U. S. AIR FORCE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

GOODFELLOW AIR FORCE BASE

AIR EDUCATION AND TRAINING COMMAND

2022

OPR: 17 CES/CEIE

ABOUT THIS PLAN

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

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

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

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DOCUMENT CONTROL

Standardized INRMP Template

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

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

NOTE: Installations are not required to update their INRMPs every time this template is updated. When it is time for installations to update their INRMPs, they should refer to the eDASH EMP Repository to ensure they have the most current version.

Installation INRMP

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

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

INRMP APPROVAL/SIGNATURE PAGES

Goodfellow AFB Integrated Natural Resources Management Plan Signature Page

MATTHEW R. REILMAN, Colonel, USAF
Commander, 17th Training Wing

29 Dec 21

Amy Lueders
Regional Director, Southwest Region
United States Fish and Wildlife Service

AMY LUEDERS Digitally signed by AMY LUEDERS Date: 2021.12.07 08:15:20 -07'00'

U.S. Fish and Wildlife Service — Date

Carter Smith
Executive Director
Texas Parks and Wildlife Department

Texas Parks & Wildlife Department — 15 December 2021 Date

Life's better outside.

EXECUTIVE SUMMARY

The 2022 Integrated Natural Resource Management Plan (INRMP) updates the INRMP prepared in 2011, in compliance with Air Force Manual (AFMAN) 32-7003 Environmental Conservation, AFI 32-7001 Environmental Management and Department of Defense Instruction (DoDI) 4715.3, Environmental Conservation Program.

The 2022 INRMP, as mandated by the Sikes Act as Amended by the Sikes Act Improvement Act of 1997, is a means to ensure conservation and rehabilitation of natural resources on DoD property in coordination with the U.S. Fish & Wildlife Service (USFWS) and the Texas Parks & Wildlife Department (TPWD). The purpose of the INRMP is to achieve an ecosystem based management program directed at maintaining a healthy ecological condition on base, while sustaining military and socio-economic values. When implemented, this management plan will support present and future mission requirements while promoting ecological integrity and biological diversity in compliance with federal, state and local standards.

The intent of this INRMP and future versions will be to guide base staff in maintaining and improving the sustainability and biological diversity of the natural resources found on Goodfellow Air Force Base (GAFB). The long-term vision for the management of natural resources on GAFB will focus on sustaining/enhancing native species and better managing nuisance and noxious species.

The primary goals of the INRMP will be to improve wildlife habitat/native vegetation. This will be accomplished by scientifically surveying the present vegetation and wildlife. This information, along with the historic vegetative climax community from the Natural Resources Conservation Service, will allow for a more informed decision on how to remove the primary nuisance and noxious species on base (mesquite, prickly pear and white-tailed deer). An Urban Forestry Management Plan will also be created to include a survey of existing developed trees to include species identification, tree identification number, GIS location, stem class, tree height, tree canopy diameter, health status, location type, diameter breast height (DBH) age, condition, and value. This information can be used to gather siting information for future construction. The trees are often used to shade buildings and aid in energy conservation on base. These goals will significantly change the landscape of GAFB and will represent a more hands on approach to the conservation of natural resources on base.

The INRMP's goals and objectives must be given consideration early in the planning process for projects and mission changes on GAFB. For the INRMP to be an effective planning document, all appropriate installation staff, offices, flights, and other groups must be aware of and comply with the INRMP.

In 2022, the annual update of this INRMP included re-formatting the plan to fit the 2020 Standardized Template.

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

1.1 Purpose and Scope

The INRMP will be used as a guide to provide natural resources information used in the early planning phases of changes (e.g. mission, construction) that occur on base. Implementation of the INRMP will ensure successful accomplishment of the mission by integrating all aspects of natural resource management with each other and the mission. The Air Force has recognized that maintaining biodiversity is crucial to the overall ecosystem integrity and sustainability, and that failure to maintain ecosystem diversity may result in degradation of the land and loss of public confidence in the Air Force's stewardship of the land. With this premise, all Air Force facilities are required to develop and implement an Integrated Natural Resources Management Plan, or INRMP.

The scope of GAFB's INRMP covers approximately 1,234 acres and all aspects of the wide variety of wildlife and vegetation explained in detail throughout the plan.

1.2 Management Philosophy

All installation personnel, both civilian and military, will act responsibly in the public's interest when managing the land and natural resources that are an integral part of the installation. There shall be a conscious and active concern for the inherent value of natural resources in all installation plans, decisions, actions, and programs.

Natural resources under control of the installation will be managed in a manner compatible with the military mission, while practicing the principles of multiple use and sustained yield, using scientific methods and an interdisciplinary approach. The conservation of natural resources and the military mission need not and shall not be mutually exclusive.

All current and planned installation activities (e.g., master planning, construction requests, site approval requests, and training/exercise plans) shall be planned and conducted so as to ensure effective and timely coordination with installation natural resources management personnel.

1.3 Authority

The following guidance provides the authority for the development of this plan.

- The Sikes Act, 16 U.S.C. 670 et. seq.
- Department of Defense Instruction (DoDI) 4715.3—*Environmental Conservation Program*, May 3, 1996
- Air Force Policy Directive (AFPD) 32-70 – *Environmental Quality*

- Air Force Manual (AFMAN) 32-7003 – *Conservation Management*

1.4 Integration with Other Plans

GAFB developed an Installation Development Plan (IDP) which is reviewed annually through the operations and engineering flights. The IDP briefly covers natural resources, but the IDP and INRMP share many of the same goals. Among these are the "wise protection, use and management of resources within the natural and man-made environments" and to ensure "the highest possible quality of life for the Air Force community". The IDP also recognizes the invasiveness of mesquite and prickly pear due to lack of disturbance (e.g. mowing, disking) and suppression of fire in the unimproved areas of the base, a problem that is getting worse with time. The IDP also sets guidance for a cohesive landscaping theme for the base. It "encourages creativeness and use of similar species and thematic design elements" and states xeriscaping should be implemented due to water constraints of the region. An approved plant list for native species is included in Appendix 2.

The INRMP and Integrated Pest Management Plan (IPMP) reference each other several times with relation to natural resources impacts on the current mission, what caused the impact (e.g. ground squirrels, bats, snakes, invasive vegetation, etc.) and ways to manage the various situations. The State of Texas has created a nuisance/noxious plant list and it has been included in Appendix 3.

2.0 INSTALLATION PROFILE

Office of Primary Responsibility (OPR)	17 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/Point of Contact (POC)	Name: Jarrett Louder Phone: 325-654-3456 Email: jarrett.louder@us.af.mil
State and/or local regulatory POCs (Include agency name for Sikes Act cooperating agencies)	United States Fish and Wildlife Service Donelle Robinson Fish and Wildlife Biologist Austin Ecological Services Field Office 10711 Burnet Road, Suite 200 Austin, TX 78758-4460 512-490-0057 Texas Parks and Wildlife Department Richard Hanson Habitat Assessment Biologist Richard.hanson@tpwd.texas.gov 806-761-4936
Total acreage managed by installation	Main installation: 1,234 acres Landfill: 33.4 acres Recreation Camp: 15.4 acres River pump and water line: 1.74 acres Privatized housing: 101 acres Total: 1385.54 acres
Total acreage of wetlands	N/A
Total acreage of forested land	N/A
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
Natural Resources 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 ☒ Outdoor Recreation and Access to Natural Resources ☐ Conservation Law Enforcement ☐ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☐ Wetland Protection ☒ Grounds Maintenance ☐ Forest Management ☒ Wildland Fire Management ☐ Agricultural Outleasing ☒ Integrated Pest Management Program ☐ Bird/Wildlife Aircraft Strike Hazard (BASH) ☐ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection

	☒ Public Outreach ☒ Geographic Information Systems (GIS)

2.1 Installation Overview

2.1.1 Location and Area

Goodfellow AFB is a U.S. Air Force (USAF) training installation under the command of the Air Education & Training Command (AETC). The main installation comprises 1,234 acres and is located inside the city limits of San Angelo in Tom Green County, Texas (Figure 2-1). Other base documentation may show variations of this acreage. Base properties include an adjacent, off-base landfill (33.4 acres), two off-base easements, a recreation camp (15.4 acres), a river pump and water line (1.75 acres), and 101 acres of privatized housing.

Goodfellow AFB, Texas

2.1.1.1 Off-Base Recreation Camp

The recreation camp is located at Lake Nasworthy, approximately eight miles from the main base.

Lake Nasworthy Rec Camp.

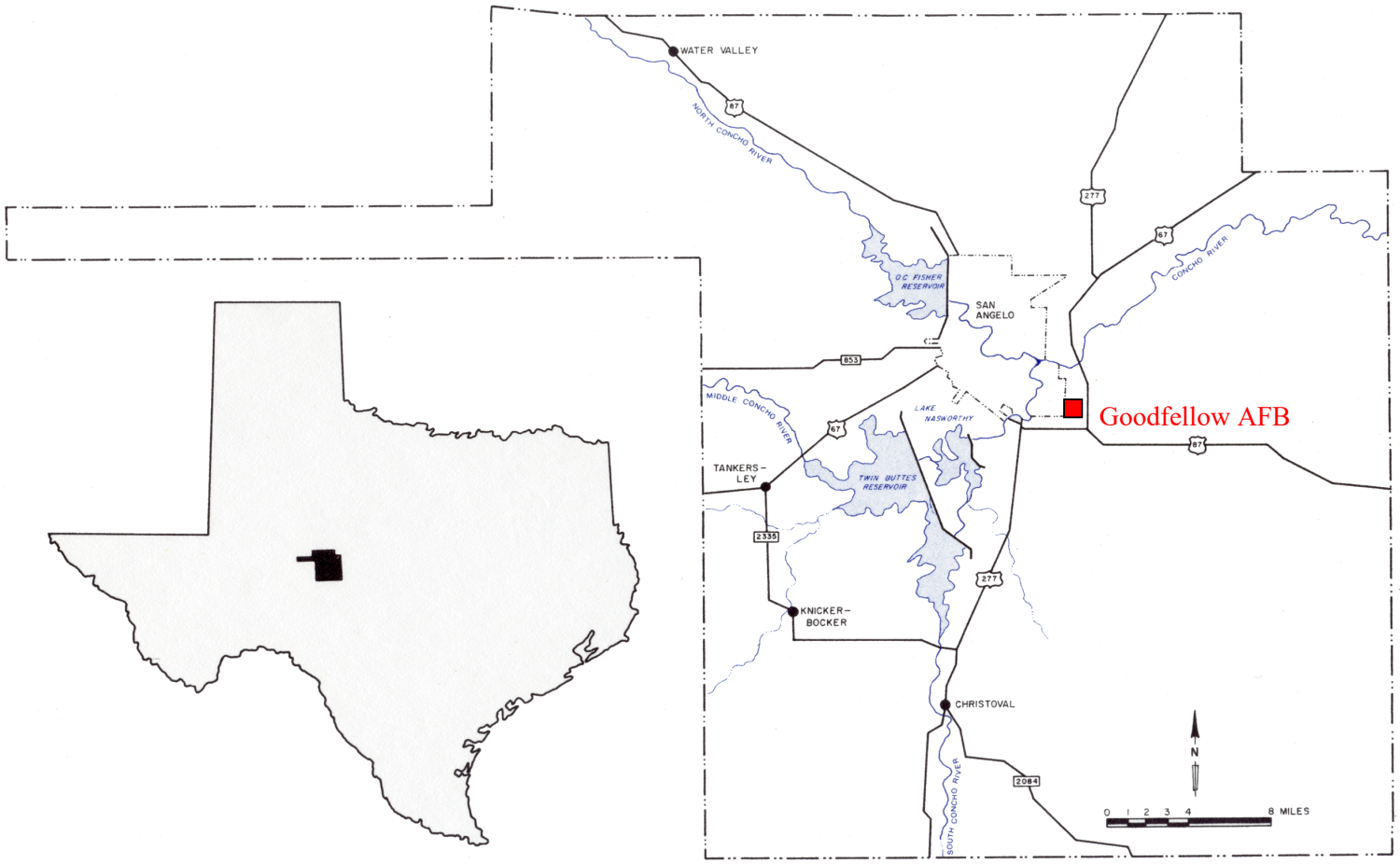

Figure 2-1 Location of Goodfellow AFB within Tom Green County

The Rec Camp has a marina, swimming pool, tennis courts, volley ball net, picnic pavilions, campgrounds, and support facilities. It is on property leased from the City of San Angelo until 2022.

2.1.1.2 Off-Base Landfill

Covering of Materials- South Landfill.

A former base landfill is located off-base across state highway FM 1223, just outside the installation's south gate. This property was originally a "crash" zone for the end of the main north/south aircraft runway. Either prior to obtaining the land by the Air Corps or during the early base years, a "gravel pit" was excavated in the center of the property. This ready-made pit became a convenient landfill serving as a wet weather alternate disposal site for base-operated trash collection services and then later as a construction debris disposal area. The landfill portion of the land parcel occupies approximately 14 acres of the 33 acres and operated from about 1950 until 1989. It was closed and capped in October 1993. The rest of the site is currently not in use; however, the site is being considered as a future location of a photovoltaic cell plant.

2.1.1.3 Water Line Easement

The water line utility easement is located from a river pump on the Concho River, at Woodruff and Kennedy Drive, south under Woodruff Street to GAFB. This is a distance of approximately 3,800 feet. This pump and pipeline were originally installed to supply non-potable water to a one million-gallon holding tank (former Facility #506). From here, the water was supplied through its own distribution system for the irrigation of base grounds. This irrigation system is currently not in use and the holding tank and the pump house were demolished in November 2000.

2.1.1.4 Base Assets

Goodfellow AFB assets include 169 buildings totaling 2.6 million square feet (9 Oct 14). This number includes 161 buildings on the main base and 8 at the Recreation Camp. It should be noted that these are "buildings", and do not include other "facilities" such as pavilions, flag poles, and static displays which may have facility numbers but are not buildings by Real Property definition. There are 426 total facilities on base. The base has maintained an active demolition program to provide the most efficient utilization of facilities and to complement the new construction and modernization program.

2.1.2 Installation History

In the late 1930s, President Franklin Roosevelt began a program of military preparedness which included the development of facilities dedicated to advanced air training. Construction of the new San Angelo Air Corps Basic Flying School began in August 1940. By January 1941, the base was ready for occupancy, and the first classes of students soon arrived. On 4 July 1941, the base was officially renamed Goodfellow Field in honor of 1st Lieutenant John J. Goodfellow, a pilot originally from San Angelo who had been killed in France in 1918. The next four years saw the graduation of more than ten thousand pilots.

Goodfellow Field continued to train pilots following World War II, first in the AT-6 "Texan" and later, beginning in 1954, in the twin-engine B-25 "Mitchell" medium bomber. On 3 September 1958, with nearly 20,000 aviators to its credit, Goodfellow AFB graduated its last class of pilots.

With transfer of the base from Air Training Command (ATC) to the USAF Security Service in 1958, Goodfellow's mission became the training of Air Force personnel in advanced cryptologic skills that the Security Service required at installations worldwide. Eight years later, in 1966, the mission expanded further to include joint-service training in these same skills for Army, Navy, and Marine Corps personnel. In 1978, jurisdiction for Goodfellow transferred back to ATC, which changed in 1993 to the Air Education and Training Command (AETC).

The 17th Training Wing (17 TRW) was activated at GAFB on 1 July 1993. Along with this change in name was a marked diversification and increase in mission. Earlier rounds of military base closure actions had transferred both special instruments training from Lowry AFB in Colorado and fire protection training from Chanute AFB in Illinois to GAFB. To support the increased training activities, the base underwent extensive modernization and growth with the construction of new training facilities, dormitories, dining halls, a new commissary, a youth center, and a new physical fitness center.

2.1.3 Military Missions

GAFB's primary missions are to provide cryptologic and intelligence training, special instruments training (formerly seismic sensor training) and fire protection training. This training is accomplished locally and with three geographically separated units at Fort Huachuca, Arizona, Corry Station, Florida, and the Defense Language Institute in Monterey, California.

GAFB hosts a number of other service tenant units including the United States (U.S.) Army's 344th Military Intelligence Battalion (344 MI BN) of the 111th Military Intelligence Brigade, a Navy Center for Information Dominance Detachment (NCIDD), and a U.S. Marine Corps Detachment (MCD).

- The 344 MI BN provides administrative, command and control, and instructional support to soldiers assigned to GAFB for training.
- The NCIDD provides support and instruction for Navy personnel temporarily assigned to GAFB for cryptological and general intelligence training and fire suppression training.
- The Marine Corps Detachment provides instructor support to the Air Force's training facilities at GAFB and also provides administrative, management, and other requisite support for Marine instructors and students.

DOT tire testing.

GAFB has another tenant organization that influences the base infrastructure.

- The Department of Transportation (DOT) is located in Buildings 3525 and 3527. They perform testing and rating of automobile tires on a 1.2-mile oval track on base property. This specially designed track was constructed in 1991. Another track area utilizing the former aircraft runways was used until the relocation of fire training from Chanute AFB was programmed as part of the Base Realignment and Closure actions. The site of the new fire training school required the area of the tire testing track so a new track was constructed.

2.1.4 Natural Resources Needed to Support the Military Mission

Current emphasis on training by Army and Air Force personnel in preparation for deployed missions requires field training in the undeveloped area of the base. Camp Sentinel (Buildings 3276 & 3298) on the

east side of the base serves this purpose. Roadways have been constructed which can duplicate travel scenarios in wooded areas. Management of mesquite and prickly pear should be undertaken to support the 344th MIBN's mission. Selective treatment of mesquite and prickly pear would enhance their mission and lessen safety hazards to personnel training in those areas.

2.1.5 Surrounding Communities

As previously described, GAFB is within the city limits of San Angelo, population 98,975 (Source: US Census Bureau). Land use on the north and west side is residential. There is also a public school, Glenmore Elementary School, adjacent to the west perimeter of the base. The south side is a combination of commercial businesses, residential, and cropland. On the east side, there is both cropland and a residential area.

2.1.6 Local and Regional Natural Areas

Tom Green County is part of an area known as the Concho Valley, which is the drainage area for the Concho River and its tributaries. It is mostly an agricultural area for cotton, sorghum, cattle, sheep, and goat. Oil production is a growing industry throughout the region. There are several oil related companies in the vicinity of the base.

Three local major surface water reservoirs (Twin Buttes Reservoir, O.C. Fisher Lake, and Lake Nasworthy) provide recreational areas for hunting, fishing, and boating. In addition, there are two other reservoirs, Lake E.V. Spence north of San Angelo, and O.H. Ivie Lake, east of San Angelo, which provide regional fishing and boating opportunities.

The South Concho River is approximately ½ mile west of the base. This river begins as a clear, permanent stream created by a series of springs located in the limestone hills about 30 miles to the south of GAFB. The confluence of the South Concho River with the North Concho River is less than a mile north from the base at the Bell Street dam, where the rivers combine to form the Concho River.

Starting at the Bell Street dam is a city-maintained park area along-side the North Concho River portion and continues upstream for several miles. This area consists of a hike/bike trail, picnic areas, and display gardens.

The San Angelo State Park is located adjacent to the west side of San Angelo. It surrounds O.C. Fisher Lake and supports many wildlife programs through coordination with Angelo State University.

Paint Rock, TX, located 25 miles east of San Angelo is named after the presence of significant Native American cliff paintings located along the banks of the Concho River. This site is on private land, but visiting tours are conducted.

