CANNON AIR FORCE BASE
NEW MEXICO

AIR INSTALLATIONS COMPATIBLE USE ZONES STUDY

FINAL

U.S. AIR FORCE

2017

CANNON AIR FORCE BASE

AIR INSTALLATIONS COMPATIBLE USE ZONES (AICUZ) STUDY

FINAL

2017

Prepared for:

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DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS WING (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

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County Officials and Citizens,

The Air Installations Compatible Use Zones (AICUZ) Study is an update of the 2005 Cannon Air Force Base (CAFB) AICUZ Study. This updated study presents and documents changes in flight operations, noise exposure areas, accident potential, and land use compatibility conditions since the previous AICUZ Study.

The basic objective of the AICUZ program is to achieve compatible uses of public and private lands in the vicinity of military airfields. This can be accomplished by controlling incompatible development through local regulatory actions. The AICUZ Study provides the information necessary to maximize beneficial use of the land surrounding Cannon AFB, while minimizing the potential for degradation of the health and safety of the affected public.

The AICUZ Study includes a description of the area of influence around the base and outlines the location of noise contours, runway clear zones, and accident potential zones. The study also provides land use recommendations to ensure compatible development in the vicinity of the base. It is our hope this information will be incorporated into your community comprehensive plans, ordinances, regulations, building codes, and related planning initiatives.

We greatly value the positive relationship Cannon AFB has experienced with its neighbors over the years. As a partner in the process, we have attempted to minimize disturbances generated by our aircraft operations in the area. We solicit your cooperation in implementing the recommendations and guidelines presented in this study.

Sincerely

Stewart A. Hammons, Colonel, USAF
Commander

Attachment: CAFB AICUZ Study 2017

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27 SOMSG	27th Special Operations Mission Support Group
27 SOMXG	27th Special Operations Maintenance Group
27 SOW	27th Special Operations Wing
318 SOS	3187th Special Operations Squadron
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AFR	Air Force Range
AFSOC	Air Force Special Operations Command
AICUZ	Air Installations Compatible Use Zones
Air Force	United States Air Force
APZ	Accident Potential Zone
ATC	Air Traffic Control
BASH	bird/wildlife aircraft strike hazard
CFR	Code of Federal Regulations
CZ	Clear Zone
dB	decibel
dBA	A-weighted decibel
DNL	day-night average sound level
DoD	Department of Defense
DoDI	Department of Defense Instruction
EMI	Electromagnetic Interference
EPCOG	Eastern Plains Council of Governments
ETZ	extra territorial zone
FAA	Federal Aviation Administration
FAR	floor area ratio
HAFZ	Hazards to Aircraft Flight Zone
Hz	hertz
IFR	Instrument Flight Rules
LED	Light Emitting Diode
mph	miles per hour

MSL	mean sea level
MTR	military training route
MW	megawatt
NOTAM	Notice to Airmen
NVG	night-vision goggle
PAPI	precision approach path indicator
PM	Program Manager
R	restricted
REPI	Readiness and Environmental Protection Integration
RPA	Remotely Piloted Aircraft
SOF	Special Operations Forces
SOS	Special Operations Squadron
SSALR	simplified short approach lighting system with runway alignment indicator lights
UFC	Unified Facilities Criteria
VFR	visual flight rules

1 INTRODUCTION

This study is an update of the 2005 Cannon Air Force Base (AFB) Air Installations Compatible Use Zones (AICUZ) Study. This AICUZ Study reaffirms the United States Air Force (Air Force) policy of assisting local, regional, state, and federal officials in the areas surrounding Cannon AFB by promoting compatible development within the AICUZ area of influence, and protecting Air Force operational capability from the effects of land use that are incompatible with aircraft operations. The information provided in this AICUZ Study is intended to assist local communities and Cannon AFB with future planning.

The study presents the updated noise contours, which are based on 2016 aircraft operations at Cannon AFB, and documents changes to flight operations, noise exposure areas, accident potential, and land use compatibility conditions since the previous AICUZ Study. Additionally, this study also addresses potential encroachment issues for operations at the Melrose Air Force Range (AFR).

