										BC2	S4	O	O	O	
Green-tailed Towhee	*Pipilo chlorurus*										SC2	S3B/ S4N			R	
Green-winged Teal	*Anas crecca*												A	U	C	U
Hairy Woodpecker	*Picoides villosus*												VGT	VGT	VGT	VGT
Harris's Hawk (B)	*Parabuteo unicinctus*										BC2	S2B/ S3N	O		R	R
Hermit Thrush	*Catharus guttatus*												VGT	VGT	VGT	VGT
Herring Gull	*Larus argentatus*												VGT	VGT	VGT	VGT

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													SP	S	F	W
Hooded Merganser	*Lophodytes cucullatus*												VGT	VGT	VGT	VGT
Horned Grebe	*Podiceps auritus*											S4N	VGT	VGT	VGT	VGT
Horned Lark	*Eremophila alpestris*				X							S5	C	C	C	A
House Finch (B)	*Haemorhous mexicanus*											S5	C	C	C	C
House Sparrow	*Passer domesticus*											SNA	U	U	U	U
House Wren (wf)	*Troglodytes aedon*										BC1	S5		O	O	
Hudsonian Godwit	*Limosa haemastica*		X									SNA	VGT	VGT	VGT	VGT
Indigo Bunting	*Passerina cyanea*												VGT	VGT	VGT	VGT
Killdeer (B)	*Charadrius vociferous*											S4B/ S5N	C	C	U	R
Ladder-backed Woodpecker (B)	*Picoides scalaris*											S5	U	O	U	
Lapland Longspur	*Calcarius lapponicus*											S4N	VGT	VGT	VGT	VGT
Lark Bunting	*Calamospiza melanocorys*	X	X								SC2/ BC2	S3B/ S5N	C	R	C	R
Lark Sparrow	*Chondestes grammacus*												R		R	
Least Sandpiper	*Calidris minutilla*												C	C	C	U
Least Tern	*Sterna antillarum*				X		X		E	E	BC1	S1B/ S2N	VGT	VGT	VGT	VGT
Lesser Goldfinch (B)	*Spinus psaltria*											S4	R	O	U	R
Lesser Nighthawk (B)	*Chordeiles acutipennis*											S5B/ S5N	U	U	R	
Lesser Scaup	*Aythya affinis*												C	O	R	R
Lesser Yellowlegs	*Tringa flavipes*		X									S4N	R	U	U	O
Lincoln's Sparrow	*Melospiza lincolnii*												O		O	O
Little Gull	*Hydrocoloeus minutus*												VGT	VGT	VGT	VGT
Loggerhead Shrike (B)	*Lanius ludovicianus*	X	X	X	X		X				SC2	S3B/ S4N	C	C	C	C
Long-billed Curlew	*Numenius americanus*	X	X		X		X				BC1	S3B/ S4N	R	U	R	
Long-billed Dowitcher	*Long-billed Dowitcher*												C	R	R	U

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													SP	S	F	W
Long-eared Owl (B)	*Asio otus*					X					BC2	S4B/ S4N	VGT	VGT	VGT	VGT
Long-tailed Duck	*Clangula hyemalis*												VGT	VGT	VGT	VGT
Lucy's Warbler	*Oreothlypis luciae*		X		X		X				SC2	S3B/ S4N	VGT	VGT	VGT	VGT
MacGillivray's Warbler	*Geothlypis tolmiei*										BC2	S5B/ S5N			R	
Mallard (B)	*Anas platyrhynchos*												C	C	C	U
Marbled Godwit	*Limosa fedoa*												R	O	O	
Marsh Wren (B)	*Cistothorus palustris*												R	O	R	R
McCown's Longspur	*Rhynchophanes mccownii*	X	X			X	X				SC1	S3N			O	O
Merlin	*Falco columbarius*												VGT	VGT	VGT	VGT
Mississippi Kite	*Ictinia mississippiensis*												VGT	VGT	VGT	VGT
Mountain Bluebird	*Sialia currucoides*						X				SC2	S4B/ S4N	VGT	VGT	VGT	VGT
Mountain Chickadee	*Poecile gambeli*	X	X								SC1	S5B/ S5N			O	O
Mountain Plover	*Charadrius montanus*	X	X		X		X				BC1	S2B/ S4N	VGT	VGT	VGT	VGT
Mourning Dove (B)	*Zenaida macroura*											S5	C	C	C	U
Nashville Warbler	*Oreothlypis ruficapilla*												VGT	VGT	VGT	VGT
Neotropic Cormorant	*Phalacrocorax brasilianus*						X		T			S3B/ S4N	VGT	VGT	VGT	VGT
Northern Flicker	*Colaptes auratus*												R	R	R	R
Northern Harrier	*Circus cyaneus*										BC2	S2B/ S5N	R	O	R	U
Northern Mockingbird (B)	*Mimus polyglottos*											S5	C	C	R	
Northern Pintail	*Anas acuta*										BC2	S4B/ S5N	R	R	C	C
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*												U	R	R	
Northern Shoveler (B)	*Anas clypeata*											S3B/ S5N	A	A	A	A
Northern Waterthrush	*Parkesia noveboracensis*												VGT	VGT	VGT	VGT