2.2 Physical Environment

2.2.1 Climate

The county is situated in a transition zone. Geographers have traditionally considered the 100th meridian, seven miles east of the county, the dividing line between two climatic regions. To the east is a subtropical/subhumid region characterized by hot summers and dry winters; to the west a subtropical steppe typified by semi-arid to arid conditions.

During most of the year, warm dry weather predominates. May is historically the wettest month, January the driest. Annual rainfall is highly variable. Recorded annual precipitation has ranged from a maximum of 40.4 inches in 1936 (with over 27 inches falling in September) down to 7.41 inches in 1956, with a 25-year average of 21.25 inches.

In 2011, 9.21 inches of rainfall was recorded for the entire year. This was the lowest quantity of annual

rainfall in the last 25 years. This was followed by 12.98 inches in 1998.

GAFB has mild winter temperatures with a mean minimum January temperature of 33°F (0.7°C), and hot summers. Record extremes are -4°F (-20°C) and 111°F (44°C). Approximately 120 days per year have a maximum temperature above 90°F, and 54 days a minimum below 32°F. The growing season averages 235 days, with the average first killing frost on 15 November and last average frost on 15 March. Table 2-1 provides a summary of temperature and precipitation data for San Angelo, TX.

The climate of West Texas has a significant influence on base requirements.

- Rainfall—Decisions involving activities such as landscaping are often impacted by a false presumption that there will always be adequate rainfall to support landscape designs. Being located in a transition area from a subhumid climate to semiarid climate, the required amount of support/maintenance is not often provided for base landscape projects which use the community standards for selecting plants that generally require higher maintenance standards. Using more native vegetation and plants would reduce the number of plants lost to heat stress.
- Temperature—West Texas is subject to intense summer heat which places very heavy burdens on electrical consumption for operating cooling systems. Landscaping is greatly affected and it is difficult to maintain sufficient supplemental water on plants. Normally, the winters are mild, but historically there have been times when cold weather was so severe that community facilities had to close because of demands on the natural gas system which could not be met. There is generally at least one occasion each winter when the base will delay normal working hours because of ice conditions on the roads.

Table 2-1 Climate data for San Angelo, Texas.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °F (°C)	91 (33)	97 (36)	98 (37)	107 (42)	110 (43)	110 (43)	111 (44)	111 (44)	107 (42)	102 (39)	93 (34)	91 (33)	111 (44)
Average high °F (°C)	59.5 (15.3)	63.5 (17.5)	71.1 (21.7)	80.1 (26.7)	87.2 (30.7)	92.1 (33.4)	95.1 (35.1)	94.7 (34.8)	87.8 (31)	78.8 (26)	68.3 (20.2)	59.9 (15.5)	78.2 (25.7)
Average low °F (°C)	33.3 (0.7)	37.0 (2.8)	44.4 (6.9)	51.9 (11.1)	61.8 (16.6)	68.8 (20.4)	71.2 (21.8)	70.7 (21.5)	63.5 (17.5)	53.6 (12)	42.3 (5.7)	33.6 (0.9)	52.7 (11.5)
Record low °F (°C)	1 (−17)	−1 (−18)	8 (−13)	23 (−5)	35 (2)	40 (4)	54 (12)	45 (7)	35 (2)	19 (−7)	12 (−11)	−4 (−20)	−4 (−20)
Average precipitation inches (mm)	0.93 (23.6)	1.35 (34.3)	1.50 (38.1)	1.42 (36.1)	2.82 (71.6)	2.59 (65.8)	1.20 (30.5)	2.26 (57.4)	2.46 (62.5)	2.73 (69.3)	1.14 (29)	0.85 (21.6)	21.25 (539.8)

Source: National Weather Service [20].

Climate Projections

To predict future climate conditions at GAFB, CSU CEMML generated site-specific climate projections under two future carbon-emission scenarios: Representative Concentration Pathway (RCP) 4.5 (moderate emission levels) and RCP 8.5 (high emission levels). The group of researchers then used these projections to assess potential impacts of future climate on natural resources at the installation. Models used historical daily climate data recorded from 1980 through 2009 to represent average historical (also called baseline) conditions and generate climate projections. The historical daily climate data represent the 30-year historical reference point used by the Intergovernmental Panel on Climate Change (IPCC) to define climate change scenarios. Future climate conditions, assessed under both RCP 4.5 and RCP 8.5, were projected to produce two decadal time series of daily climate values for 2026–2035 and 2046–2055, represented hereafter as 2030 and 2050, respectively (CEMML 2019).

Historical data included average daily temperature, maximum and minimum daily temperatures, and daily precipitation. For each of these variables, researchers calculated a daily anomaly (the difference of a future climate compared to the historical climate) under each emission scenario (RCP 4.5 and RCP 8.5) for both 2030 and 2050. Daily data were then averaged within both 10-year periods for each variable and emission scenario to produce an annual average temperature (TAVE), annual average maximum (TMAX) and minimum (TMIN) temperatures, and annual average precipitation (PRECIP).

The climate assessment was based primarily on publicly available data and data provided by AFCEC (CEMML 2019). Climate projections were based on recent global climate model simulations developed for the IPCC Fifth Assessment Report (IPCC AR5), the IPCC Coupled Model Intercomparison Project Phase 5 (IPCC-CMIPP5), and the U.S. National Center for Atmospheric Research Community Climate System Model (NCAR CCSM; Hibbard et al. 2007, Moss et al. 2008, 2010, Gent et al., 2011, Hurrell et al. 2013).

Climate Model Results

Climate projections for GAFB (Table 2-2) suggest minimum and maximum temperatures will increase over time under both emission scenarios (RCP 4.5 and RCP 8.5). For the decade centered around 2030, both of the scenarios project a similar degree of increase in TAVE of between 2.3 °F (1.3 °C) and 2.9 °F (1.6 °C) over historical average. The two emission scenario projections show higher warming by 2050, with RCP 4.5 expressing a warming of 3.4 °F (1.9 °C). RCP 8.5 expresses a greater warming of 4.6 °F (2.6 °C) for this period.

PRECIP varies between emission scenarios and over time due to larger interconnected ocean-atmosphere dynamics associated with the NCAR CCSM model. For 2030, the RCP 4.5 scenario projects an increase in PRECIP of 22% while RCP 8.5 shows an increase of 8%. For 2050, RCP 4.5 projects an increase in PRECIP of 15% while RCP 8.5 shows a smaller increase of 7%.

Table 2-2 Summary of historical and projected climate data.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	21.5	26.3	24.8	23.2	22.9
TMIN (°F)	51.8	54.0	54.7	54.5	56.2
TMAX (°F)	78.8	81.2	82.6	81.9	83.7
TAVE (°F)	65.3	67.6	68.7	68.2	69.9
GDD (°F)	6455	6993	7204	7095	7433
HOTDAYS	104.4	132.5	141.6	135.3	150.8
WETDAYS	0.4	0.7	0.2	0.0	0.1

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

2.2.2 Landforms

Region and County

GAFB lies within the Rolling Plains physiographic province, a region characterized by a level to very gently rolling topography. Tom Green County, located near the northern edge of the Edwards Plateau, can be divided into three regions: (1) low to moderate hills 2,000-2,500 feet in elevation along the county's northern, western and southern boundaries; (2) river valleys formed by the North, Middle, and South Concho Rivers and their tributaries; and (3), the Lipan Flat (a broad, flat plain covering the center of the county east of San Angelo and south of the Concho River). The county's highest elevation (2,603 feet) is near its southwest corner. The lowest elevation (1,645 feet) is in the Concho River basin at the county's northeast corner.

Goodfellow AFB

The base lies east of the South Concho River as it flows to its confluence with the North Concho River, less than a mile north of the base, to create the Concho River. Elevations range from 1,834 feet in the northern-central portion of the base to 1,880 feet in the south-central portion. The former airfield area east of Kearney Blvd. has the greatest elevation change but the percent slope is small, generally 0.1% to 1.0%. The cantonment area has slightly more relief, generally from 0.4% to 8%. No major natural surface features, either depressions or rises, break the view as one stands at the southern boundary of the base looking north across the former airfield area.

2.2.3 Geology and Soils

Geology

GAFB lies on a bedrock surface formed on the Choza formation. This formation developed in the Pleistocene Epoch and in more recent times. Alluvium of the Leona Formation mantles the surface and obscures the bedrock. Depth to bedrock is from 5 to 20+ feet. The rockbed dips to the west-northwest. The Choza formation, uppermost unit of the Clear Fork Group, is about 625 feet thick, and composed of red, green-blue, and yellow shale, silty clay, and beds of gray dolomitic limestone. The shale and clay layers make up most of the formation. Most of the dolomitic limestone beds range from a few inches to about 2 feet in thickness. Beds 5 to 15 feet thick, however, occur about 30 to 50 feet below the top and also near the base of the formation. The Choza formation trends north-south in a belt 10 to 14 miles wide in the eastern part of the county.

Soils

The soils of GAFB are typical of the surrounding area, and are considered most suitable for grazing and ranchland.

Landscapes at GAFB are dominated by Cho, Mereta, and Angelo soils, minor soils in the association are Tulia, Olton, Estacado, Rotan, Slaughter, and Owens soils. In general, the association is characterized by very shallow to deep, nearly level to sloping and undulating, clayey and calcareous soils of outwash plains in broad valleys of the Concho River and its tributaries. The association is predominantly in rangeland. Properties of the three primary soils are summarized in this section. Further information on the soils' characteristics and limitations can be found in the U.S. Department of Agriculture (USDA), Soil Conservation Service Soil Survey of Tom Green County, Texas (1976), an updated version of the soil survey and interactive maps can be found online at http://websoilsurvey.sc.egov.usda.gov.

Overall, soils at GAFB are moderately alkaline, possess permeabilities ranging from 0.2 to 2.0 inches/hour (in/hr) and exhibit moderate runoff potentials. Information on each major soil series is given below, and Table 2-3 shows comparison between the types.

ANGELO SERIES: Nearly level to gently sloping soils on smooth outwash plains.

- Profile— In representative profile the surface layer is dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of 92 inches. The upper 6 inches is grayish-brown clay loam; the next 16 inches is reddish brown clay; the next 30 inches is pink silty clay loam; and the lower 34 inches is reddish-yellow clay loam.
- Properties—These soils are well drained and have slow surface runoff. Permeability is 0.2 to 2.0 in/hr. The pH range is 7.9 to 8.4. Angelo soil is in hydrologic unit "C".

CHO SERIES: Nearly level to moderately sloping soils on outwash plains.

- Profile—In representative profile the surface layer of Cho series soils is dark brown gravelly loam about 10 inches thick. The next layer is pinkish white, indurated caliche about 4 inches thick. Below the indurated caliche is pink loam layer that extends to a depth of 60 inches.
- Properties—Cho soils are well drained, and surface runoff is medium. Permeability is 0.6 to 2.0 in/hr. The pH is 7.9 to 8.4. The hydrologic unit for this soil type is "D". These soils are not suited to crops. They are mostly used as range and wildlife habitat.

MERETA SERIES: Nearly level to gently sloping soils on outwash plains.

- Profile—In a representative profile the surface layer is clay loam about 18 inches thick. It is dark brown in the upper 6 inches, dark grayish-brown in the middle 6 inches, and brown in the lower 6 inches. The underlying material extends to a depth of 87 inches or more. The upper 3 inches is pinkish-white indurated caliche; the next 57 inches is pink silty clay loam, and the lower 9 inches is light reddish-brown clay loam.
- Properties—Mereta soils are well drained and have slow surface runoff. Permeability ranges from 0.63 to 2.0 in/hr in the indurated caliche. The pH range is 7.9 to 8.4. The hydrologic unit for Mereta soil is "C". These soils are suited to crops or to use as range or wildlife habitat.

Table 2-3 Soil type characteristics.

Symbol	Soil Type	Slopes (%)	Permeability (inches per hour)	Reaction pH	Shrink-swell potential	Highly Erodible Lands (HEL)
AnA	Angelo clay loam	0–1	0.63–2.00	7.9–8.4	Moderate	N

Table 2-3 Soil type characteristics.

Symbol	Soil Type	Slopes (%)	Permeability (inches per hour)	Reaction pH	Shrink-swell potential	Highly Erodible Lands (HEL)
AuB	Angelo urban land complex	0–3	0.63–2.00	7.9–8.4	Moderate	Y
KmC	Cho association	Undulating	0.63–2.00	7.9–8.4	Low	N
KuD	Cho-urban land complex	1 to 8	0.63–2.00	7.9–8.4	Low	N
MeA	Mereta clay loam	0 to 1	0.20–0.63	7.9– 8.4	Moderate	Y
MeB	Mereta clay loam	1 to 3	0.20–0.63	7.9–8.4	Moderate	Y
MuB	Mereta urban land complex	0 to 3	0.20–0.63	7.9–8.4	Moderate	Y

2.2.4 Hydrology

Tom Green County

Surface water plays an important role in the San Angelo area, both for domestic and recreational use. Surface water that is currently used for these purposes is generally considered of acceptable quality. The principal streams in Tom Green County are the Concho River and its main tributaries: the North, Middle, and South Concho Rivers. The South Concho River is a clear, permanent stream fed by a series of springs located in the limestone hills about 30 miles to the south of GAFB. The North and Middle Concho, although formerly perennial streams, have recently been dry for periods of time since many of the springs in the county have dried up. The decrease in the water table has resulted from both an increase in mesquite trees on the watersheds and the withdrawal of water for agricultural irrigation. An extensive brush/mesquite control project began in 1999 on the North Concho system in an attempt to restore the historical flow to that river. It will require significant time for this project to be fully implemented. The three tributaries converge in San Angelo to form the main Concho River. The Middle Concho and South Concho Rivers empty into Twin Buttes Reservoir west of the city which empties into Lake Nasworthy. The subsequent flow from Lake Nasworthy is the South Concho River. The confluence of the North and South Concho Rivers is less than a mile north of the base at the Bell Street dam.

Of historical note, there have been three notable floods which did significant damage in the San Angelo area. In August 1882, a flood on the South Concho River killed sixty-five people and destroyed the town of Ben Ficklin, which was located within the city limits of present day San Angelo, only about three miles from GAFB. This caused San Angelo to be designated as the county seat. In August 1906, another flood took nine lives and flooded most of downtown San Angelo, and then in September 1936, "the flood" left 1,500 people homeless and did millions of dollars of damage. The fundamental decision that San Angelo needed protection from devastating floods led to the construction of the dams that created the local lakes.

Three major surface water reservoirs of the area are established along the tributaries of the Concho River. O.C. Fisher Lake is on the North Concho. Twin Buttes Reservoir was constructed on both the Middle and South Concho Rivers. Lake Nasworthy is situated downstream of the Twin Buttes Reservoir. The three reservoirs provide most of the domestic water for the City of San Angelo and, in turn, GAFB, which obtains potable water from the city's system. In addition, Lake E.V. Spence, northwest of the town of Robert Lee, Texas, is used as a supplemental source during periods of water shortage. The city has also contracted with

the Colorado River Municipal Water District for water from the O.H. Ivie Reservoir located 40 miles to the east. Although the City of San Angelo derives its water supply almost exclusively from these surface water developments, most residents outside the city use private ground-water sources for domestic or other uses.

Goodfellow AFB

No permanent surface water impoundments, natural or man-made, exist on the GAFB main installation. Surface drainage ditches and depressions do temporarily contain water during periods of adequate precipitation. The quality of storm water runoff in this or any developed area is generally degraded. Non-point sources of oil, grease, dirt, litter, leaves, pesticide or herbicide residues, fertilizers, and animal droppings typically affect the quality of storm-water runoff.

While there are no well-developed natural surface drainage features such as ditches or creeks, GAFB can be divided into five watershed areas. Kearney Blvd basically divides the base in half, physically and topographically, and is a drainage basin in itself. The western portion of the base from Kearney has three different areas and the eastern portion is a single area.

- The former airfield area on the east side of the base is generally a single drainage area. Due to a system of catch basins and underground drainage pipes that were installed to manage surface runoff while the airfield was in operation, the surface runoff from most of the area is diverted to a set of open collection ditches. These ditches run along the northern and eastern boundaries of the base, channeling runoff to a location in the north-central portion of the base where the surface runoff leaves the installation property. Base responsibility continues from the outfall on Paint Rock road, along a drainage easement 1,400 feet to Era Street. This easement is not carried on the base real property records and neither is acreage for the river pump and water line. The City maintains the easements from Era St. to the Concho River.

- This area also includes the fire training school. Their drainage system is a mini-drainage area within this entire area. The runoff at the school is managed separately to reduce pollution influences on the runoff and to support a recycled water system used for the fire training.

- The northwest side of the base which has both an underground storm water collection system and street drainage is concentrated around Bldg 504 where several outlets converge into an open, earthen ditch. This ditch runs along the west perimeter fence to an outlet at the intersection of Bell Street and Paint Rock Road, where it enters the South Concho River, just above the Bell Street dam.

- The middle western portion of the base involves the area including and around the privatized housing, called Concho Pearl (formerly Lanham Housing). All of this area is involved in the project to repair the drainage system and divert the water into the west retention pond. This pond was constructed in 1998 and will retain 47 acre feet of water. There is the capability for excess water to backfill the 48" outlet pipe and drainage ditch from family housing. There are also some drainage berms on the south side of the pond which will contain water if the pond overflows. As previously described, currently the drainage from Concho Pearl empties on the off-base LaSalle Street. Other drainage from around the housing, empties into the field north of the Clinic, where the collection ditch is now located. The ditch was constructed with the retention pond under Phase I of the Repair Storm Water Drainage MFH project.

- The southwest area is another system of both underground storm water sewers and street drainage. The discharge is concentrated around Building 910, where it exits the base on private property. A pipeline was installed under the intersection of Mitchell St and Ft. Stockton Ave in April 2000 to connect the open drainage ditch on the base side with a culvert off-base.

- The last drainage basin is along Kearney Blvd. Runoff from facilities along this roadway is

collected in an underground system. For the area on the south end of Kearney, the runoff is collected in an east storm water detention pond. The water is released from this pond and piped to the north detention pond. From here, any overflow is directed into the city storm water system and the remainder is left in the pond. This pond had held water continuously for several years and even supported a population of several species of fish. It is also the primary bird attraction on the base, being the identification location for 26 of the 65 bird species identified on base. The pond started drying out in 1996, and has been intermittently holding water.

There are no flood plains on GAFB as shown on the Flood Hazard Boundary Maps. The north storm water drainage outlet across Paint Rock Road is approximately 600 feet from a Zone A (100-year flood) area of the Concho River. The west boundary of the base is also approximately 600 feet from a Zone B (500-year flood) area of the South Concho River.

Other than the seasonal and temporary detention and retention ponds associated with the storm water runoff as described in Section 2.3.5, there are no permanent bodies of water on GAFB.