1.1 AICUZ PROGRAM

Military airfields attract development—people who work on base want to live close to the base, while others want to provide services to base employees and residents. When incompatible development occurs near an installation or training area, affected parties within the community may seek relief through political channels that could restrict, degrade, or eliminate capabilities necessary to perform the defense mission. In the early 1970s, the Department of Defense (DoD) established the AICUZ Program. The goal of the program is to protect the health, safety, and welfare of those living and working in the vicinity of a military installation while sustaining the Air Force's operational mission. The Air Force accomplishes this goal by promoting proactive, collaborative planning for compatible development to sustain mission and community objectives.

The AICUZ Program recommends that noise levels, Clear Zones (CZs), Accident Potential Zones (APZs), and flight clearance requirements associated with military airfield operations be incorporated into local community planning programs in order to maintain the airfield's operational requirements while minimizing the impact to residents in the surrounding community. Mutual cooperation in the planning process between military airfield planners and community-based counterparts serves to increase public awareness of the importance of air installations and the need to address mission requirements and associated noise and risk factors. As the communities that surround airfields grow and develop, the Air Force has the responsibility to communicate and collaborate with local government on land use planning, zoning, and similar matters that could affect the installation's operations or missions. Likewise, the Air Force has responsibility to understand and communicate potential impacts that new and changing missions may have on the local community.

1.2 SCOPE AND AUTHORITY

1.2.1 SCOPE

This study uses the 2016 air operations as the basis for the noise contours. CZs and APZs associated with Cannon AFB's runways are provided with recommendations for compatible land uses in the vicinity of the base for state and local governments to incorporate into comprehensive plans, zoning ordinances, subdivision regulations, building codes, and other related documents.

1.2.2 AUTHORITY

Department of Defense Instruction (DoDI) 4165.57, "*Air Installations Compatible Use Zones,"* (DoD 2015), establishes policy and assigns responsibility for educating air installation personnel and engaging local communities on issues related to noise, safety, and compatible land use in and around air installations as well as prescribes procedures for plotting noise contours for land use compatibility analysis.

Air Force Instruction (AFI) 32-7063, "*Air Installations Compatible Use Zones Program,*" (Air Force 2015a) implements DoDI 4165.57 and applies to all Air Force installations with active runways located in the United States and its territories. This instruction provides guidance to installation AICUZ Program Managers (PMs).

Air Force Handbook 32-7084 *AICUZ Program Manager's Guide* (Air Force 2017) provides installation AICUZ PMs specific guidance concerning the organizational tasks and procedures necessary to implement the AICUZ Program. It is written in a "how to" format and aligns with AFI 32-7063.

1.3 PREVIOUS AICUZ EFFORTS AND RELATED STUDIES

Previous studies relevant to this AICUZ Study include:

- 2005 AICUZ Study for Cannon AFB
- 2007 Environmental Impact Statement for the Air Force Special Operations Command Assets Beddown at Cannon AFB, New Mexico
- 2011 Joint Land Use Study for Cannon AFB and Melrose AFR
- 2016 Environmental Assessment for Utilization Enhancements at Melrose AFR, New Mexico

1.4 CHANGES THAT REQUIRE AN AICUZ STUDY UPDATE

AICUZ studies should be updated when an installation has a significant change in aircraft operations (i.e., the number of takeoffs and landings), a change in the type of aircraft stationed and operating at the installation, or changes in flight paths or procedures. This AICUZ Study has been prepared to reflect current flight tracks, noise contours, APZs, and flight operations.

As the DoD aircraft fleet mix and training requirements change over time, the resulting flight operations, which drive the noise contours, change as well. Additionally, non-operational changes may also require the need for an AICUZ Study update. The primary changes at Cannon AFB since the previous 2005 AICUZ Study include:

- Approximate 66 percent decrease in air operations at Cannon AFB
- Changes in flight tracks, runway usage, and total flying days
- Minimum 30 percent increase in night operations for C-130 missions
- Introduction of new aircraft, including the MQ-9, PC-12, and U-28
- Replacement of older model of the C-130 aircraft with the AC-130W and C-130J
- Departure of all F-16 fighter jets and C-145/C-146

1.4.1 UPDATE OF AIR FORCE INSTRUCTIONS

The 2017 Cannon AFB AICUZ Study uses the most recent AFI, which uses “annual average day” aircraft operations (Air Force 2015a). The primary reason for the change to average annual day is to be consistent with the land use recommendations guidelines.