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													SP	S	F	W
Olive-sided Flycatcher	*Contopus cooperi*				X	X	X				BC2	S3B/ S4N	VGT	VGT	VGT	VGT
Orange-crowned Warbler	*Oreothlypis celata*														O	
Orchard Oriole	*Icterus spurius*										BC2	S3B/ S5N	VGT	VGT	VGT	VGT
Osprey	*Pandion haliaetus*											S2B/ S4N	O		O	
Pacific Loon	*Gavia pacifica*												VGT	VGT	VGT	VGT
Palm Warbler	*Setophaga palmarum*												VGT	VGT	VGT	VGT
Pectoral Sandpiper	*Calidris melanotos*												O	O	R	
Peregrine falcon	*Falco peregrinus*	X	X				X	X	T			S2B/ S3N	R	O	R	O
Phainopepla	*Phainopepla nitens*											S4	R	R		
Pied-billed Grebe (B)	*Podilymbus podiceps*										BC2	S5B/ S5N	R	R	R	O
Pine Siskin	*Spinus pinus*														R	
Plumbeous Vireo	*Vireo plumbeus*												VGT	VGT	VGT	VGT
Prairie Falcon	*Falco mexicanus*				X							S4B/ S4N			R	O
Prothonotary Warbler	*Protonotaria citrea*		X			X						S4N	VGT	VGT	VGT	VGT
Pyrrhuloxia (B)	*Cardinalis sinuatus*											S5B/ S5N	U	U	U	U
Red Knot	*Calidris canutus*		X									SNA	VGT	VGT	VGT	VGT
Red Phalarope	*Phalaropus fulicarius*												VGT	VGT	VGT	VGT
Red-breasted Merganser	*Mergus serrator*												VGT	VGT	VGT	VGT
Redhead	*Aythya americana*										BC1	S4B/ S5N	U	R	U	R
Red-naped Sapsucker	*Sphyrapicus nuchalis*												VGT	VGT	VGT	VGT
Red-necked Phalarope	*Phalaropus lobatus*												O	O	O	
Red-tailed Hawk (B)	*Buteo jamaicensis*												U	R	U	U
Red-winged Blackbird (B)	*Agelaius phoeniceus*											S5	C	C	U	U
Ring-billed Gull	*Larus delawarensis*												C	R	R	U