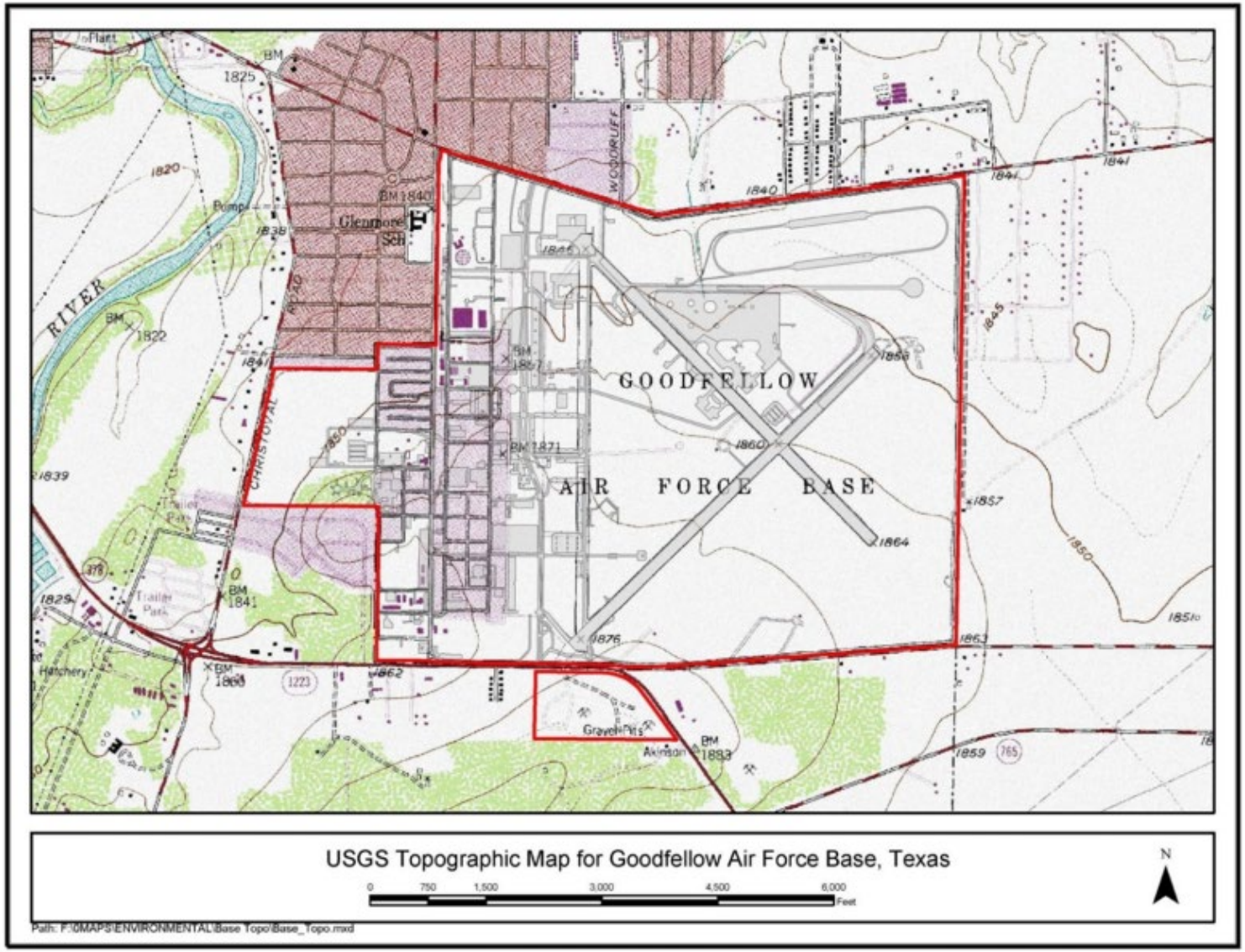

Figure 2-2 U.S. Geological Survey (USGS) topographic map, Goodfellow AFB, TX.

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

Tom Green County is the center of what is locally referred to as the Concho Valley. This area includes the neighboring counties of Sterling, Irion, and Concho, and portions of Schleicher, Glasscock, and Reagan counties. These counties are the drainage area for the Concho River system. This river system includes the North, Middle, and South Concho Rivers, and Spring and Dove Creeks. In addition to being in a climatic transition area, the Concho Valley is also in an ecotone between two biotic regions; where the Edwards Plateau surrounds a westward extension of the grasslands of the Rolling Plains. A diversity of habitats occurs in the area, from grasslands, riparian areas, and the live oak/mesquite/red berry juniper savanna typical of the Edwards Plateau.

2.3.2 Vegetation

2.3.2.1 Historic Vegetation Cover

Historically, GAFB was grassland composed of mid and short grasses with scattered shrubs that evolved under the influence of grazing, fire and drastic fluctuations in precipitations, in the form of droughts that could last several years. There appear to be only four mesquite trees, near the west boundary of the base and the original ranch house, that are old enough to be present when the base began in 1941. More detailed information about the historical climax plant community is available on the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS) website at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/ or at the local NRCS office.

2.3.2.2 Current Vegetation Cover

Native vegetative cover can be found around the clinic and in the former airfield area. Primarily these are grasses, but also include various forbs and shrubs. Mesquite trees and prickly pear have become established in the past several years and have taken over areas in some instances. A list of plants found in the unimproved areas of the base is located in Appendix 1.

2.3.2.3 Future Vegetation Cover

Two primary natural ecosystems on GAFB were identified by CSU CEMML using the USGS National GAP Analysis Land Cover 2011 classification: grasslands and shrublands mixture and woodland and shrubland mixture (CEMML 2019). Natural ecosystems as well as developed land and crop/pasture areas are summarized in Table 2-4.

Climate change impacts to grassland and shrubland ecosystems could include increased seasonal, annual, minimum, and maximum temperatures, as well as changing precipitation patterns. Because these ecosystems are relatively dry with a strong seasonal climate, they are sensitive to climatic changes and vulnerable to shifts in climatic regime.

Table 2-4 Ecosystem coverage by area.

Ecosystem Type	Area (acres)	Coverage (%)
Woodland & Shrubland	485.0	40.0
Grassland & Shrubland	41.2	3.4
Developed & Crops/Pasture	684.6	56.5

Slight changes in temperature and precipitation can substantially alter the composition, distribution, and abundance of species, and the products and services they provide. The extent of these changes will also depend on changes in precipitation and fire regimes. Increased drought frequency could also cause major

changes in vegetation cover. Losses of vegetative cover coupled with increases in precipitation intensity and climate-induced reductions in soil aggregate stability will dramatically increase potential erosion rates. The combination of eroded sediment transport to streams coupled with changes in the timing and magnitude of minimum and maximum flows can affect water quality, riparian vegetation, and aquatic fauna.

Rising temperatures will enhance soil decomposition, and, together with reductions in rainfall, may also reduce plant productivity in large areas, such as woodlands. Changes in climate may also alter important biomes such as forests (Ovaskainen et al., 2013).

Woodland areas are susceptible to climate change. There is a temperature below which the equilibrium state of woodlands appears constant, but above which cover declines steadily. This threshold represents a point where some degree of tree loss is inevitable. As the threshold is exceeded, there is a gradual increase in the committed die-back, with changes that are more progressive than sudden. Woodland vegetation at GAFB may experience some degree of die-back before impacts are observed (Moss et al., 2008).

2.3.2.4 Turf and Landscaped Areas

Areas around facilities are usually landscaped and classified as “improved grounds”. This also includes Kearney Blvd, the main access to the base.

The predominant grass in the improved areas of base is Bermuda grass although buffalo grass can be found in certain maintained areas. The majority of trees in these same areas are pecan, red oak and live oak. Several species of shrubs have been used in landscaping over the years, the most predominant and conspicuous of these are purple sage and red yucca.

Xeriscaping which combines the use of plants adapted to the area, mulch, and drip irrigation is encouraged to minimize water usage. A recommended plant list for the base can be found in Appendix 2.

In accordance with AETCI32-7065, trees and shrubs planted in the cantonment area will be indigenous to the region and will be selected based on life expectancy and physical attributes (e.g. water consumption, maintenance required, shade provided). Replacement of damaged trees or trees removed during construction projects will be replaced according to the same guidance.

2.3.3 Fish and Wildlife

Several scientific papers are available which detail plants and animals of Tom Green County and the surrounding Concho Valley. *The Mammals of Tom Green County, Texas* (Boyd et al. 1997) describes the collection and records of 48 species of mammals found in the county, plus an additional five species, the gray wolf (*Canis lupis*), bison (*Bison bison*), pronghorn (*Antilocapra americana*), black-tailed prairie dog (*Cynomys ludovicianus*), and the northern grasshopper mouse (*Onychomys leucogaster*), which had been extirpated from the county. Historical accounts by early settlers and travelers mention great herds of bison, large flocks of prairie hens, and other predators such as mountain lions and black bear in the area.

A Field Checklist Birds of the Concho Valley Region, Texas lists 332 species of birds which have been recorded in the Concho Valley since 1980. There are 114 confirmed nesting species and 14 more suspected nesting species.

The TPWD completed a survey of biological species on GAFB in April 1995 (though no copy of this can be found and TPWD does not maintain these records for more than 10 years). Current local surveys maintained by base personnel since 1996 have visually identified 12 species of reptiles and amphibians, 65 species of birds, and 16 mammals on base. A new survey of plants and animals on the base should be completed to ensure biological diversity. Species lists maintained by the base are available in Appendix 1.

The Texas horned lizard, a Texas state listed threatened species, is of particular interest to local personnel because of regional interest in the declining lizard populations. The species is seen frequently on base,

which presents a unique opportunity to preserve an otherwise at-risk species. Populations across Texas have been impacted by urbanization, agriculture, and, in some cases, imported red fire ants. Texas horned lizards are found more often in native grassland, mixed grass and shrub communities, or in improved grasslands. Their preferred food source is native harvester ants (TPWD 2008). Continued management of their habitat and control of non-native fire ants could have positive impacts for species population levels. Additional species monitoring is needed to understand population dynamics and habitat use on the installation.

GAFB is located within the migratory bird Central Flyway. The Flyway is the largest in North America, stretching for more than 5,000 miles from the Arctic to South America (Johnsgard 2012). About 400 bird species rely on the diverse habitats of the Central Flyway for annual migrations (BirdLife International, 2010). Since 1970, migratory bird populations have declined 29%. This is in large part due to habitat loss and fragmentation, human-caused mortalities such as infrastructure and vehicle collisions, and climate change impacts. T&E species identified in Tom Green County such as the chestnut-collared longspur (*Calcarius ornatus*), lark bunting (*Calamospiza melanocorys*), Franklin's gull (*Leucophaeus pipixcan*), mountain plover (*Charadrius montanus*), and zone-tailed hawk (*Buteo albonotatus*) all use the Central Flyway during their annual migrations (TPWD 2021; Cornell Lab of Ornithology 2019). However, there is limited habitat for migratory birds on GAFB. The Migratory Bird Treaty Act (MBTA) implements various treaties for the protection of migratory birds, so a biological survey is undertaken whenever a new project is initiated on the installation to determine any potential impacts on migratory bird species. If migratory birds and/or their habitat are detected, steps are taken to mitigate impacts.

The Central Flyway is also a critical migration corridor for Monarch butterfly (*Danaus plexippus*), currently a candidate species for listing (Howard 2019). Central Texas is a significant segment of the Monarch migration path, as it is where the monarch Central Flyway converges with Coastal Flyways to form one single migration path to their wintering grounds in Mexico. Once abundant in their range across North America, monarch populations have undergone significant declines in recent decades. Major causes for the monarch's decline are reduced forage (Inamine et al., 2016), high mortality rates during migration (Badgett and Davis 2015), habitat loss/fragmentation (Pleasants and Oberhauser 2013), and exposure to chemicals (Pecenka and Lundgren 2015). Increasing volatility in weather patterns at overwintering sites (Barve et al., 2012) and altered breeding habitats (Batalden et al. 2007) due to climate change will likely further the decline of the monarch butterfly.

The Texas pimpleback (*Cyclonaias petrina*), also a candidate species, is of importance due to GAFB proximity to occupied habitat along the Concho River. Freshwater mussels in Texas face an array of threats such as water diversions, sedimentation and degraded water quality. Though there is currently no on-site habitat, potential impacts from GAFB may still exist through polluted run-off inputs or erosion. As of October of 2021, 494.7 miles of the Concho River is being considered by the USFWS for habitat protection (DOI 2021). Listing of the Texas pimpleback and its Concho River habitat may require mitigation efforts by GAFB under Section 7 of the ESA.

Climate Impacts on Fish and Wildlife

Climate change is not anticipated to result in large direct impacts to fish and wildlife populations on the installation. Most species that inhabit GAFB are widespread generalists that can tolerate a wide range of environmental conditions; however, increasing temperatures at GAFB could result in indirect threats to wildlife. In particular, migratory birds may be indirectly vulnerable to rising temperatures because many birds time their spring migrations to coincide with the emergence of insects. Rising temperatures will prompt insects to emerge earlier, and birds migrating to GAFB may miss a major feeding opportunity, resulting in decreased bird populations (Both et al. 2010).

Changing climate also has the potential to alter vegetation communities, which could have a negative impact on specialist wildlife species that have historically depended on specific native plant species for their survival (Dukes and Mooney 1999). Changing conditions may also create open niches for non-native

invasive species to expand onto GAFB. Newly arriving invasive species often have the ability to outcompete native species that are already experiencing reduced fitness due to shifting environmental conditions (Hellmann et al. 2008). Rising temperatures could also increase the potential for foodborne diseases and incidences of infectious diseases of animals that are transmittable to humans, particularly those carried by foxes, rodents and arthropods such as rabies and West Nile virus (Parkinson and Butler 2005).

Increasing precipitation could have a positive impact on amphibian species inhabiting GAFB, but this benefit may be offset by higher evapotranspiration rates due to increasing temperatures. Increasing air temperature could also have a negative impact on water quality by increasing water temperatures. As water temperatures rise in lentic systems, dissolved oxygen content will lower, decreasing habitat quality, particularly for larval amphibians and aquatic macroinvertebrates. Increased water temperatures will also raise the potential for algal blooms, further depleting dissolved oxygen content and decreasing habitat suitability for amphibians (Paerl et al. 2011).

2.3.4 Threatened and Endangered Species and Species of Concern

Updated plant and animal listings obtained from online listings have revised the species previously described as threatened or endangered in earlier GAFB environmental assessments. We have included a list of federally listed species found in Tom Green County (Table 2-5) and state T&E species (Table 2-6) below.

Table 2-5 Listed species believed or known to occur in Tom Green County, Texas (USFWS 2021)

Scientific Name	Common Name	Listed Population	Group	Status
Danaus plexippus	Monarch butterfly	Wherever found	Insects	Candidate
Calidris canutus rufa	Red knot	Wherever found	Birds	Threatened
Vireo atricapilla	Black-capped Vireo	Wherever found	Birds	Recovery (Delisted)
Haliaeetus leucocephalus	Bald eagle	U.S.A., conterminous (lower 48) States.	Birds	Recovery (Delisted)
Quadrula petrina	Texas pimpleback	Wherever found	Clams	Candidate
Lampsilis bracteata	Texas fatmucket	Wherever found	Clams	Candidate
Sterna antillarum	Least tern	U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA, Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX except within 50 miles of coast)	Birds	Recovery (Delisted)
Nerodia paucimaculata	Concho water snake	Wherever found	Reptiles	Recovery (Delisted)

Table 2-6 Rare, threatened, and endangered species of Texas (TPWD 2021).

Scientific Name	Common Name	Habitat Description	Group	Status
Bombus pensylvanicus	American bumblebee	Habitat description is not available at this time.	Insects	Unranked
Haliaeetus leucocephalus	Bald eagle	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	Birds	Vulnerable
Ursus americanus	Black bear	Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.	Mammals	Vulnerable
Vireo atricapilla	Black-capped vireo	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer	Birds	Vulnerable
Cynomys ludovicianus	Black-tailed prairie dog	Dry, flat, short grasslands with low, relatively sparse vegetation, including areas overgrazed by cattle; live in large family groups	Mammals	Vulnerable
Nerodia harteri	Brazos water snake	Aquatic: Shallow, fast-flowing water with a rocky or gravelly substrate preferred. Adults can be found in deep water with mud bottoms, such as large sections of rivers and reservoirs. Riffle habitat is particularly important for this species.	Reptiles	Threatened

Scientific Name	Common Name	Habitat Description	Group	Status
Myotis velifer	Cave myotis bat	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore.	Mammals	Imperiled
Calcarius ornatus	Chestnut-collared longspur	According to Partners in Flight's Landbird Conservation Plan (2016), this species has a continental decline of 85%. Occurs in open shortgrass settings especially in patches with some bare ground. Also occurs in grain sorghum fields and Conservation Reserve Program lands	Birds	Vulnerable
Dionda sp. 3	Colorado roundnose minnow	Endemic to San Saba and Concho rivers, northern Colorado river drainage; primarily restricted to clear spring-fed waters that have slight temperature variations.	Fish	Unranked
Buteogallus anthracinus	Common black-hawk	Cottonwood-lined rivers and streams; willow tree groves on the lower Rio Grande floodplain; formerly bred in south Texas	Birds	Threatened
Nerodia paucimaculata	Concho water snake	Aquatic: Shallow, fast-flowing water with a rocky or gravelly substrate preferred. Adults can be found in deep water with mud bottoms, such as large sections of rivers and reservoirs. Riffle habitat is particularly important for this species.	Reptiles	Critically Imperiled

Scientific Name	Common Name	Habitat Description	Group	Status
Lasiurus borealis	Eastern red bat	Red bats are migratory bats that are common across Texas. They are most common in the eastern and central parts of the state, due to their requirement of forests for foliage roosting. West Texas specimens are associated with forested areas (cottonwoods). Also common along the coastline. These bats are highly mobile, seasonally migratory, and practice a type of wandering migration". Associations with specific habitat is difficult unless specific migratory stopover sites or wintering grounds are found. Likely associated with any forested area in East	Mammals	Apparently Secure
Spilogale putorius interrupta	Eastern spotted skunk	Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. *Spilogale putorius interrupta* found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.	Mammals	Critically Imperiled
Leucophaeus pipixcan	Franklin's gull	This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shores, or islands to roost for the night.	Birds	Imperiled

Scientific Name	Common Name	Habitat Description	Group	Status
Micropterus treculii	Guadalupe bass	Endemic to the streams of the northern and eastern Edwards Plateau including portions of the Brazos, Colorado, Guadalupe, and San Antonio basins; species also found outside of the Edwards Plateau streams in decreased abundance, primarily in the lower Colorado River; two introduced populations have been established in the Nueces River system. A pure population was re-established in a portion of the Blanco River in 2014. Species prefers lentic environments but commonly taken in flowing water; numerous smaller fish occur in rapids, many times near eddies; large individuals found mainly in riffle tail races; usually found in spring-fed streams having clear water and relatively consistent temperatures.	Fish	Vulnerable
Penstemon guadalupensis	Guadalupe beardtongue	Scattered in calcareous prairies on the Lampasas Cutplain and Edwards Plateau; Perennial; Flowering/Fruiting March-July	Plants	Vulnerable
Penstemon triflorus var. integrifolius	Heller's beardtongue	Occurs sparingly on rock outcrops and in grasslands associated with juniper-oak woodlands (Carr 2015).	Plants	Imperiled
Argythamnia aphoroides	Hill Country wild-mercury	Mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes; Perennial; Flowering April-May with fruit persisting until midsummer	Plants	Vulnerable
Lasiurus cinereus	Hoary bat	Hoary bats are highly migratory, high-flying bats that have been noted throughout the state. Females are known to migrate to Mexico in the winter, males tend to remain further north and may stay in Texas year-round. Commonly associated with forests (foliage roosting species) but are found in unforested parts of the state and lowland deserts. Tend to be captured over water and large, open flyways.	Mammals	Apparently Secure