1.4.2 UPDATE OF LAND USE ENVIRONMENT

The land use compatibility analysis of the AICUZ Study should be updated to reflect the current land use environment. New development has occurred around Cannon AFB since the previous AICUZ Studies, and this AICUZ Study includes newly identified areas of compatibility concern.

2 INSTALLATION PROFILE

2.1 LOCATION

Cannon AFB is in the southern portion of Curry County, New Mexico, approximately eight miles west of the city of Clovis (Figure 2-1). The base is situated on the south side of U.S. Highway 60/84. Cannon AFB occupies 4,397 acres, including a 3.8-acre land lease in the northwest corner of the installation and 603 acres of land purchased from the State of New Mexico in the southwest corner of the installation. Development of the 3.8 acres of land is restricted under a 25-year lease agreement with home owners, and the 603 acres of land purchased by the state are under a Conservation Reserve Program contract and cannot be developed until 2017.

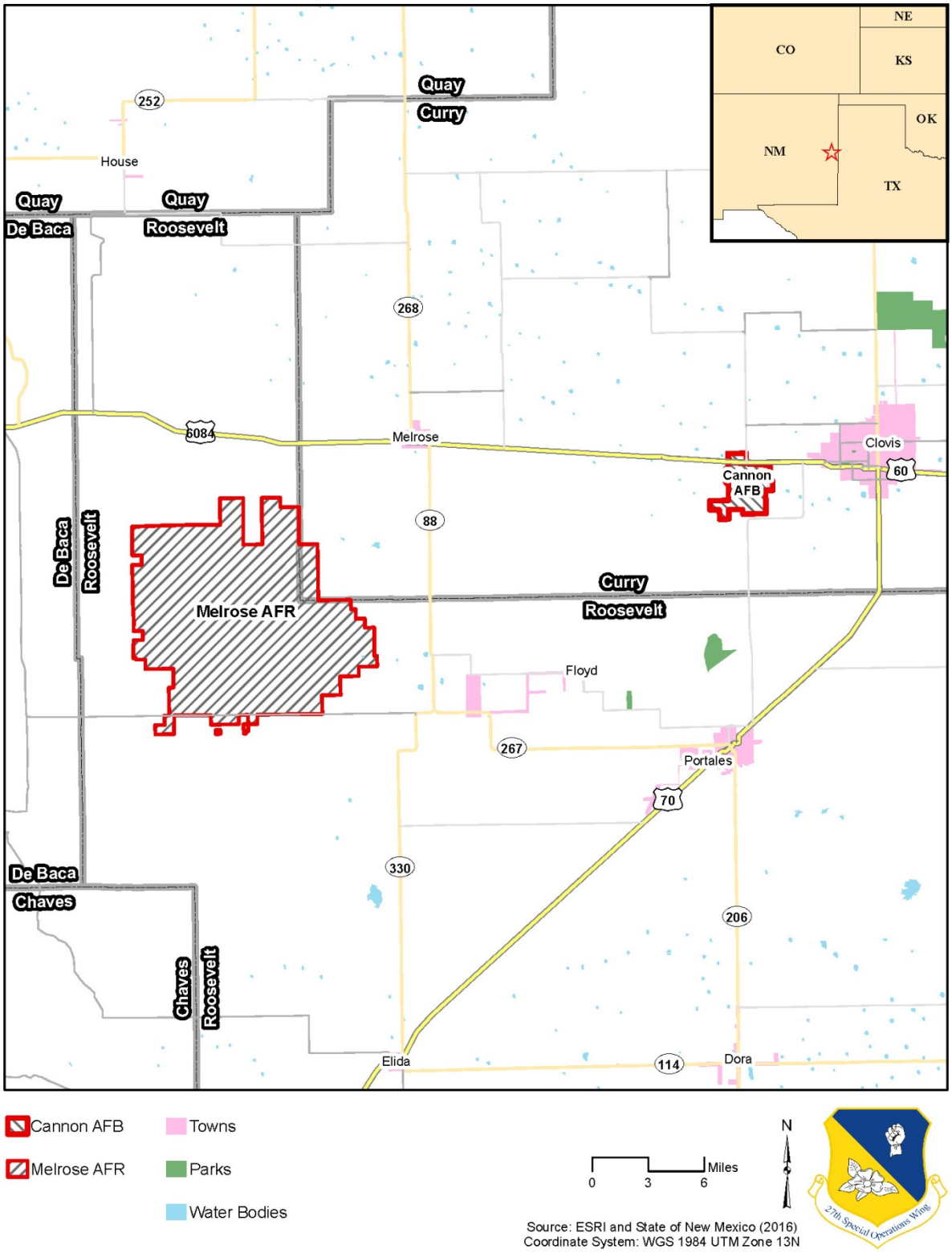
Installation tenants also conduct operations at Melrose AFR, which is approximately 25 miles west of Cannon AFB, in Curry and Roosevelt counties. Melrose AFR occupies approximately 70,978 acres, including a Land Gift Area from the State of New Mexico.