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													SP	S	F	W
Ring-necked Duck	*Aythya collaris*												R	O	R	C
Rock Pigeon (B)	*Columba livia*											SNA	U	U	U	U
Rock Wren	*Salpinctes obsoletus*										SC2	S5B/ S5N	R		R	
Ross's Goose	*Chen rossii*												VGT	VGT	VGT	VGT
Rough-legged Hawk	*Buteo lagopus*												VGT	VGT	VGT	VGT
Ruby-crowned Kinglet	*Regulus calendula*												O			R
Ruddy Duck (B)	*Oxyura jamaicensis*											S4B/ S5N	A	C	A	C
Ruddy Turnstone	*Arenaria interpres*												VGT	VGT	VGT	VGT
Ruff	*Calidris pugnax*												VGT	VGT	VGT	VGT
Rufous Hummingbird	*Selasphorus rufus*					X							VGT	VGT	VGT	VGT
Rufous-crowned Sparrow	*Aimophila ruficeps*										SC2		VGT	VGT	VGT	VGT
Rusty Blackbird	*Euphagus carolinus*		X		X							S2N	VGT	VGT	VGT	VGT
Sabine's Gull	*Xema sabini*												VGT	VGT	VGT	VGT
Sage Thrasher	*Oreoscoptes montanus*				X						BC2	S3B/ S4N	R	O	C	C
Sagebrush Sparrow	*Amphispiza belli nevadensis*				X		X				SC2	S3B/ S4N	R		U	C
Sanderling	*Calidris alba*												O		O	
Sandhill Crane	*Grus canadensis*											S4N			R	O
Savannah Sparrow	*Passerculus sandwichensis*												R		U	R
Say's Phoebe (B)	*Sayornis saya*											S4B/ S4N	U	U	U	R
Scaled Quail (B)	*Callipepla squamata*					X					SC1	S3B/ S4N	U	U	U	U
Scott's Oriole (B)	*Icterus parisorum*											S4B/ S5N	U	R	R	
Semipalmated Plover	*Charadrius semipalmatus*												O	O	O	
Semipalmated Sandpiper	*Calidris pusilla*												O		O	
Sharp-shinned Hawk	*Accipiter striatus*											S4B/ S4N	O		R	R

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													SP	S	F	W
Short-billed Dowitcher	*Limnodromus griseus*		X									S3N	VGT	VGT	VGT	VGT
Snow Goose	*Chen caerulescens*												VGT	VGT	VGT	VGT
Snowy Egret	*Egretta thula*												R	O	O	
Snowy Plover (B)	*Charadrius nivosus*	X	X		X		X			T	BC1	S2	C	C	R	
Solitary Sandpiper	*Tringa solitaria*		X									S4N	O		O	
Song Sparrow	*Melospiza melodia*															R
Sora (B)	*Porzana carolina*												R	R	R	
Spotted Sandpiper	*Actitis macularius*												U	R	R	
Spotted Towhee	*Pipilo maculatus*												VGT	VGT	VGT	VGT
Sprague's Pipit	*Anthus spragueii*	X		X	X	X	X	X			BC1	S2N	VGT	VGT	VGT	VGT
Stilt Sanpiper	*Calidris himantopus*												O		R	
Summer Tanager	*Piranga rubra*															
Surf Scoter	*Melanitta perspicillata*												VGT	VGT	VGT	VGT
Swainson's Hawk (B)	*Buteo swainsoni*											S4B/ S4N	O		R	R
Swamp Sparrow	*Melospiza georgiana*												VGT	VGT	VGT	VGT
Tennessee Warbler	*Oreothlypis peregrina*												VGT	VGT	VGT	VGT
Townsend's Warbler	*Dendroica townsendi*											S4N	VGT	VGT	VGT	VGT
Tree Swallow	*Tachycineta bicolor*												U	O	R	O
Tricolored Heron	*Egretta tricolor*												VGT	VGT	VGT	VGT
Turkey Vulture	*Cathartes aura*											S5B/ S5N	R	R	R	
Verdin (B)	*Auriparus flaviceps*											S4B/ S4N	U	U	U	U
Vermilion Flycatcher	*Pyrocephalus rubinus*												VGT	VGT	VGT	VGT
Vesper Sparrow	*Pooecetes gramineus*						X				SC2	S5B/ S4N	R	C	R	
Violet-green Swallow	*Tachycineta thalassina*										SC2	S3B/ S4N	C	R	C	