Scientific Name	Common Name	Habitat Description	Group	Status
Sternula antillarum athalassos	Interior least tern	Sand beaches, flats, bays, inlets, lagoons, islands. Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony	Birds	Delisted
Vulpes macrotis	Kit fox	Open desert grassland; avoids rugged, rocky terrain and wooded areas.	Mammals	Critically Imperiled
Calamospiza melanocorys	Lark bunting	According to Partners in Flight's Landbird Conservation Plan (2016), this species has a continental decline of 86%. Overall, it's a generalist in most short grassland settings including ones with some brushy component plus certain agricultural lands that include grain sorghum. Short grasses include sideoats and blue gramas, sand dropseed, prairie junegrass (Koeleria), buffalograss also with patches of bluestem and other mid-grass species. This bunting will frequent smaller patches of grasses or disturbed patches of grasses including rural yards. It also uses weedy fields surrounding playas. This species avoids urban areas and cotton fields.	Birds	Apparently Secure
Mustela frenata	Long-tailed weasel	Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.	Mammals	Secure
Puma concolor	Mountain lion	Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.	Mammals	Imperiled
Charadrius montanus	Mountain plover	Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous	Birds	Imperiled

Scientific Name	Common Name	Habitat Description	Group	Status
Holbrookia lacerata	Plateau spot-tailed earless lizard	Terrestrial: Habitats include moderately open prairie-brushland regions, particularly fairly flat areas free of vegetation or other obstructions (e.g., open meadows, old and new fields, graded roadways, cleared and disturbed areas, prairie savanna, and active agriculture including row crops); also, oak-juniper woodlands and mesquite-prickly pear associations (Axtell 1968, Bartlett and Bartlett 1999).	Reptiles	Imperiled
Gaura triangulata	Prairie butterfly-weed	Open sandy areas; Annual; Flowering March-June	Plants	Vulnerable
Antilocapra americana	Pronghorn	Prefers hilly & plateau areas of open grassland, desert-grassland, & desert-scrub, where it frequents south-facing slopes & other sheltered areas.	Mammals	Secure
Vitis rupestris	Rock grape	Occurs on rocky limestone slopes and in streambeds; Perennial; Flowering March-May; Fruiting May-July	Plants	Critically Imperiled
Phrynosoma modestum	Roundtail Horned Lizard	This species seems to prefer rocky or gravelly substrates in open areas that are sparsely vegetated.	Reptiles	Secure
Apalone mutica	Smooth softshell	Aquatic: Large rivers and streams; in some areas also found in lakes and impoundments (Ernst and Barbour 1972). Usually in water with sandy or mud bottom and few aquatic plants. Often basks on sand bars and mudflats at edge of water. Eggs are laid in nests dug in high open sandbars and banks close to water, usually within 90 m of water (Fitch and Plummer 1975).	Reptiles	Vulnerable
Lampsilis bracteata	Texas Fatmucket	Reported to occur in slow to moderate current in sand, mud, and gravel substrates among large cobble, boulders, bedrock ledges, horizontal cracks in bedrock slabs, and macrophyte beds. Has also been observed inhabiting the roots of cypress trees and vegetation along steep banks. Past authorities have reported this species intolerant of reservoir conditions but recent surveys suggest it may persist in some impoundment conditions (Howells 2010c; Randklev et al. 2017b). [Mussel of Texas 2019]	Mollusks	Threatened

Scientific Name	Common Name	Habitat Description	Group	Status
Truncilla macrodon	Texas Fawnsfoot	Occurs in large rivers but may also be found in medium-sized streams. Is found in protected near shore areas such as banks and backwaters but also riffles and point bar habitats with low to moderate water velocities. Typically occurs in substrates of mud, sandy mud, gravel and cobble. Considered intolerant of reservoirs (Randklev et al. 2010; Howells 2010o; Randklev et al. 2014b,c; Randklev et al. 2017a,b). [Mussels of Texas 2019]	Mollusks	Threatened
Phrynosoma cornutum	Texas horned lizard	Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.	Reptiles	Threatened
Graptemys versa	Texas map turtle	Aquatic: Primarily a river turtle but can also be found in reservoirs. Can be found in deep and shallow water with sufficient basking sites (emergent rocks and woody debris).	Reptiles	Unranked
Cyclonaias petrina	Texas Pimpleback	Occurs in medium-size streams to large rivers primarily in riffles and runs. Often found in substrates composed of sand, gravel, and cobble, including mud-silt or gravel-filled cracks in bedrock slabs. Considered intolerant of reservoirs (Howells 2010m; Randklev et al. 2017b). [Mussels of Texas 2019]	Mollusks	Threatened
Notropis amabilis	Texas shiner	In Texas, it is found primarily in Edwards Plateau streams from the San Gabriel River in the east to the Pecos River in the west. Typical habitat includes rocky or sandy runs, as well as pools.	Fish	Apparently Secure
Perimyotis subflavus	Tricolored bat	Forest, woodland and riparian areas are important. Caves are very important to this species.	Mammals	Vulnerable
Crataegus turnerorum	Turner's hawthorn	Brush, dwarf oak scrub, stream banks, 300-600 m elevation; Perennial; Flowering April-June; Fruiting April-Sept	Plants	Vulnerable

Scientific Name	Common Name	Habitat Description	Group	Status
Terrapene ornata	Western box turtle	Terrestrial: Ornate or western box turtles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) (Converse et al. 2002) or enter burrows made by other species.	Reptiles	Vulnerable
Athene cunicularia hypugaea	Western burrowing owl	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows	Birds	Imperiled
Heterodon nasicus	Western hognose snake	Terrestrial: Shortgrass or mixed grass prairie, with gravel or sandy soils. Often found associated with draws, floodplains, and more mesic habitats within the arid landscape. Frequently occurs in shrub encroached grasslands.	Reptiles	Apparently Secure
Conepatus leuconotus	Western hog-nosed skunk	Habitats include woodlands, grasslands & deserts, to 7200 feet, most common in rugged, rocky canyon country; little is known about the habitat of the ssp. telmalestes	Mammals	Apparently Secure
Sistrurus tergeminus	Western massasauga	Terrestrial: Shortgrass or mixed grass prairie, with gravel or sandy soils. Often found associated with draws, floodplains, and more mesic habitats within the arid landscape. Frequently occurs in shrub encroached grasslands.	Reptiles	Vulnerable
Crotalus viridis	Western rattlesnake	Terrestrial: Dry desert and prairie grasslands, shrub desert rocky hillsides; edges of arid and semi-arid river breaks.	Reptiles	Secure
Spilogale gracilis	Western spotted skunk	Brushy canyons, rocky outcrops (rimrock) on hillsides and walls of canyons. In semi-arid brushlands in U.S., in wet tropical forests in Mexico. When inactive or bearing young, occupies den in rocks, burrow, hollow log, brush pile, or under building.	Mammals	Secure
Plegadis chihi	White-faced ibis	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.	Birds	Threatened

Scientific Name	Common Name	Habitat Description	Group	Status
Anaxyrus woodhousii	Woodhouse's toad	Terrestrial and aquatic: A wide variety of terrestrial habitats are used by this species, including forests, grasslands, and barrier island sand dunes. Aquatic habitats are equally varied.	Amphibians	Unranked
Buteo albonotatus	Zone-tailed hawk	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions	Birds	Threatened

2.3.5 Wetlands and Floodplains

Wetlands are areas that are covered by water, have waterlogged soils for significant periods during the growing season and support characteristic vegetation. No areas of GAFB remain covered in water for extended periods of time.

2.3.6 Other Natural Resource Information

No other biological inventories or surveys were conducted on the installation.

2.4 Mission and Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Currently there are few constraints to missions and mission planning. A few of the soil types found on base are considered highly erodible lands (HEL), during development on these lands GAFB will ensure best management practices (BMP) are used to mitigate potential erosion effects. Construction areas over one acre are mandated to have at a minimum a storm water pollution prevention plan prepared and implemented and in addition, if over five acres, must submit a notice of intent to the Texas Commission on Environmental Quality (TCEQ).

As stated previously, the encroaching and flourishing mesquite and prickly pear do affect areas used by the 344th MIBN at Camp Sentinel. Some areas are very hard to walk through due to the density and physiology of the plants. The increasing deer herd is another safety risk due to unpredictability of rutting males and vehicle strike hazards.

The installation restoration program (IRP) sites are possibly another constraint due to development restrictions on some of the sites. The IRP sites are covered in more depth in Section 2.4.3.

2.4.2 Land Use

As previously described, GAFB occupies 1,234 acres of land approximately 3 miles east-southeast of the city of San Angelo’s central business district. The base was originally divided into the airfield area of 840 acres on the east side of the base and the "cantonment" area of 212 acres on the west side. In 1953, a 65-acre parcel of land was purchased on the west side of base, originally intended for the construction of additional military family housing. In 1988, Kearney Blvd was constructed on what was originally the edge of the aircraft apron. This new roadway, which included new base entrance gates at each end, opened the expansion of the base to the east. Much of the base student housing and industrial areas are located in this area, in addition to the fire training center and Department of Transportation tire testing track. Two external easements — the recreation camp easement, and water line easement — add another 17.15 acres. Finally, in 2008, 100.8 acres was added for privatized housing known as Rio Concho Housing approximately 2 miles NE of the main base.

A land use plan has been developed to provide direction for the development and improvement of the base in which people can work and live in an efficient, aesthetic, and safe environment. This is accomplished through good planning principles, to include collocating compatible or similar types of land uses and separating incompatible land uses. Table 2-7 provides definitions of ten categories of GAFB land use.

Table 2-7 Land-use definitions.

Land-Use Category	Typical Facilities and Features
Training	Intelligence training, special instruments, and fire training facilities
Industrial	Civil engineering, maintenance shops, storage, transportation, warehousing
Administrative	Headquarters, civilian personnel, law center, security operations
Community–Commercial	Commissary, clubs, dining hall, recreation center, gym, theater, bowling alley and arts & crafts
Community–Service	Post office, library, chapel, child care center, education center
Medical	Clinic, medical storage
Housing– Accompanied	Concho Pearl, Rio Concho and Eagle Pass Housing
Housing–Unaccompanied	Housing for singles, visitor housing
Outdoor Recreation	Outdoor courts and fields, swimming pool
Open Space	Conservation area, buffer space, clear zones

Improved Grounds

Grounds on which personnel plan and perform intensive maintenance activities. These are developed areas of an installation that have lawns and landscape plantings requiring intensive maintenance. They usually include the cantonment area, parade grounds, athletic fields, and housing areas. GAFB has approximately 359 acres classified as improved. A grounds map is maintained by the 17 Civil Engineer Squadron.

Semi-Improved Grounds

Grounds where personnel perform periodic maintenance primarily for operational and aesthetic reasons (such as erosion and dust control, and visual clear zones). These usually include grounds adjacent to roadways, around the munitions storage facility, and other outlying facilities. GAFB has approximately 125 acres of semi-improved grounds.

Unimproved Grounds

Grounds where little or no maintenance is performed. GAFB has approximately 750 acres classified as unimproved. Most of the unimproved grounds are divided into smaller parcels, mostly separating training activities. The largest single parcel is only about 360 acres remaining in the southeast corner of the base. Until about 1985, the entire former airfield area, east of the apron, was kept maintained as semi-improved grounds and mowed regularly. The existing mesquite trees and other native brush and trees have grown unchecked since mowing ceased.

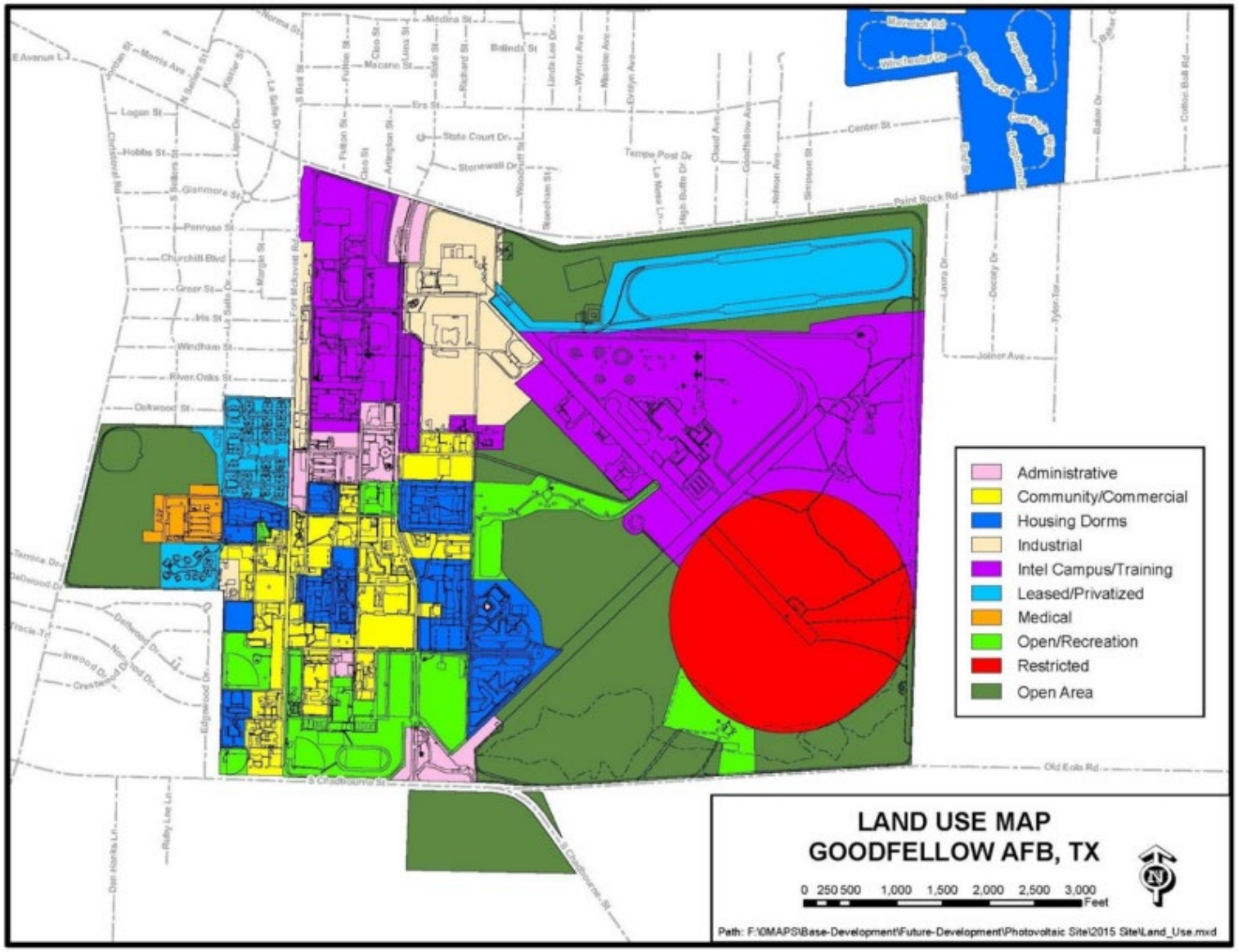

Figure 2-3 Land use at Goodfellow AFB.

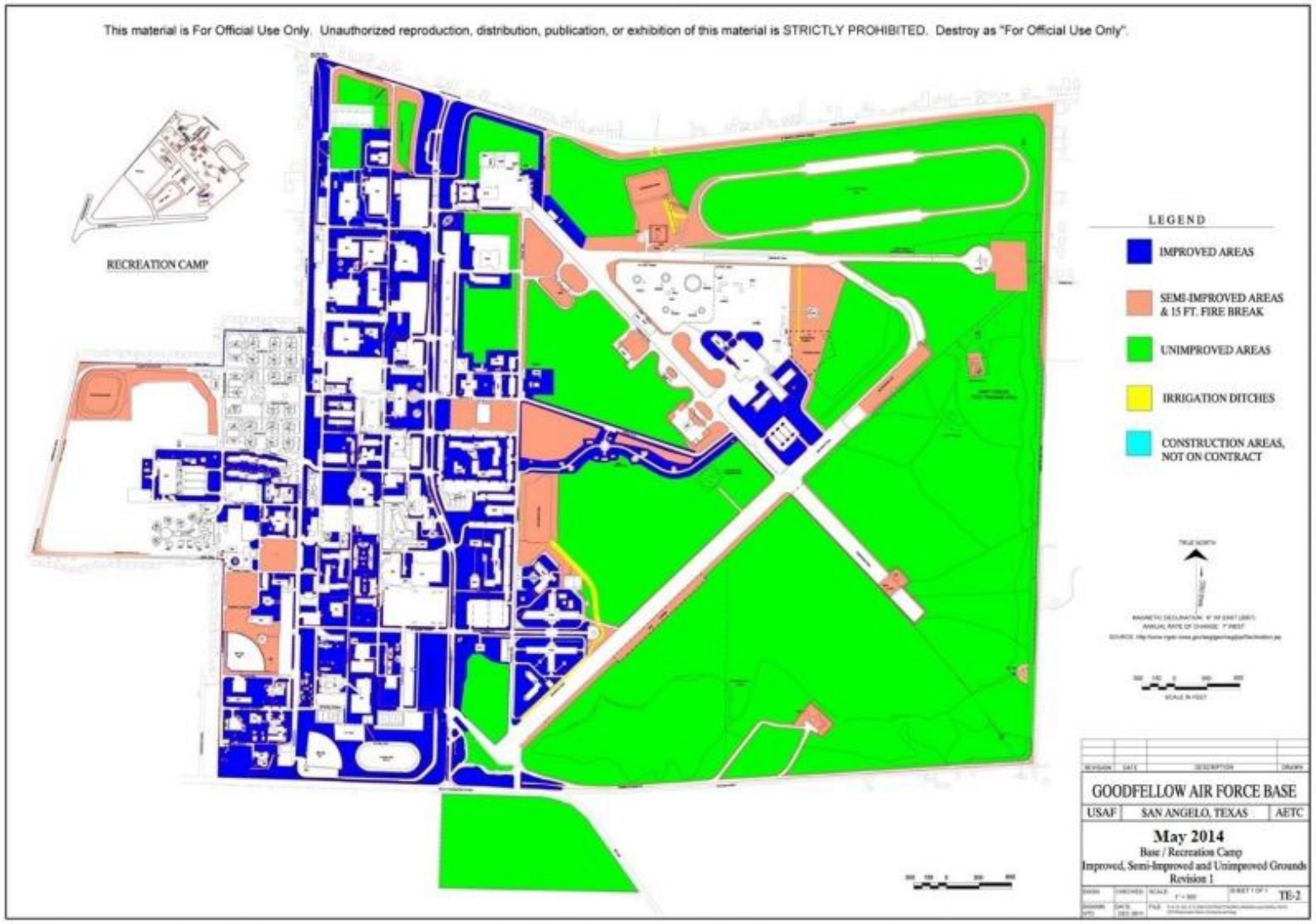

Figure 2-4 Grounds maintenance map.

2.4.3 Current Major Mission Impacts on Natural Resources

Air Quality

Regional Air Quality

Since neither Tom Green County, wherein GAFB is located, nor any of the surrounding counties (Coke, Runnels, Concho, Menard, Schleicher, Irion, and Sterling) have been designated as nonattainment or maintenance areas for any criteria pollutants, no baseline emissions inventories are available for the area immediately surrounding the base.

Base Emissions

A total of 325 air emission units at GAFB comprise the latest inventory. Based on 30 Texas Administrative Code (TAC), Section 101.10, GAFB is not a major stationary source based on the 1997 criteria pollutant emissions. Potential emissions of all criteria pollutants (particulate matter [PM, PM10 and PM2.5], lead [Pb], nitrogen oxides [NOx], carbon monoxide [CO], volatile organic compounds [VOCs], and sulfur oxides [SOx]) do not exceed the 100 tons per year major source threshold. GAFB is also not considered a major stationary source for the emission of hazardous air pollutants (HAPs) because potential emissions were below the individual 10 tons per year and aggregate 25 tons per year emissions thresholds. The maximum actual annual contribution for any single HAP was 0.36 tons for toluene, which is less than the 10-tons-per-year threshold. The total actual HAPs were 1.08 tons per year. GAFB maintains one NSR Air Permit for the indoor firing range.