2.2 HISTORY

Cannon AFB was originally established as a civilian passenger terminal known as Portair Field in the late 1920s and was renamed the Clovis Municipal Airport in the 1930s. During World War II, when the military began to use the Clovis Municipal Airport for heavy bomber training, the airport was re-designated as the Clovis Army Airfield in 1942. The Clovis Army Airfield was deactivated in 1947 due to the significant reduction of flying operations after the war and demobilization of armed forces. The Air Training Command, an Air Force Major Command that was a re-designation of the Army Air Forces Training Command, maintained ownership of the airfield until July 1951 when the Air Force Tactical Air Command acquired the airfield. In November 1951, the Tactical Air Command moved the 140th Fighter-Bomber Wing and reactivated the airfield as the Clovis Air Force Base.

In June 1957, the base was officially named Cannon AFB in honor of the late General John K. Cannon, the former commander of the Tactical Air Command. The 27th Fighter Wing moved to Cannon AFB in 1959, and the base eventually transitioned from Air Combat Command to a Special Operations Command. The 27th Fighter Wing was designated the 27th Special Operations Wing in 2007.

Figure 2-1: Regional Location



2.3 MISSION

Cannon AFB is home to the 27th Special Operations Wing (27 SOW). The primary mission of the 27 SOW is to "plan and execute specialized and contingency operations using advanced aircraft tactics, and air refueling techniques to infiltrate, exfiltrate, surveillance and reconnaissance, and close air support in support of the special operations forces" (Headquarters Air Force 2012). The 27 SOW is part of the Air Force Special Operations Command (AFSOC), which provides Special Operations Forces (SOF) for worldwide deployment and assignment to regional unified commands. The wing's core operations include "close air support, agile combat support, information operations, precision strike, forward presence and engagement, intelligence, surveillance and reconnaissance operations, and specialized aerospace mobility"(Cannon AFB 2016b). The primary mission is accomplished through the support of 27th Special Operations Group (27 SOG), 27th Special Operations Maintenance Group (27 SOMXG), 27th Special Operations Medical Group (27 SOMDG), and 27th Special Operations Mission Support Group (27 SOMSG).

The 27 SOG "conducts infiltration/exfiltration, combat support, helicopter and tilt-rotor aerial refueling, psychological warfare, and other special missions. The group is responsible for deployment, employment, training, and planning for the squadrons that operate the based aircraft and other aircraft as necessary" (Headquarters Air Force 2012). Special Operations Squadrons (SOS) in the 27 SOG include the 9 SOS, 12 SOS, 16 SOS, 20 SOS, and 318 SOS.