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIF Priority	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season			
													SP	S	F	W
Virginia Rail	*Rallus limicola*												O	O	O	
Virginia's Warbler	*Oreothlypis virginiae*	X				X	X				SC1	S3B/ S4N			O	
Warbling Vireo	*Vireo gilvus*												VGT	VGT	VGT	VGT
Western Bluebird	*Sialia mexicana*						X				SC2	S4B/ S4N				O
Western Grebe	*Aechmophorus occidentalis*										BC2	S3B/ S5N	R	O	R	
Western Kingbird (B)	*Tyrannus verticalis*											S5	A	A	C	
Western Meadowlark	*Sturnella neglecta*												C	U	C	U
Western Sandpiper	*Calidris mauri*												C	C	C	U
Western Tanager	*Piranga ludoviviana*											S4			R	
Western Wood-Pewee	*Contopus sordidulus*												R		O	
Whimbrel	*Numenius phaeopus*		X									SNA	O	O		
White-crowned Sparrow	*Zonotrichia leucophrys*											S5	R		R	R
White-faced ibis	*Plegadis chihi*			X								S3B/ S4N	C	C	U	
White-rumped Sandpiper	*Calidris fuscicollis*												O		O	
White-throated Sparrow	*Zonotrichia albicollis*												VGT	VGT	VGT	VGT
White-throated Swift	*Aeronautes saxatalis*											S3B/ S4N	R	O		
White-winged Dove (B)	*Zenaida asiatica*												C	C	C	C
White-Winged Scoter	*Melanitta fusca*												VGT	VGT	VGT	VGT
Willet	*Tringa semipalmata*												R	R	R	
Willow Flycatcher	*Empidonax traillii*											S4N	VGT	VGT	VGT	VGT
Wilson's Phalarope	*Phalaropus tricolor*										BC2	S2B/ S4N	A	A	A	
Wilson's Snipe	*Gallinago delicata*												O		O	O
Wilson's Warbler	*Cardellina pusilla*										BC2	S2B/ S5N	R		U	
Winter Wren	*Troglodytes hiemalis*												VGT	VGT	VGT	VGT

Common Name	Scientific Name	BCC2008BCR35	BCC2008Region2	BLMsensitiveNMSO	DoDPIFpriority	PIF Priority	SGCN2016	USFSregion3sensitive	NMDGF Status	Federal Status	NMACP 2016	State Rank	Season			
													SP	S	F	W
Wood Duck	*Aix sponsa*												O		O	
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*										SC1	S5B/ S5N	O		R	
Yellow Warbler (Sonoran)	*Setophaga petechia sonorana*	X	X									S4B/ S4N (SN R)		R	R	
Yellow-breasted Chat	*Icteria virens*												R	R		
Yellow-headed Blackbird	*Xanthocephalus*												U	C	A	
Yellow-rumped Warbler	*Setophage coronata*												U		C	R

BCC2008BCR35=US Fish and Wildlife Service Bird of Conservation Concern in the Chihuahuan Desert (USFWS 2008); BCC2008Region2=US Fish and Wildlife Service Bird of Conservation Concern in the Southwest US (USFWS 2008); BLMSensitiveNMSO=BLM Sensitive Species (Biota Information System of New Mexico 2015); DoDPIFpriority=Department of Defense Partners in Flight mission-sensitive priority birds (DoD PIF 2014); PIF Watch List= Partners in Flight Species of Continental Concern(land birds only; Rosenberg et al. 2016); SGCN=NM Species of Greatest Conservation Need (NMDGF 2016); USFS Sensitive=US Forest Service Sensitive Species (USFS 2013); NMDGF Status=New Mexico state status (T= threatened, E=endangered; NMDGF 2016b); Federal Status=Endangered Species Act (E=Endangered; 1973, 16 USC 1531-1544); NMACP 2017 = New Mexico Avian Conservation Partners priority list status (SC = Species Conservation Level 1 or 2, BC = Biodiversity Conservation Level 1 or 2); State rank=NM Natural Heritage state rank (lower numbers indicate higher conservation priority; NatureServe 2015). Shading indicates known breeders at HAFB.

Code	Definition
A	Abundant
BC1	NMACP - Biodiversity Conservation Level 1
BC2	NMACP - Biodiversity Conservation Level 2
C	Common
CS	Candidate Species
E	Endangered
EXPN	Experimental Population
O	Occasional
R	Rare
SC1	NMACP - Species Conservation Level 1
SC2	NMACP - Species Conservation Level 2
S*B	NM State Rank Breeding
S*N	NM State Rank Nonbreeding
T	Threatened
U	Uncommon
VGT	Vagrant

15.0 ASSOCIATED PLANS

Tab 1 – Wildland Fire Management Plan

Document is available upon request

Tab 2 – Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

Document is FOUO but available upon request

Tab 3 – Golf Environmental Management (GEM) Plan

Document is available upon request

Tab 4 – Integrated Cultural Resources Management Plan (ICRMP)

Document is available upon request

Tab 5 – Integrated Pest Management Plan (IPMP)

Document is available upon request