Storm Water

GAFB maintains a municipal separate storm sewer system (MS4) permit and multi-sector general permit (MSGP) non-exposure certifications through TCEQ. By maintaining MSGP non-exposure certifications, GAFB does not need to apply a full MSGP. Minor pollution of the storm water occurs from runoff from parking lots or when various materials (e.g. engine coolant, oil) are improperly disposed of in dumpsters. All incoming personnel to GAFB are given storm water pollution training to limit this occurrence. Storm water pamphlets are also given out during earth week and other base activities throughout the year. Shops with MSGP non-exposure certification are spot checked at regular intervals.

Construction storm water permits are required by TCEQ when a planned project disturbs more than 5 acres of land. The contractor is responsible for filing for the permit and adhering to the regulations of the permit. GAFB's environmental element receives a copy of the permit and reserves the right to halt all activity on the sight if the contractor is not following BMP.

Air Installation Compatible Use Zone (AICUZ)

Active aircraft operations at GAFB have been permanently suspended for 63 years as of 2021. Pilot training ceased in 1958. Another mission from 1958-1971 supporting atmospheric air sampling using helium-filled balloons used a variety of support aircraft. These aircraft included H-21 helicopters and U-6A, C-47, C-130, and Piper Cherokee 100 aircraft. There was also an "unofficial" aeroclub operated in the early 1980s which used two or three small private aircraft.

Since GAFB does not have a flying mission, AICUZ or other noise problems associated with airfield operations are not an issue. GAFB has an Installation Encroachment Management Team that addresses encroachment concerns.

Hazardous Waste Management

GAFB is registered as a Small Quantity Generator by the Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act (RCRA) and is allowed by regulation to temporarily store hazardous waste up to 180 days. An additional 90-day storage time is also permitted since disposal sites for

the waste are over 200 miles away. This provides a total of 270 days that waste can be stored on base. The largest percentage of hazardous or industrial solid wastes generated on GAFB is derived from vehicle, equipment, and building maintenance activities.

The "HAZMAT Pharmacy" concept was fully implemented in January 1998. This program, operated in conjunction by Civil Engineer (CE) Environmental, CE Logistics, Safety, Supply, and Bioenvironmental Engineering, manages the issue, use, and ultimate disposal of hazardous materials. Base organizations desiring to obtain a chemical product must have their purchase approved by the HAZMAT Pharmacy before it can be obtained. The pharmacy will also investigate if a nonhazardous substitute is available for hazardous materials.

There are fifteen hazardous waste initial accumulation points on GAFB and one facility, Building 3530, designated as the Hazardous Waste Accumulation Site, where hazardous wastes can be stored up to 270 days.

Environmental Restoration Program

An environmental restoration program was initiated in 1984 to investigate possible contamination caused by waste disposal practices prior to that time. In addition, several compliance programs have been implemented to ensure that present waste and resource management practices are consistent with applicable laws and regulations.

The Installation Restoration Program (IRP) Management Action Plan (MAP) summarizes the current status of the installation's environmental restoration and associated compliance programs. The IRP MAP also presents a comprehensive strategy for implementing response actions necessary to protect human health and the environment from conditions caused by past waste and resource management practices. The response action strategy integrates activities performed under both the IRP and the associated environmental compliance programs to support full restoration of the installation. The IRP MAP is intended as a dynamic planning document, to be updated on a regular basis with incorporation of newly obtained information and to reflect the completion, or change of status, of any Remedial Action. The current IRP MAP contains information available as of June 2014.

IRP sites at GAFB are listed below.

- LF-01 (South Landfill) - The South Landfill LF-01 is geographically separated from the main base and located south of the base across South Chadbourne St. The land was originally used as the south approach and clear zone for the original north/south main runway. Either prior to obtaining the land by the Air Corps, or during the early base years, a "gravel pit" was excavated in the center of the property. This ready-made pit conveniently began a landfill in the later years. The landfill occupies approximately 14 acres of a 33 acre parcel. LF-01 was operated as a general purpose pit landfill from 1950, and was permitted by the state as a Class I landfill in 1982 (Permit # 1501). The landfill was used until 1989 and was capped and closed September 1993. Contents include demolition debris, industrial waste, household solid waste, and some containerized liquids. This landfill served as the wet weather base landfill during the period when the trench landfill (LF-02) was being operated. On 10 Aug 98, the Texas Natural Resource Conservation Commission (TNRCC, now TCEQ) officially completed the post-closure maintenance period monitoring and approved final closure as a landfill.
- LF-02 (Southeast Landfill) - The Southeast Landfill LF-02 is located in the southeastern corner of the base approximately 3,500 ft east of the South Gate. LF-02 was operated as a general purpose trench landfill from 1970, and was permitted by the state as a Class I landfill in 1981 (Permit # 1439). The trenches were approximately 600 feet long, 15 feet wide, 15 feet deep, and 3 feet apart. Civil Engineers operated waste collection trucks which operated on regular collection routes serving base facilities. Wastes disposed-of were predominantly household

wastes which averaged 161 cubic yards per month and were collected from the main base and housing. The landfill was used until 1982 when the base changed to contract waste collection and disposal. The unused portion of the last trench being used was leveled with fill dirt and the landfill operations ceased. It was officially closed December 1988 after a post-closure maintenance period was completed. State regulatory requirements did not require a "cap" for this landfill.

- SS-03 Drum Storage Area - A storage area for several hundred metal drums was identified from aerial photos on the northwestern corner of the base approximately 500 ft west of the north gate. Aerial photographs of this area from the early 1950s show an area 100 to 150 ft in diameter used to store drums. Photographs after 1954 show that all the drums were removed and the area was graded. The site was investigated for petroleum hydrocarbon and lead contamination. There were some elevated levels of contamination, but not enough to require remedial clean-up actions. Investigation at this site was completed and the site closed in September 1995. There are land use restrictions on this site which limits development to industrial/commercial use.
- ST-04 Fuel Storage Are - Underground storage tanks (USTs) containing aviation fuels were located south of Farrow Street and east of Scherz Boulevard. Fuel was distributed from this location via underground pipeline and tanker truck to the flightline. The tanks were reported to be taken out of service in 1958 and removed in 1976. It was noted on the tank removal project specifications to also remove contaminated soil, which had resulted from tank leakage. The remedial action for this site is biodegradation of the remaining fuel. This site was investigated and closed in December 2005. In the process of investigating this site, arsenic groundwater contamination from an unknown source was discovered. The site, although closed, is currently undergoing long-term monitoring at the request of TCEQ.
- ST-05 Buried Tank Area - Motor vehicle fuels were stored in USTs located at a military service station formerly located at the intersection of Griffin Street and Ft. Lancaster Avenue. Two fuel storage tanks were removed in 1988. TNRCC inspectors were on site during the removal and did not determine any evidence of fuel leakage from the tanks or around the tanks and approved backfill of the excavation. This site was closed April 1990.
- SS-06 South Skeet Range - This site was added to the IRP program in 2000 to address possible contamination from lead shot and clay targets used at a recreational skeet range. This range was located on the southeast side of the base at Bldg 3070 (“Lodge”). The interim remedial action to remove 7,200 cubic yards of soil was completed in November 2006. There are land use restrictions on this site which limits development to industrial/commercial use.
- SS-07 Carbon Tetrachloride Spill Site - This site was designated in 2002 to address groundwater contamination from carbon tetrachloride that was being found in some of the groundwater monitoring wells both on and off base. No source of contamination was determined. The remedial action was completed and the site closed in November 2008. There are land use restrictions on this site which limits development to industrial/commercial use.
- SS-08 Railroad Spur - This site was designated in 2003 from the conversion of AOC-06 (Railroad Tracks) into this new site. Investigation of arsenic, lead, and chromium levels was completed and the site closed in November 2004. There are partial land use restrictions on this site which limits development to industrial/commercial use along Scherz Blvd between Farrow St. and Kaydet St.

The status of each site is shown in Table 2-8 and any restrictions on land use are noted.

Table 2-8 Restoration site status.

Site	Description	Status	Notes
LF-01	South Landfill	Closed – Aug 2001	Land use restrictions
LF-02	Southeast Landfill	Closed – Jun 1999	
SS-03	Drum Storage Area	Closed – Sep 1995	Land use restrictions
ST-04	Aircraft Fuel Tanks	Closed – Dec 2005	
ST-05	Military Service Station Tanks	Closed – Nov 1998	
SS-06	South Skeet Range	Closed – Nov 2006	
SS-07	Carbon Tet Plume	Closed – Nov 2008	Land use restrictions
SS-08	Railroad Track	Closed – Oct 2004	Land use restrictions

When new areas of possible contamination are identified, they are now referred to as "Areas of Concern". Any required investigations are conducted and if the site qualifies, it can be changed to an IRP "site". GAFB has identified 13 AOCs.

- AOC-01 North Skeet Range—Site of a former recreational skeet-shooting range. The range was constructed between 1942 and 1946 and actively used for recreational target shooting until 1960. During the site investigation, hydrocarbon contamination from clay targets was detected in addition to lead contamination from spent shot. In order to achieve site closure, an Interim Remedial Action was performed to remove soils with hydrocarbon concentrations in excess of the Protected Concentration Levels. In 2005, a total of 2,600 cubic yards of soil was excavated and disposed of off-base. TCEQ approved site closure in November 2006. There are land use restrictions on this site which limits development to industrial/commercial use.
- AOC-02 Aircraft/Vehicle Washracks—AOC-02 consists of nine former wash racks related to former aircraft maintenance hangers across the base. They were reportedly used for a variety of activities including cleaning of aircraft, vehicles, and associated parts and components and were used from the early 1940s to 1958 when the flight training mission ended. All of the wash racks were demolished and removed in the late 1980s before construction of Kearney Blvd. The AOC was approved for closure in January 2007 by the TCEQ. Because of limited hydrocarbon contamination, there are land use restrictions on this site which limits development to industrial/commercial use.
- AOC-03 Flightline/Runway Runoff Area, Outfall and Storm Drains—Site consists of seven separate locations, each an individual outfall point for the base storm water drainage system. The storm water drainage was another area classified as an area of interest, where historical activities could have potentially created environmental conditions of concern. Each of the outfalls was evaluated to assess potential sources of contamination that might be incorporated in the storm water flows to the outfalls. The site investigation was completed with no contamination found and closed in March 2002.
- AOC-04 Rec Camp Former AST Location—This site was a former aboveground storage tank (AST) at the Lake Nasworthy Recreation Camp. It consisted of a sub-grade concrete containment structure and two 250-gallon tanks to store gasoline. The ASTs were in service from the late 1950s until 1990 when the tanks were removed. No fuel contamination was noted or detected at that time. The site investigation was completed and closed in September 2000. This site has no land use restrictions.
- AOC-05 Warehouse/Maintenance Facilities—Three facilities, classified as areas of interest,

were identified as facilities with historical activities that could have potentially created environmental conditions of concern. These facilities include the former motor pool, former machine shop, and the former pesticide storage facility. The sites were investigated and closed January 2007. There are land use restrictions on this site which limits development to industrial/commercial use.

- AOC-06 Railroad Tracks—During the period when the base had a flying mission (1941-1958), a railroad spur was used to transport and off-load various bulk supplies to activities adjacent to the rail line and was operational through 1960. The preliminary site investigation in 2000 indicated elevated concentrations of arsenic, lead, and chromium at levels above their respective media specific concentrations. The source of the metals was unknown, but limited to only a portion of the spur line. In 2006, the AOC was converted to IRP site SS-08 for additional investigation and subsequent closure.
- AOC-07 Building 520 UST Generator Tank—This UST is designated as an AOC, however, it was not part of the restoration program since possible contamination did not occur exclusively prior to 1984. This generator was operated from 1974 until its removal. It was managed under the Texas Petroleum Storage Tank program. An investigation was completed in July 1997 and the site closed in July 1997. This site has no land use restrictions.
- AOC-08 Building 716 UST—This UST was a diesel storage tank located in the former Civil Engineer maintenance yard. It is designated as an AOC, however, it was not part of the restoration program since possible contamination did not occur exclusively prior to 1984. The closure was managed under the Texas Leaking Petroleum Storage Tank program. The UST was in operation from 1972 until its removal. The investigation was completed in July 1997 and the site closed in July 1997. This site has no land use restrictions.
- AOC-09 Building 904 USTs 904-1 to 5, AAFES Service Station—These storage tanks were the gasoline storage tanks for the AAFES service station providing fuel for privately owned vehicles. They were in operation from 1953 until their removal in 1994. The USTs are designated as an AOC, however, it was not part of the restoration program since possible contamination did not occur exclusively prior to 1984. It was managed under the Texas Petroleum Storage Tank program. An investigation was completed in June 2004 and the site subsequently closed. This site has no land use restrictions.
- AOC-10 Refueling Pits and Piping Abandoned Fuel Line—AOC-10 is an abandoned fuel line that connected the aircraft fuel storage tanks (ST-04) with the flightline. The line runs due east from ST-04 to a point adjacent to Kearney Blvd, then south to the south end of the parade field where it turns west for about fifty feet to its termination at a former fuel pit. Fuel pits were located at regular intervals along the fuel line but all have been removed. No contaminants were identified at levels above TCEQ action levels. The site was closed August 2004 without restrictions.
- AOC-11 Former Landfill (Building 1001)—AOC-11 was identified as a result of aerial photograph review during the preparation of a non-related environmental document. Several photographs show an area of disturbed soil adjacent to west-side of Building 1001. The disturbed area is square in shape, measuring approximately 500’ X 500’. Limited sampling was conducted and no materials were detected in test pits to require remedial cleanup actions. The cause of the disturbed area was never identified. There are no land use restrictions on the site which was closed January 2002.
- AOC-12 Landfill Trench (Building 1001)—AOC-12 was also identified from the aerial photograph review, in the same review as AOC-11. Aerial photographs show a disturbed area

in a site which served as a contractor lay-down area south of Building 1001. The disturbed area is square in shape, measuring approximately 30' X 300'. Limited sampling was conducted and no materials were detected to require remedial cleanup actions. The cause of the disturbed area was never identified. There are no land use restrictions on the site which was closed January 2002.

- AOC-13 Small Arms Range—A former small arms firing range was located on the south side of the base, adjacent to the south perimeter. It was constructed in the 1960s and used through 1996. In 1969 the range consisted of a rifle range with a long bermed area, and a pistol range in a small bermed area attached on the east side. The site originally covered approximately five acres until it was reduced in size and reconfigured in the early 1970s. There were large amounts of lead debris from spent bullets in the earthen berms at the site and site analysis identified other metal contamination. In 2005, remediation activities removed metals-contaminated soil from the site. The site was closed January 2009 with no land use restrictions.
- There is an additional site that is managed under the Military Munitions Response Program:
- PR-889 North Small Arms Firing Range—The North Small Arms Firing Range was constructed in the early 1940s and used weekly until 1948 for small arms training. Range operations consisted of several lineal firing lines used for pistol shooting practice. The site is scheduled for remediation in 2015.

Table 2-9 details the current AOCs and Figure 2-5 provides locations of all Goodfellow IRP and AOC sites.

Table 2-9 Areas of concern.

Site	Description	Status	Notes
AOC-01	North Skeet Range	Closed	Deed Restrictions
AOC-02	Aircraft/Vehicle Washracks	Closed	Deed Restrictions
AOC-03	Flightline/Runway Runoff Area, Outfall and Storm Drains	Closed	
AOC-04	Rec Camp Former AST Location	Closed	
AOC-05	Warehouse/Maintenance Facilities	Closed	Deed Restrictions
AOC-06	Railroad Tracks	-	Converted to SS-08
AOC-07	Bldg 520 UST - Generator Tank	Closed	
AOC-08	Bldg 716 UST - Old CE Yard	Closed	
AOC-09	Bldg 904 USTs - 904-1 to 5, AAFES Service Station	Closed	
AOC-10	Refueling Pits and Piping - Abandoned Fuel Line	Closed	
AOC-11	Former Landfill (Bldg 1001)	Closed	
AOC-12	Landfill Trench (Bldg 1001)	Closed	
AOC-13	Small Arms Range	Closed	

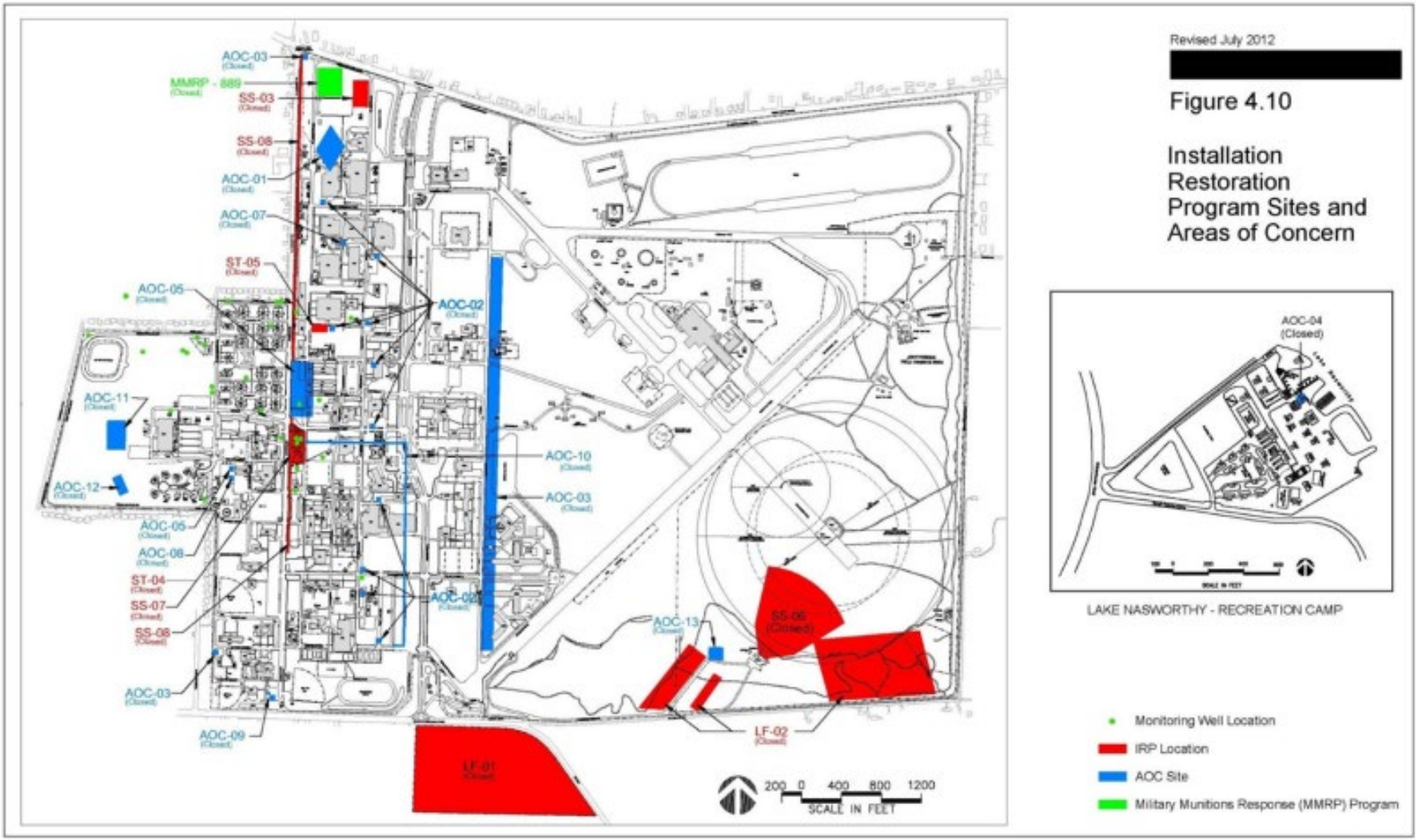

Figure 2-5 Installation Restoration Program and Areas of Concern.

2.4.4 Potential Future Mission Impacts on Natural Resources

Potential impact of future missions is the continued loss of unimproved grounds used for the expansion of new activities. GAFB has approximately 300 acres remaining of unimproved grounds which can sustain wildlife and native vegetation. The only major "protected' area is a restricted clear zone of 113 acres around the munitions storage facility (Bldg 3298). As mentioned previously, GAFB is undergoing the development of an Installation Development Plan whereby all future mission changes will reference any potential impacts to natural resources.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

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

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

4.0 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**

5.0 TRAINING

USAF installation NRMs/POCs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required 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

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.

Installation Supplement—Recordkeeping

6.2 Reporting

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

Installation Supplement—Reporting

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

Implementation Organizations

The Wing Commander is the approval authority for the INRMP. The Base Civil Engineer ensures the annual review is accomplished by designating the Natural Resources Manager (NRM) as the office of primary responsibility with direct support from AFCEC/CZO. The NRM with recommendations by AFCEC will determine if a revision and update to the plan is required. The Judge Advocate office will review the plan and provide a determination that the plan meets the regulatory requirements. Base organizations will implement the plan into their activities as required.

Other Defense Organizations for Assistance in Implementation

The base will consult with HQ AETC and AFCEC as required for issues related to implementation of the INRMP.

Government Agencies for Assistance in Implementation

The USFWS and TPWD are signatories of the INRMP and will provide general oversight of the plan.

7.1 Fish and Wildlife Management

Applicability Statement

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

Program Overview/Current Management Practices

Hunting Program

In 2020, the GAFB Hunting Program developed an archery hunt in collaboration with Texas A&M and Camp Bullis NRM to increase recreation opportunities for active-duty military personnel, DoD civilians, military retirees, active duty military dependents, family members and the general public (when FPCON allow). The goal of the hunting program is to maximize hunting and recreation opportunities while ensuring security and mission demands on GAFB are met.

The GAFB Hunting Program and Regulations Manual was produced to inform participants in the program and guide natural resources managers (17 CES Natural Resources Office, 2020). This is a living document and can change annually to adapt to current conditions and game populations. The most recent copy of this manual should be referenced for up-to-date information pertaining to hunting on GAFB.

All participants wishing to hunt must complete a state approved bow hunter's education course and possess a State of Texas hunting license and all endorsements or stamps pertaining to the game species they wish to harvest. They must also obtain the appropriate GAFB hunting permit and adhere to all regulations described in the Hunting Program and Regulations Manual. Hunting areas with designated blinds can be reserved for hunting and scouting and can be accessed during restricted hours identified in the GAFB Hunting Program and Regulations Manual (Figure 7-1).

Annual white-tailed deer census surveys are conducted to ensure responsible harvest and the species' persistence on GAFB. Census and harvest data help the NRM set harvest quotas and meet management goals. Hunting will be closed for the season once quotas are reached.

Fishing Policy

There are no viable fishing areas located within the GAFB perimeter fence. The GAFB Recreation Camp, situated at Lake Nasworthy, has fishing available. Other nearby fishing includes areas on the Concho Rover, Twin Buttes Reservoir and O.C. Fisher Reservoir (TPWD State Park).

Figure 7-1 Hunting areas.

Permitted Access for Wildlife Programs

Any base personnel can utilize wildlife programs that are available. This also includes any sponsored guests of base personnel as allowed under current Force Protection Conditions (FPCON).

Demand for Wildlife Programs

Because the size of the base is small and there are only limited available undeveloped areas, there have been few requests for wildlife programs. The base is also within the San Angelo city limits where the discharge of firearms is prohibited, and off-base development is adjacent to most of the base perimeter.

Wildlife Education and Interpretation Programs

GAFB has no formal wildlife education or interpretation programs. The hiking/bike trail offers an ideal place to get into the interior of the undeveloped grounds for wildlife viewing. Lake Nasworthy, Concho River, Twin Buttes Reservoir and O.C. Fisher Reservoir (TPWD State Park) are popular locations for observing wildlife.

Nuisance Wildlife Control

GAFB experiences some problems with nuisance wildlife. Skunks are a particular problem when they get under and around facilities. The base traps them whenever possible and turns them over to the City of San Angelo Animal Control Services. Snakes get into facilities and are removed and released into the undeveloped areas. Bats have presented a few problems getting into facilities, and create special problems in the alarmed intelligence training facilities activating alarms as they fly around. When possible, bats are caught and released outside and the areas they entered through are sealed.

Feral Animal Control

Feral cats present the most significant animal control issue at GAFB. Civil engineer's entomology shop will trap the animals and turn them over to the City Animal Control Services for disposition. This is a sensitive issue with some base personnel who establish feeding stations and shelter. The Integrated Pest Management Plan (IPMP) addresses control of feral cats and the responsibility of base personnel. A copy of the IPMP is available through 17 CES/CEO.

Requirements for Fish and Wildlife Habitat Improvement

The USFWS Information for Planning and Consultation (IPaC) system can be referenced to determine if a Section 7 consultation is needed for any habitat modifications or potential T&E species impacts. As of October 2021, there is no USFWS designated habitat for T&E species on GAFB. IPaC does identify four listed species, listed below, that will need a Section 7 consultation if a proposed action or project will affect them:

- Piping plover – Only needs consideration if a wind energy project is proposed
- Red knot– Only needs consideration if a wind energy project is proposed
- Texas pimpleback
- Monarch butterfly

Habitat improvement would be beneficial for parcels of unimproved/semi-improved lands available on GAFB. This would include control of prickly pear cactus and mesquite, which continue to spread to additional areas every year. Removal would help stabilize the base's deer herd and also benefit the state threatened horned lizards. Maintenance of native grassland, mixed grass and shrub communities, or improved grasslands would also support horned lizard populations. Control of invasive red-fire ants is important for Texas horned lizard populations as well as native insects and any ground-nesting birds that

may occur on GAFB.

Measures to Protect Significant Fossil Resources

No fossils have been found on GAFB, therefore no protection measures are required.

Climate Impacts on Fish and Wildlife Management

Fish and wildlife management on GAFB will not require large adjustments stemming from climate change. Current wildlife management issues, such as overabundance of deer, are likely to persist in the future and culling in addition to brush removal will remain important management tools. Fish and wildlife surveys should continue to be conducted on a regular basis to monitor impacts of increasing temperatures and reduced precipitation. Changing climactic conditions also present opportunities for invasive species to flourish and push out native species. Monitoring invasive species will continue to be important and management plans should be flexible enough to accommodate changing fish and wildlife populations (Hellmann et al., 2008).

Increasing temperatures under all climate scenarios have the potential to increase water temperatures in benthic systems, leading to less dissolved oxygen in water, as well as increased potential for algal blooms; amphibians, especially, will be negatively impacted.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

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

Program Overview/Current Management Practices

Outdoor recreation on GAFB is limited to active-duty military personnel, DoD civilians, military retirees, active duty military dependents and family members for security, antiterrorism and force protection purposes. The restriction is due to the small size of the base (quick access to any other part of the base in a matter of minutes) and proximity of recreational areas to secure facilities on base. Recreational trails through the unimproved areas are close to sensitive compartmented information facilities (SCIF), munitions storage and associated clear zone.

Climate Impacts on Outdoor Recreation and Public Access to Natural Resources

Projected changes in temperature and annual precipitation are not anticipated to dramatically affect outdoor recreation and public access to natural resources on GAFB. It is likely that white-tail deer population control will continue to be necessary in the future, providing hunting opportunities for those with access to GAFB. Recreational facilities such as courts, fields, tracks, ponds and walking/running trails should continue to serve recreational needs without disruption from the projected changes in climate.

7.3 Conservation Law Enforcement

Applicability Statement

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

Program Overview/Current Management Practices

Reports of poaching will be verified by the environmental element and the information passed on to local Texas Game Wardens.

In the Fall of 2014, two deer were poached on base. The Environmental Element called the game wardens for both incidents. An investigation was initiated but both incidents remain unsolved. The base issued a public announcement through the 17 Training Wing Public Affairs Office notifying the base populace of these incidents and directing them to the Security Forces Squadron if anyone had information on these illegal acts. The announcement also reminded base personnel that the unauthorized discharge of firearms (including guns, bow, crossbows, etc.) and unauthorized hunting on base was prohibited. Violation could result in Uniform Code of Military Justice or civil prosecution.

In the Fall of 2020, 5 white-tailed deer were observed to be lethargic and dying. Substantial mucous was noted around the mouth and nose and they could not stand. GABF NRM reached out to a TPWD biologist and game warden for guidance. All 5 deer were humanely euthanized and determined to be fatally ill from respiratory distress. Further discussion suggested that due to increased deer population and inadequate food and water sources led to illness and subsequent deaths. These unnecessary deaths bolster the need to effectively manage the white-tailed deer population.

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

Applicability Statement

This section applies to USAF installations that have threatened and endangered species on USAF property. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

There are no federally listed threatened or endangered species and habitats on GAFB. One state threatened species, the Texas horned lizard, is present. No management for this species exists, but sightings are documented by the natural resources manager.

7.5 Water Resource Protection

Applicability Statement

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

Program Overview/Current Management Practices

Water quality is very important in this area because of our dependence on surface water as a drinking water supply. New state permits were issued in July 2019 for storm water management. Implementation of this updated permit will help protect downstream users of the Concho River. The base has six significant storm water outfalls where the discharges eventually reach the South Concho River and the Concho River. The storm water program is currently managed under the EPA Texas Pollution Discharge Elimination System (TPDES) program and the base has a discharge permit.

7.6 Wetland Protection

Applicability Statement

This section applies to USAF installations that have existing wetlands on USAF property. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

No wetlands have been identified on base but a wetland survey is programmed to be completed.

7.7 Grounds Maintenance

Applicability Statement

This section applies to USAF installations that perform ground maintenance activities that could impact natural resources. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

General Management Issues

Maintenance issues are managed a variety of ways. The grounds maintenance contractor is responsible for tree pruning and removal of dead or diseased trees or shrubs. All tree removals shall be coordinated and approved by the GAFB NRM prior to removal or pruning attempts. Tree pruning and removals shall be in accordance with ANSI A300 Standards. Proper pruning cuts are to be made on trees and shrubs, utilizing ANSI A300 Standards. Proper collar cuts shall be made, and when cutting back limbs, the limb must be cut back to a branch at least one-third of the diameter of the limb being cut. Bad pruning practices such as topping will only be allowed with approval from the Natural Resources Manager. They also perform the mowing of turf (improved and unimproved) areas.

17 CES will do a limited amount of maintenance based on the situation and if resources are available. Most of the xeriscaped areas to reduce turf maintenance and cost are installed by CE. The decision may also be made during review of a work order request to have CE perform some removals.

The facility managers are responsible for some pest control on their grounds. Certain pesticides are available through the CE Self Help store for problems such as insect control (e.g. fire ants, wasps, roaches).

The base ensures grounds maintenance contract personnel utilize proper techniques and operations. There have been problems in the past regarding damage to trees by mowers and weed-eaters. This still requires constant surveillance.

There is a general problem inherent on military installations with landscaping. This is especially evident with the pruning practices of shrubbery to present a “military” appearance. Very few shrubs are allowed to retain their natural growth characteristics and shrubs not intended for growth as a trimmed hedge are often used as such.

Non-Point Source Pollution

To reduce the amounts of pesticides used on hard surfaces which could run off into the base drainage system, marker dye is used to show what has been sprayed so that additional applications will be avoided. Other materials, such as fertilizers, are applied with equipment calibrated to keep chemicals restricted to open grounds only and reduce overlap into the streets and drainage systems.

Solid Waste Management

In cooperation with the base recycling program and solid waste reduction program, most of the limb trimming and tree removal waste is mulched by the grounds maintenance contractor and delivered to the city compost program.

Urban Forestry

Trees are an important component of landscaping in the urban, developed portions of the installation, providing both aesthetic and economic benefits. In addition to being pleasing to the eye, trees provide shade to buildings and facilities that assist in keeping them cool, thereby, reducing air conditioning costs.

Urban Forestry Management Plan

Contingent upon environmental element manning or contract support, a base urban forestry inventory will be completed and the results will be used to develop an urban forest management component plan. This component plan governs the treatment of all landscape trees and ornamentals, and makes management recommendations, such as removal of hazard and volunteer trees. The plan will include a list of recommended trees and shrubs based on life expectancy and physical attributes. Priority will be given to planting species that are native to the area, or that have been proven suitable to the local region. In accordance with AETCI 32-7065 Forest and Tree Management Plan, the management plan will identify tree planting and maintenance recommendations. High maintenance plantings and extreme pruning practices such as topping, pollarding, or topiary are discouraged.

Tree Inventory

Contingent upon environmental element manning or contract support, an urban forestry inventory will be completed for GAFB and maintained regularly as trees are removed or planted. This survey will include species, size, condition, global positioning system (GPS) location, value of each tree in the installation's cantonment area. The privatized housing areas will not be included. The survey will be prepared in a nonproprietary format compatible with the Tri-Service Geospatial mapping standard (or equivalent) and should be revalidated every 5 years. Trees recommended for removal in the approved urban forestry plan (such as hazard trees and volunteer trees near foundations, sidewalks, and streets) may be considered routine maintenance. All tree removals will be coordinated with the natural resource manager.

Tree Management on Project Sites

GAFB will closely review any activity that could damage or lead to the removal of existing trees. The customer, construction manager, and natural resource manager will visit and assess trees on any proposed construction site before sending the requirements document for MILCON Projects (DD 1391). All trees larger than 4 inches diameter breast height (DBH) located within the project footprint or the immediate construction site will be shown on the construction drawing. The project definition documentation for each military construction project will include a requirement to effectively manage desirable and undesirable tree removal, relocation, or replacement.

The assessment will include all options regarding tree disposition, facility siting, and work to be performed. Trees located on or near the construction site will be considered for saving, replacement, or relocation. Priority will be given to trees in good condition that appear on the base list of recommended trees and shrubs. Consideration should be given to the species, size, location, historic value, the season, estimated moving cost, and long-term maintenance cost. Trees with a DBH less than six inches can usually be economically relocated with a high probability of survival. Trees that are not on the list of recommended trees or that are larger than six inches should be removed and replaced. At a minimum, removed trees less than ten inches will be replaced on a two-for-one basis, using trees greater than 2.5” DBH, while trees greater than ten inches will be replaced on a three-for-one basis. The cost to relocate, replace or remove trees located where the facility or its corresponding parking areas are constructed will be funded as part of the supporting utilities and is not a MILCON option.

Design and Construction

The Tree Conservation Policy is to conserve and maintain trees requiring siting decisions for new buildings or additions to existing buildings to retain and incorporate existing trees into landscape design to the maximum extent possible. The base project manager or natural resource manager is responsible for the special requirement of identifying the project site at the pre-project definition conference. Design drawings will be reviewed by the natural resource manager to ensure the design agent has incorporated the project siting requirements. Any landscape or arboriculture contractor conducting urban tree work will have a certified arborist design and certify the work.

Tree Removal Exceptions

Trees being removed to comply with safety regulations do not have to be replaced or relocated. The base mission precludes consideration of airfield waivers or Clear Zone requirements that other bases would have to consider.

Arbor Day Celebration

GAFB no longer holds Arbor Day Celebrations, instead there are annual xeriscape planting events held in conjunction with earth week celebrations. The xeriscaping events are more appropriate to the surrounding landscape.

7.8 Forest Management

Applicability Statement

This section applies to USAF installations that maintain forested land on USAF property. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

There are no forests or forestry activities located on GAFB.

7.9 Wildland Fire Management

Applicability Statement

This section applies to USAF 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 this installation.

Program Overview/Current Management Practices

There are no prescribed burns conducted on base. The base does comply with city/county burn bans or restrictions to help prevent wildfires. Because of the relatively small size of GAFB, the base fire department is considered adequate to respond to any fires. Personnel and equipment are also available from the Fire Training School if necessary.

Climate Impacts on Wildland Fire Management

Wildfire frequencies and intensities are likely to remain similar to current conditions at GAFB due to minimal acreages of unmanaged vegetation to support wildfire, a lack of ignition sources, surrounding properties that contain almost no wildland fuels, and minimal changes associated with climate change. With the exception of the RCP 8.5 2050 scenario, the average temperature increase of 2.8 °F is relatively small and not likely to produce meaningful changes in ignition probability or fire intensity.

Precipitation is projected to remain essentially unchanged overall, but will increase by substantial amounts in some months within some scenarios, representing as much as 55% of current precipitation. During the current fire season of June through August, precipitation is expected to remain largely unchanged, though there is a greater likelihood of drying under the RCP 8.5 scenarios.

The only scenario that is likely to cause a substantial increase in ignition probability or fire intensity is the RCP 8.5 2050 scenario. During fire season, temperatures are expected to increase by 6.1 °F on average and precipitation is projected to decrease by 0.3 inches. The higher temperatures combined with lower precipitation would result in an environment that is more receptive to fire. However, the minimal ignition potential represented by the installation's mission and the surrounding land use makes it unlikely that fires will be ignited, even in these conditions.

7.10 Agricultural Outleasing

Applicability Statement

This section applies to USAF installations that lease eligible USAF land for agricultural purposes. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

An evaluation conducted by the U.S. Natural Resources Conservation Service did not identify any prime or unique farmlands on base. Only small parcels of land interspersed between mission activities could be used for either grazing or cropland. It is not considered to be economically feasible to construct necessary fencing and provide water for grazing or clear the land of mesquite trees and native shrubs to farm small plots of land. No agricultural outleasing is done.

7.11 Integrated Pest Management Program

Applicability Statement

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

Program Overview/Current Management Practices

The base maintains an Integrated Pest Management Plan (IPMP), which is complementary to this plan. There are no pest species that are inter-related to natural resources and general pest control. Some mosquito control is done in the field training areas as required.

There are no federally designated “invasive species” on base, but the prickly pear cactus and honey mesquite are considered “noxious weeds”. Both species are spreading throughout the field training area and present a physical hazard to personnel training in the area. As part of the integrated pest control procedures, mechanical removal should be considered to lower the risk of injury.

Pollinator impacts should be considered before any pesticide use. Sensitive invertebrate and pollinator species such as the monarch butterfly and native bees could be adversely impacted by certain pesticides, especially if applied while flowers are in bloom. Buffers between application sites and habitat should be among mitigation measures considered.

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to USAF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

Active aircraft operations at GAFB have been permanently suspended for 63 years. Since GAFB does not have a flying mission, the BASH program is not applicable.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USAF installations that are located along coasts and/or within coastal management zones. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

GAFB is approximately 325 miles from the Gulf of Mexico. This issue is not applicable for base programs.

7.14 Cultural Resources Protection

Applicability Statement

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

Program Overview/Current Management Practices

GAFB has no recognized cultural resources on base. If any artifacts are found on base, personnel will follow the steps laid out in the GAFB Integrated Cultural Resource Management Plan.

Archaeological Resources

A comprehensive local survey of base facilities was completed February 1998. A survey form was developed from SHPO inventory forms and completed for each base facility. This data was also entered into a computerized database and digital photos of each facility or structure are being added. No facilities were determined to be architecturally or functionally significant requiring additional formal evaluation.

There is one item of local historical interest located on base. Original concrete gate posts marking the entrance to the Metcalfe Ranch, who sold the property to the Army Air Corps, are located at the intersection of Hornet Street and Scherz Blvd. They are marked with a plaque describing their significance. There was an agreement between the land owner and the government that the posts would remain when the property was officially turned over to the Army Air Corps.

Ranch gate posts.

Off-Base Property

In 2008, an off-base parcel of land was acquired to construct military family housing. During the preparation of the environmental assessment, possible Native American mortar holes were identified on the property adjacent to the Concho River (Figure 7-2). A subsequent investigation identified two archaeological sites, 41TG607 and 41TG608 of possible significance. An existing site, 41TG218, was identified in SHPO records as being on the project site. Investigation showed it was actually out of the project area, and was re-defined in the official records to move its location (USAF, 2007).

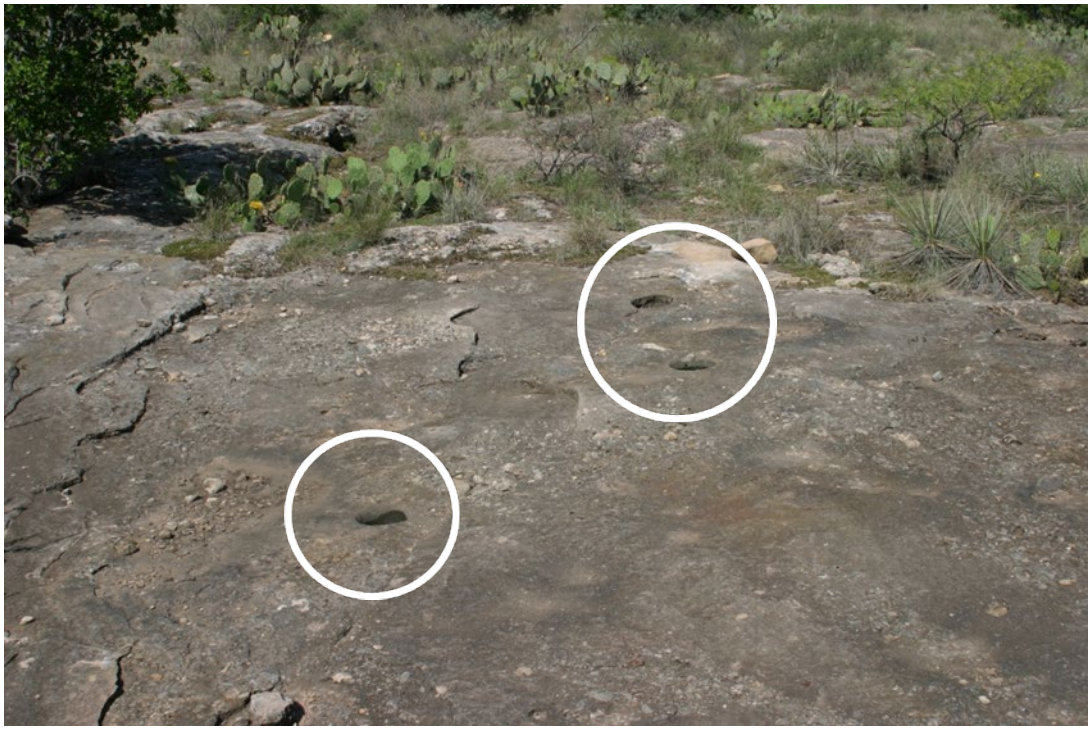

Figure 7-2 Mortar hole sites.

A 300-foot-wide buffer zone along the Concho River was designated as part of the project. The proposed construction activities would not impact sites 41TG218 and 41TG607 and no further archaeological investigations were required. The Texas Historical Commission agreed with this finding.

Cold War Resources

In 2002, an inventory and assessment of the Cold War-era (1945-1991) facilities was completed. A total of 343 Cold War buildings were inventoried, but only nine were further evaluated based on their association with the Cold War missions of GAFB. These included Bldgs 447, 448, 501, 519, 521, 523, 525, and 530. Of the nine properties, all were cited in the report as potentially eligible for inclusion in the National Register.

Further base evaluation determined these facilities that provide intelligence (INTEL) training are common throughout Texas bases and have no unique historical significance, thus the base elected not to nominate these buildings for registration.

Goodfellow Historical District

A Goodfellow Historic District has been designated, which is centered on the Norma Brown Wing Headquarters between two 1943 aircraft hangers.

GAFB's designated local historic district is maintained to reflect the base's beginnings as a WWII flying training base. While the buildings at the center of the base have since been extensively renovated and are not suitable for registering as historic buildings, they reflect the base's roots.

Goodfellow Historical District.

7.15 Public Outreach

Applicability Statement

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

Program Overview/Current Management Practices

There are no particular outreach programs for wildlife or natural resource management. Outdoor recreational activities are organized and publicized by the Force Support Squadron. There are however, earth week events such as a water and energy awareness displays and green procurement handouts at the commissary and exchange. New employees and facility managers receive information on and attend presentations about recycling, storm water pollution prevention and water and energy awareness.

7.16 Climate Change Vulnerabilities

Applicability Statement

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

Program Overview/Current Management Practices

GAFB's mission as a fire suppression training location for the DoD could be jeopardized as climate change affects temperature and precipitation patterns in the region. A substantial increase in the number of days over 90°F could lead to training interruptions. Although precipitation is expected to increase, a large increase in average temperatures and extreme heat days could still lead to drought conditions. As a junior water rights holder, GAFB may not be allowed to pull water from its usual sources during extended droughts, which could lead to inadequate reserves for use in fire suppression training.

7.17 Geographic Information Systems (GIS)

Applicability Statement

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

Program Overview/Current Management Practices

A Geographic Information System (GIS) has been implemented as part of the installation's GeoBase system. Natural resource features are added as requirements are identified. GAFB's environmental element

submitted an unfunded requirement to procure a GPS system to internally update natural resources information within the GIS database. The Engineering Flight currently provides this expertise and assistance with environmental data updates.

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 with defined time scales that can be accomplished within a single year or across several years. Also, in cases where off-installation land uses may jeopardize USAF missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

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

Installation Supplement—Management Goals and Objectives

GOAL 1 IMPROVE EXISTING WILDLIFE HABITAT ON GAFB, WHILE CONTINUING TO SUPPORT THE 17 TRW MISSION.

OBJECTIVE 1.1 Continue identifying natural resources occurring on base.

PROJECT 1.1.1 Conduct Environmental Biological Surveys (EBSs) in unimproved areas of the base, to include vegetation, as needed for Real Property transactions.

PROJECT 1.1.2 Conduct wetlands survey of base, as needed for projects.

PROJECT 1.1.3 Conduct annual white-tailed deer censuses; establish harvest quotas.

PROJECT 1.1.4 Enhance urban tree health and inventory; including maintenance activities

OBJECTIVE 1.2 Control invasive/nuisance species in semi-improved and unimproved areas and maintain.

PROJECT 1.2.1 Identify critical areas for brush removal.

PROJECT 1.2.2 Remove prickly pear and mesquite as needed for mission success.

PROJECT 1.2.3 Apply mowing and herbicide treatments to maintain areas with reduced cost.

GOAL 2 DEVELOP AN URBAN FORESTRY PLAN.

OBJECTIVE 2.1 Perform urban forestry survey as funds allow.

PROJECT 2.1.1 Inventory trees in urban areas of the base with GPS, record data of each tree.

PROJECT 2.1.2 Create map and database of trees.

OBJECTIVE 2.2 Monitor and evaluate urban trees for disease, mortality, obstruction.

PROJECT 2.2.1 Identify trees for pruning, trimming, removal and replacement.

PROJECT 2.2.2 Update tree inventory as changes occur and revalidate every five years.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

Natural Resources Management Staffing

Goodfellow is authorized one Natural Resources Manager, GS-0401-12, located within the 17th Civil Engineer Squadron, Installation Management Flight, Environmental Element. Goodfellow continues to experience cyclical manning shortages. When the Environmental Element experiences shortages, only compliance type requirements are monitored and provided oversight. Program enhancement and non-compliance driven requirements will not be worked. With centralized management of AF environmental programs located at AFCEC, little assistance can be provided to the enhancement of Goodfellow's programs. Full time permanently filled positions on site are needed to meet all requirements in this plan.

Implementation

Organizations responsible for the implementation of the INRMP include 17 CES, specifically the Environmental Element within the Installation Management Flight, the Environmental Management System Cross Functional Team (EMS-CFT), the Environmental Energy Safety Occupational Health Council (EESOHC), and support from Air Force Civil Engineer Center program managers.

9.2 Monitoring INRMP Implementation

When filled, the Natural Resources Manager actively works the goals/objectives/projects identified in this plan. Funding requests are submitted to AFCEC and projects/plans/studies executed upon award. The Natural Resources Manager provides updates to the EMS-CFT along with the EESOHC on a quarterly basis. Any and all compliance type activities will be actively managed by the Environmental Element Chief and reported accordingly.

9.3 Annual INRMP Review and Update Requirements

The Integrated Natural Resources Management Plan (INRMP) will be reviewed, at least annually, by the Natural Resources Manager (NRM) with direct support from the Air Force Civil Engineer Center Environmental Operations Division (AFCEC/CZO) and assistance by internal stakeholders. In accordance with the Sikes Act, the cooperating agencies U.S. Fish & Wildlife Service (USFWS) and Texas Parks & Wildlife Department (TPWD) must review the INRMP on a regular basis, but not less often than every five years. Findings of the annual review will be documented in an Annual INRMP Review Summary. The summary will contain the following.

- A summary of specific INRMP accomplishments since the last review.
- An annual work plan for implementing the INRMP that includes the current year and at least two future fiscal years. The work plan must include all projects and activities identified as essential for the successful implementation of INRMP goals and objectives, and an implementation schedule that is reasonable and practical.
- A statement that sufficient numbers of qualified natural resources management personnel and resources are available to oversee implementation of projects and activities identified in the INRMP Work Plan.
- A summary of the required INRMP updates that will be incorporated into the INRMP to keep it current in operation and effect for the management of installation natural resources or a statement that significant changes to the installation mission or natural resources goals require an INRMP revision.

By signing the annual INRMP Review Summary, collaborating agencies assert concurrence with the

findings that the INRMP is current and compliant with the Sikes Act, or alternatively, that the INRMP requires revision as indicated in Air Force Manual (AFMAN) 32-7003, section 3.3.

Dependent on the manning situation within the Environmental Element, the Annual INRMP Review Summary will be documented but may be extremely limited in detail.

10.0 ANNUAL WORK PLANS

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

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

The following tables identify Goodfellow's proposed five-year plan to execute projects that meet the INRMP's goals and objectives:

Table 10-1 FY 2022 Annual Work Plan.

Project	OPR	Funding Source	Priority Level
8.1.1.1: Conduct Environmental Baseline Surveys in areas of the base, as needed for Real Property transactions	Contract	AFCEC	Medium
8.1.1.3: Conduct annual white-tailed deer censuses, establish quota.	CEIE	AFCEC	High
8.1.2.2: Remove prickly pear and mesquite. Leave thicker areas of mesquite for wildlife escape and thermal cover (no more than 10% of total unimproved acreage).	Contract	AFCEC	Medium
8.1.2.3: Alternate mowing and herbicide application every 3 years (or a third of the acreage each year) to maintain treated areas with reduced cost.	Contract	AFCEC	Low
8.1.2.4: Implement annual WTD archery hunting for management	CEIE	AFCEC	High

Table 10-2 FY 2023 Annual Work Plan.

Project	OPR	Funding Source	Priority Level
8.1.1.1: Conduct Environmental Baseline Surveys in areas of the base, as needed for Real Property transactions.	Contract	AFCEC	Medium
8.1.1.3: Conduct annual white-tailed deer censuses, establish quota.	CEIE	AFCEC	High
8.1.1.4: Remove prickly pear and mesquite. Leave thicker areas of mesquite for wildlife escape and thermal cover (no more than 10% of total unimproved acreage).	Contract	AFCEC	Medium
8.1.2.3: Alternate mowing and herbicide application every 3 years (or a third of the acreage each year) to maintain treated areas with reduced cost.	Contract	AFCEC	Low
8.1.2.4: Implement annual WTD archery hunting for management.	CEIE	AFCEC	High
8.1.2.5: If listed species are determined to be present and may be impacted by military operations, conduct a Base-wide Section 7 consultation.			

Table 10-3 FY 2024 Annul Work Plan.

Project	OPR	Funding Source	Priority Level
8.1.1.1: Conduct Environmental Baseline Surveys in areas of the base, as needed for Real Property transactions.	Contract	AFCEC	Medium
8.1.1.3: Conduct annual white-tailed deer censuses, establish quota.	CEIE	AFCEC	High
8.1.2.2: Remove prickly pear and mesquite. Leave thicker areas of mesquite for wildlife escape and thermal cover (no more than 10% of total unimproved acreage).	Contract	AFCEC	Medium
8.1.2.3: Alternate mowing and herbicide application every 3 years (or a third of the acreage each year) to maintain treated areas with reduced cost.	Contract	AFCEC	Low
8.1.2.4: Implement annual WTD archery hunting for management.	CEIE	AFCEC	High

Table 10-4 FY 2025 Annual Work Plan.

Project	OPR	Funding Source	Priority Level
8.1.1.1: Conduct Environmental Baseline Surveys in areas of the base, as needed for Real Property transactions.	Contract	AFCEC	Medium
8.1.1.3: Conduct annual white-tailed deer censuses, establish quota.	CEIE	AFCEC	High
8.1.2.2: Remove prickly pear and mesquite. Leave thicker areas of mesquite for wildlife escape and thermal cover (no more than 10% of total unimproved acreage).	Contract	AFCEC	Medium
8.1.2.3: Alternate mowing and herbicide application every 3 years (or a third of the acreage each year) to maintain treated areas with reduced cost.	Contract	AFCEC	Low
8.1.2.4: Implement annual WTD archery hunting for management.	CEIE	AFCEC	High

11.0 REFERENCES

11.1 Standard References (Applicable to all USAF installations)

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

11.2 Installation References

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12.0 ACRONYMS

12.1 Standard Acronyms (Applicable to all USAF installations)

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

12.2 Installation Acronyms

AETC	Air Education and Training Command
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFCEC	U.S. Air Force Civil Engineer Center
AICUZ	Air Installation Compatible Use Zone
AOC	Area of Concern
BMP	Best Management Practices
CCSM	Community Climate System Model
CE	Civil Engineer
CEMML	Center for Environmental Management of Military Lands
CSU	Colorado State University
DBH	Diameter at Breast Height
DoDI	Department of Defense Instruction
DoD	Department of Defense
DOT	Department of Transportation
EBS	Environmental Biological Surveys
EESOHC	Environmental Energy Safety Occupational Health Council
EMS-CFT	Environmental Management System Cross Functional Team
EPA	Environmental Protection Agency
FPCON	Force Protection Conditions
GAFB	Goodfellow Air Force Base
GDD	Average annual accumulated growing degree days with a base temperature of 50 °F
GIS	Geographic Information System
GPS	Global Positioning System
HAPs	Hazardous Air Pollutants
HEL	Highly Erodible Lands
IDP	Installation Development Plan
INRMP	Integrated Natural Resources Management Plan

IPaC	Information for Planning and Consultation
IPCC	Intergovernmental Panel on Climate Change
IPMP	Integrated Pest Management Plan
IRP	Installation Restoration Program
MAP	Management Action Plan
MBTA	Migratory Bird Treaty Act
MCD	United States Marine Corps Detachment
MSGP	Multi-Sector General Permit
NCAR	National Center for Atmospheric Research
NCIDD	Navy Center for Information Dominance Detachment
NRCS	Natural Resources Conservation Service
NRM	Natural Resources Manager
PRECIP	Average annual precipitation
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
SHPO	State Historic Preservation Office
TAC	Texas Administrative Code
TAVE	Annual average temperature
TCEQ	Texas Commission on Environmental Quality
TMAX	Annual average maximum temperature
TMIN	Annual average minimum temperature
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
USAF	United States Air Force
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

13.0 DEFINITIONS

13.1 Standard Definitions (Applicable to all USAF installations)

- Natural Resources Playbook—Definitions Section

13.2 Installation Definitions

Agricultural Outleasing—The use of DoD lands under a lease to an agency, organization, or person for growing crops or grazing animals.

Biological Diversity—The variety of life forms, the ecological roles they perform, and the genetic variability they contain within any defined time and space.

Commercial Forest Land—Land under management capable of producing at least 20 cubic feet of merchantable timber per acre a year. It must be accessible and programmed for silvicultural prescriptions. The smallest area for this classification is 5 acres. Roadside, streamside, and shelterbelt strips of timber must have or be capable of producing a crown width of at least 120 cubic feet to be classified as a commercial forest.

Cooperative Agreement—A written agreement between an Air Force installation and one or more outside agencies (Federal, State, or local) that coordinates planning strategies. It is a vehicle for obtaining assistance in developing natural resources programs.

Critical Habitat—Any air, land, or water area (excluding existing synthetic structures or settlements that are not necessary to the survival and recovery of a listed species) and constituents thereof that the Fish and Wildlife Service has designated as essential to the survival and recovery of an endangered or threatened species or a distinct segment of its population.

Cropland—Land primarily suitable for producing farm crops, including grain, hay, and truck crops.

Ecosystem Management—An approach to natural resources management that focuses on the interrelationships of ecological processes linking soils, plants, animals, minerals, climate, water, and topography. Managers view such processes as a living system that affects and responds to human activity beyond traditional commodity and amenity uses. They also acknowledge the importance of ecosystem services such as water conservation, oxygen recharge, and nutrient recycling.

Endangered Species—Any plant or animal listed or proposed for listing as threatened or endangered by the Federal Government or State Governments.

Exotic Species—Any plant or animal not native to a region, state, or country (this definition excludes certain game species that have become established, such as pheasants).

Featured Species—

- A fish or wildlife species whose habitat requires fish or wildlife management (including coordination, multiple use planning, direct habitat improvements, and cooperative programs) on a unit of land or water.
- A tree species that the forest management plan cites as having value for wood fiber production. The plan usually specifies one or more featured tree species along with one or more associated species to meet multiple use management objectives.

Fish—Fresh and salt water fin fish, other aquatic vertebrate organisms, and crustaceans and mollusks.

Floodplains—Lowland or flat areas adjoining inland and coastal waters, including flood prone areas on offshore islands, that have a one percent or greater chance of flooding in any given year.

Forest Land—Land on which forest trees of various sizes constitute at least 10 percent of the area. This category includes open land that is capable of supporting trees and is planned for forest regeneration and management.

Forest Management—Developing, conserving, and protecting forest resources to ensure that they provide sustained yield and multiple use.

Forest Products—Plant materials in wooded areas that have commercial value, such as sawlogs, veneer (peeler) logs, poles, pilings, pine needles, cordwood (for pulp, paper, or firewood), fence posts, mine timber, Christmas trees (from unsheared trees cut during intermediate harvests), and similar wood or chemical products.

Game—Any species of fish or wildlife for which State or Federal laws and regulations prescribe seasons and bag or creel limits.

Grazing Land—Land with vegetative cover that consists of grasses, forbs, and shrubs valuable as forage.

Habitat—An area that provides the environmental elements of air, water, food, cover, and space necessary for a given species to survive and reproduce.

Highly Erodible Soils—Soils that, because of their physical properties or slope, the US Department of Agriculture, Soil Conservation Service, identifies as being highly susceptible to wind or water erosion.

Improved Grounds—Grounds on which personnel annually plan and perform intensive maintenance activities. These are developed areas of an installation that have lawns and landscape plantings that require intensive maintenance. They usually include the cantonment, parade grounds, drill fields, athletic areas, golf courses (excluding roughs), cemeteries, and housing areas.

Integrated Natural Resources Management Plan—A natural resources management plan based on ecosystem management that shows the interrelationships of the individual component plans as well as mission and land use activities affecting the basic land management plans.

Land Management Unit—The smallest land management division that planners use in developing specific strategies to accomplish natural resources management goals. Land management units may correspond to grazing units on agricultural outleased lands, stands or compartments on commercial forest lands, various types of improved grounds (for example, athletic fields, parks, yards in family housing, or landscaped areas around administrative buildings), or identifiable semi improved grounds (for example, airfield areas, utility rights of way, or roadside areas).

Land-Use Regulation—A document that prescribes the specific technical actions or land use and restrictions with which lessees, permittees, or contractors must comply. It derives from the grazing or cropland management plan and forms a part of all outleases, land use permits, and other contracts.

Livestock—Domestic animals kept or raised for food, by products, work, transportation, or recreation.

Multiple-Use—The integrated, coordinated, and compatible use of various natural resources to derive the best benefit while perpetuating and protecting those resources.

Multiple-Use and Sustained Yield Management—The care and use of natural resources so as to best serve the present and future needs of the United States and its people without impairing the productivity of the land and water.

Natural Resources Management Professional—A person with a degree in the natural sciences who manages natural resources on a regular basis and receives periodic training to maintain proficiency in that job.

No Funds Service Contract—An agreement by which a party performs a land management service for a consideration other than funds. Such a contract exists, for example, when a party hired to establish, control, or remove vegetative cover or growth agrees to take payment for the service in the form of the growth that results.

Non-commercial Forest Land—Land not capable of yielding forest products of at least 20 cubic feet per acre a year because of adverse site conditions. The classification also includes productive forest land on which mission requirements, accessibility, or non-compatible uses preclude forest management activities.

Outdoor Interpretation—Observing and explaining history, development, and significance of our natural heritage and natural resources.

Outdoor Recreation—Recreation that relates directly to and occurs in natural, outdoor environments.

Outdoor Recreation Resources—Land and water areas and associated natural resources that provide, or have the potential to provide, opportunities for outdoor recreation for present and future generations.

Parcourse—Physical fitness trails created for jogging and calisthenics. They are usually located in wooded areas and are about 1.5 to 2 miles in length. Numerous exercise stations located along the route direct the participants through various exercises.

Prime Farmland—Land that has the best combination of chemical and physical characteristics for producing food, feed, forage, fiber, and oil seed crops and is also available or potentially available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops under modern farming methods. Existing pastureland, rangeland, forest land, and other land not in an urban buildup condition is considered eligible for designation as prime farmland, providing it meets the other criteria.

Procurement Contract—An agreement by which the Government agrees to pay a contractor to establish, control, or remove vegetative cover or growth for land management purposes. This contract may not extend beyond the period for which funding for the service is available.

Rangeland—Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use. It includes lands revegetated, naturally or artificially to provide a forage cover that is managed like native vegetation. It also includes natural grasslands, savannahs, shrubland, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

Recreation Carrying Capacity—The level of recreational use that an area can sustain without damage to the environment.

Reforestation—The renewal or regeneration of a forest by natural or artificial means.

Sales Service Contract—An agreement by which the contractor pays the Government for crops, crop residue, or grazing privilege incidental to control or removal of vegetative growth for land management purposes. Sales contracts cover a period of 1 to 5 years.

Semi-Improved Grounds—Grounds where personnel perform periodic maintenance primarily for operational and aesthetic reasons (such as erosion and dust control, bird control, and visual clear zones). These usually include grounds adjacent to runways, taxiways, and aprons; runway clear zones; lateral safety zones; rifle and pistol ranges; picnic areas; ammunition storage areas; antenna facilities; and golf course roughs.

Stewardship—The management of a resource base with the goal of maintaining or increasing the resource's value indefinitely into the future.

Threatened Species—Those Federally or State listed species of flora and fauna that are likely to become

endangered within the foreseeable future throughout all or a significant portion of their range and that have been designated for special protection and management pursuant to the Endangered Species Act.

Unimproved Grounds—Grounds not classified as improved or semi improved and usually not mowed more than once a year. These include weapons ranges; forest lands; cropland and grazing lands; lakes, ponds, and wetlands; and areas in airfield beyond the safety zones.

Unique Farmland—Land, other than prime farmland, used producing specific high value food and fiber crops at the time of designation. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop under modern farming methods. Examples are citrus, tree nuts, olives, and cranberries.

Urban Forests—Planted or remnant native tree species existing within urbanized areas such as parks, tree lined residential streets, scattered tracts of undisturbed woodlands, and cantonment areas.

Urban Wildlife—Wildlife that habitually live or periodically survive in an urban environment on improved or semi improved grounds.

Watchable Wildlife Areas—Areas identified under the Watchable Wildlife Program as suitable for passive recreational uses such as bird watching, nature study, and other nonconsumptive uses of wildlife resources.

Wetlands—Areas inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wildlife-Carrying Capacity—The maximum density of wildlife that a particular area or habitat can carry on a sustained basis without deterioration of the habitat.

14.0 APPENDICES

14.1 Standard Appendices

14.1.1 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.

Federal Public Laws and Executive Orders	
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Invasive Species*	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.

Federal Public Laws and Executive Orders	
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.

Federal Public Laws and Executive Orders	
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.

Federal Public Laws and Executive Orders	
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 INRMP and public access to natural resources and allows collection of nominal hunting and fishing fees. NOTE: AFMAN 32-7003 sec 3.11. INRMP Implementation. 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). 3.11.1. 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 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.

Federal Public Laws and Executive Orders	
OSD Policy Memorandum, 1 November 2004— *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum, 10 October 2002— *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process (EIAP)	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-1015, *Integrated Installation Planning*	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations..
AFMAN 32-7003, *Environmental Conservation*	Implements AFPD 32-70, *Environmental Quality;* DoDI 4715.03, *Natural Resources Conservation Program*; and DoDI 7310.5, *Accounting for Sale of Forest Products*. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-7065, *Cultural Resources Management*	This Manual implements AFPD 32-70 and DoDI 4710.1, *Archaeological and Historic Resources Management.* It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-10112 *Installation Geospatial Information and Services (IGI&S)*	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.
AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.

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.

14.2 Installation Appendices

14.2.1 Appendix 1. Species lists.

Table 14-1 Common Grasses of Goodfellow AFB, TX

Common Name	Scientific Name
Blue grama	*Bouteloua gracilis*
Sideoats grama	*Bouteloua curtipendula*
Buffalograss	*Bouteloua dactyloides*
Green sprangletop	*Leptocholoa dubia*
Fall witchgrass	*Digitaria cognata*
Hall's panicgrass	*Panicum hallii*
Tobosagrass	*Pleuraphis mutica*
Tumble windmillgrass	*Chloris verticillata*
Hooded windmillgrass	*Chloris cucullata*
Plains bristlegrass	*Setaria vulpiseta*
Sand dropseed	*Sporobolus cryptandrus*
Purple threeawn	*Aristida purpurea*
White tridens	*Tridens albescens*
Silver bluestem	*Bothriochloa saccharoides*
Johnsongrass	*Sorghum halepense*
Kleingrass	*Panicum coloratum*
KR bluestem	*Bothriochloa ischaemum*
Bermuda grass	*Cynodon dactylon*
Grassbur	*Cenchrus echinatus*
Dallisgrass	*Paspalum dilatatum*

Table 14-2 Common Shrubs and Trees of Goodfellow AFB, TX

Common Name	Scientific Name
Lotebush	*Ziziphus obtusifolia*
Ehedra	*Ephedra spp.*
Prickley pear	*Opuntia spp.*
Yucca	*Yucca spp.*
Honey mesquite	*Prosopis glandulosa*
Catclaw acacia	*Acacia greggii*
Redberry juniper	*Juniperus pinchotii*
Agarita	*Mahonia trifoliolata*

Table 14-3 Common Forbs of Goodfellow AFB, TX.

Common Name	Scientific Name
Croton	*Croton spp.*
Whorled milkweed	*Asclepias verticillata*

Common Name	Scientific Name
Wooly locoweed	*Astragalus mollissimus*
Prairie coneflower	*Ratibida columnifera*
Texas pricklypoppy	*Argemone aurantiaca*
Scarlet muskflower	*Nyctaginia capitata*
Silverleaf nightshade	*Solanum elaeagnifolium*
Gray golden-aster	*Heterotheca canescens*
Oldman's beard	*Clematis drummondii*
Indian blanket	*Gallardia pulchella*
Copper globemallow	*Sphaeralcea aungustifolia*
Broom snakeweed	*Gutierrezia sarothrae*
Russian thistle	*Salsola kali*
Western ragweed	*Ambrosia cumanensis*
Common sunflower	*Helianthus annuus*
Lantana	*Lantana camara*
Pink mock vervain	*Glandularia pumila*

Table 14-4 Birds of Goodfellow AFB, TX.

Common Name	Scientific Name
GREBES	
Pied-billed Grebe	*Podilymbus podiceps*
HERONS, EGRETS	
Great Blue Heron	*Ardea herodias*
Cattle Egret	*Bubulcus ibis*
IBISES	
White-faced Ibis	*Plegadis chihi*
DUCKS	
American Wigeon	*Anas americana*
Black-bellied Whistling-Duck	*Dendrocygna sutumnalis*
Blue-winged Teal	*Anas discors*
Bufflehead	*Bucephala albeola*
Canvasback	*Aythya valisineria*
Cinnamon Teal	*Anas cyanoptera*
Gadwall	*Anas strepera*
Green-winged Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anus acuta*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
VULTURES	
Turkey Vulture	*Cathartes aura*
KITES, HAWKS	

Common Name	Scientific Name
Mississippi Kite	*Ictinia mississippiensis*
Red-tailed Hawk	*Buteo jamaicensis*
Northern Harrier	*Circus cyaneus*
Swainson's Hawk	*Buteo swainsoni*
FALCONS	
American Kestrel	*Falco sparverius*
TURKEYS, QUAIL	
Wild Turkey	*Meleagris gallopavo*
Northern Bobwhite Quail	*Colinus virginianus*
CRANES	
Sandhill Crane	*Grus canadensis*
PLOVERS	
Killdeer	*Charadrius vociferus*
SANDPIPERS & OTHER WADERS	
Common Snipe	*Gallinago gallinago*
Greater Yellowlegs	*Tringa melanoleuca*
Long-billed Curlew	*Numenius americanus*
Least Sandpiper	*Calidris minutilla*
Long-Billed Dowitcher	*Limnodromus scolopaceus*
Black-Necked Stilt	*Himantopus mexicanus*
Solitary Sandpiper	*Tringa solitaria*
GULLS, TERNS	
Ring-billed Gull	*Larus delawarensis*
DOVES & PIGEONS	
Inca Dove	*Columbina inca*
Mourning Dove	*Zenaida macroura*
White-winged Dove	*Zenaida asiatica*
House Pigeon	*Columba livia*
CUCKOOS	
Greater Roadrunner	*Geococcyx californianus*
OWLS	
Burrowing Owl	*Athene cunicularia*
Common Name	Scientific Name
GOATSUCKERS	
Common Nighthawk	*Chordeiles minor*
HUMMINGBIRDS	
Black-chinned Hummingbird	*Archilochus alexandri*
FLYCATCHERS	
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Western Kingbird	*Tryannus verticalis*
SWALLOWS	
Purple Martin	*Progne subis*
Barn Swallow	*Hirundo rustica*

Common Name	Scientific Name
JAYS	
Blue Jay	*Cyanocitta cristata*
BLUEBIRDS, THRUSHES	
American Robin	*Turdus migratorius*
WRENS	
Bewicks Wren	*Thryomanes bewickii*
Cactus Wren	*Campylorhynchus brunneicapillus*
MIMIC THRUSHES	
Northern Mockingbird	*Mimus polyglottos*
WAXWINGS	
Cedar Waxwing	*Bombycilla cedrorum*
SHRIKES	
Loggerhead Shrike	*Lanius ludovicianus*
STARLINGS	
European Starling	*Sturnus vulgaris*
TANAGERS, BUNTINGS, ETC.	
Northern Cardinal	*Cardinalis cardinalis*
SPARROWS, LONGSPURS	
Lark Bunting	*Calamospiza melanocorys*
White-crowned Sparrow	*Zonotrichia leucophrys*
BLACKBIRDS, MEADOWLARKS	
Brewer's Blackbird	*Euphagus cyanocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Great-tailed Grackle	*Quiscalus quiscula*
Eastern Meadowlark	*Sturnella* sp
FINCHES	
American Goldfinch	*Carduelis tristis*
House Finch	*Carpodacus mexicanus*
OLD WORLD SPARROWS	
House Sparrow	*Passer domesticus*

Table 14-5 Reptiles of Goodfellow AFB, TX.

Common Name	Scientific Name
Prairie Kingsnake	*Lampropeltis getulus*
Plains Blind Snake	*Leptotyphlops dulcis dulcis*
Bull Snake	*Pituophis melanoleucus sayi*
Lined Snake	*Tropidoclonion lineatum*
Checkered Garter Snake	*Thamnophis marcianus*
Texas Rat Snake	*Elaphe obsoleta lindheimeri*
Coachwhip Snake	*Coluber flagellum*
Western Hognose Snake	*Heterodon nasicus*
Western Diamondback Rattlesnake	*Crotalus atrox*

Common Name	Scientific Name
Texas Horned Lizard	*Phrynosoma cornutum*
Six-lined Racerunner Lizard	*Cnemidophorus sexlineatus sexlineatus*
Plateau spot-tailed earless lizard	*Holbrookia lacerta*
Checkered Whiptail Lizard	*Aspidoscelis tesselatus*

Table 14-6 Amphibians of Goodfellow AFB, TX.

Common Name	Scientific Name
Rio Grande Leopard Frog	*Rana berlandieri*
Great Plains Narrow-mouthed Toad	*Gastrophryne olivacea*
Texas Toad	*Bufo speciosus*
Couch's Spadefoot Toad	*Scaphiopus couchii*

Table 14-7 Mammals of Goodfellow AFB, TX.

Common Name	Scientific Name
Rock Squirrel	*Spermophilus variegatus*
Fox Squirrel	*Sciurus niger*
White-tailed Deer	*Odocoileus virginianus*
Striped Skunk	*Mephitis mephitis*
Nine-banded Armadillo	*Dasypus novemcintus*
Gray Fox	*Urocyon cinereoargenteus*
Thirteen-lined Ground Squirrel	*Spermophilus tridecemlineatus*
Coyote	*Canis latrans*
Mexican Free-tailed Bat	*Tadarida brasiliensis*
Eastern Cottontail Rabbit	*Sylvilagus floridanus*
Black-tailed Jack Rabbit	*Lepus californicus*
Raccoon	*Procyon lotor*
Opossum	*Didelphis virginiana*
Red Fox	*Vulpes vulpes*
Ringtail Cat	*Bassariscus astutus*
Nutria	*Myocastor coypus*
Porcupine	*Erethizon dorsatum*
Western hog-nosed skunk	*Conepatus leuconotus*
Western spotted skunk	*Spilogale gracilis*
Eastern spotted skunk	*Spilogale putorius*

14.2.2 Appendix 2. Recommended plant species list.

Table 14-8 Recommended plant species list.

TREES	
Bur oak	Texas ash
Chinquapin oak	Texas redbud
Live oak	Desert willow
Texas red oak	Arizona cypress
Cedar elm	Goldenball lead tree
Winged elm	
LARGE SHRUBS OR SMALL TREES	
Texas mountain laurel	Carolina buckthorn
Yaupon holly	Possumhaw holly
Mexican silktassel	Kidneywood
Mexican buckeye	Mexican redbud
SHRUBS	
Hawthorn	Yellow bells
Yaupon holly (Dwarf)	Turk's cap
Salvia	Wooly butterfybush
Flame acanthus	Black dalea
Texas sage	Elbow bush
Texas lantana	Fragrant mimosa
Mealy blue sage	Fragrant sumac
Red yucca	
TURF	
Buffalograss	
GROUNDCOVERS	
Horseherb	

14.2.3 Appendix 3. Texas Department of Agriculture noxious pant list.

Table 14-9 Texas Department of Agriculture noxious plant list.

Common Name	**Scientific Name**
Alligatorweed	*Alternanthera philoxeroides*
Balloonvine	*Cardiospermum halicacabum*
Brazilian peppertree	*Schinus terebinthifolius*
Broomrape	*Orobanche ramosa*
Camelthorn	*Alhagi camelorum*
Chinese tallow tree	*Triadica sebiferum*
Deeprooted sedge	*Cyperus entreranius*
Distaff thistle	*Carthamus lanatus*
Eurasian watermilfoil	*Myriophyllum spicatum*
Giant duckweed	*Spirodela oligorrhiza*
Giant reed	*Arundo donax*
Hedge bindweed	*Calystegia sepium*
Hydrilla	*Hydrilla verticillata*
Itchgrass	*Rottoboellia cochinchinensis*
Japanese dodder	*Cuscuta japonica*
Kudzu	*Pueraria montana* var. *lobate*
Lagarosiphon	*Lagarosiphon major*
Paperbark	*Melaleuca quinquenervia*
Purple loosestrife	*Lythrum salicaria*
Rooted waterhyacinth	*Eichhornia azurea*
Saltcedar	*Tamarix spp.*
Salvinia	*Salvinia spp.*
Serrated tussock	*Nassella trichotoma*
Torpedograss	*Panicum repens*
Tropical soda apple	*Solanum varium*
Water spinach	*Ipomoea aquatic*
Water trumpet	*Cryptocoryne beckettii*
Water hyacinth	*Eichhornia crassipes*
Water lettuce	*Pistia stratiotes*

14.2.4 Appendix 4. Annual Review and Agency Coordination

The Integrated Natural Resources Management Plan (INRMP) will be reviewed, at least annually, by the Natural Resources Manager (NRM) with direct support from the Air Force Civil Engineer Center Environmental Operations Division (AFCEC/CZO) and assistance by internal stakeholders. In accordance with the Sikes Act, the cooperating agencies U.S. Fish & Wildlife Service (USFWS) and Texas Parks & Wildlife Department (TPWD) must review the INRMP on a regular basis, but not less often than every five years. Findings of the annual review will be documented in an Annual INRMP Review Summary. The summary will contain the following:

A summary of specific INRMP accomplishments since the last review.

An annual work plan for implementing the INRMP that includes the current year and at least two future fiscal years. The work plan must include all projects and activities identified as essential for the successful implementation of INRMP goals and objectives, and an implementation schedule that is reasonable and practical.

A statement that sufficient numbers of qualified natural resources management personnel and resources are available to oversee implementation of projects and activities identified in the INRMP Work Plan.

A summary of the required INRMP updates that will be incorporated into the INRMP to keep it current in operation and effect for the management of installation natural resources or a statement that significant changes to the installation mission or natural resources goals require an INRMP revision.

By signing the annual INRMP Review Summary, collaborating agencies assert concurrence with the findings that the INRMP is current and compliant with the Sikes Act, or alternatively, that the INRMP requires revision as indicated in Air Force Manual (AFMAN) 32-7003, section 3.3.

RECORD OF ANNUAL REVIEW

ANNUAL REMARKS

Year One (2022)

Year Two (2023)

Year Three (2024)

Year Four (2025)

Note: Annual review summary findings will be retained with the INRMP.