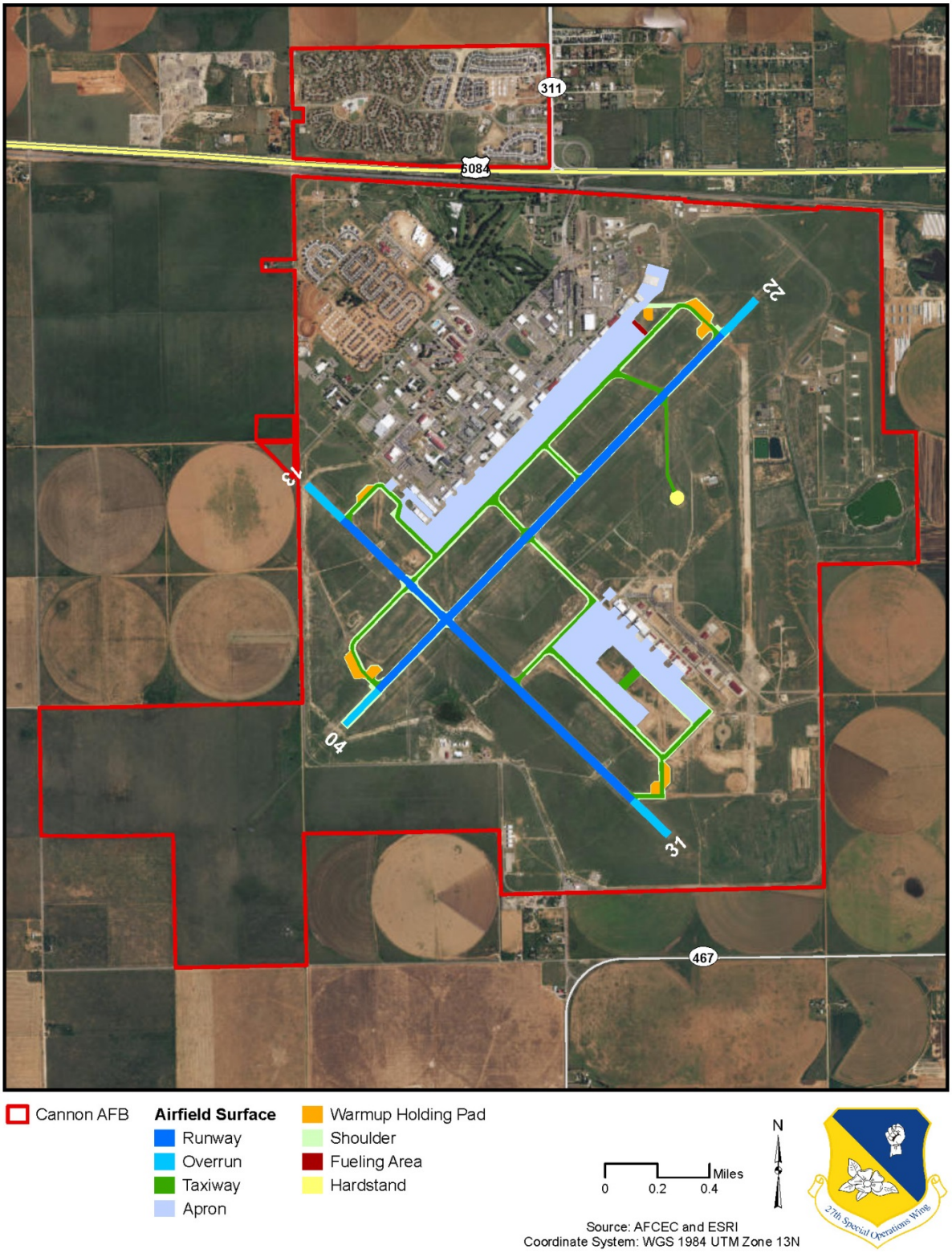
2.4 OPERATIONAL AREAS

Cannon AFB airfield is located on 231 acres of land in the center of the base and consists of crossed Class B runways[1] and associated building and service areas for base operations and maintenance. Airfield components are shown in Figure 2-2. Class B runways are primarily used by large, heavy, and high-performance aircraft.

Runway 04/22, the primary runway, is oriented northeast/southwest and measures 10,003 feet long and 150 feet wide. Runway 13/31 is oriented northwest/southeast and measures 8,196 feet long and 150 feet wide (Cannon AFB 2016b). The airfield elevation is 4,295 feet above mean sea level (MSL). Runway 04/22 is equipped with a high intensity approach lighting system with centerline sequenced flashers, and precision approach path indicators (PAPI). Runway 13/31 is equipped with simplified short approach lighting system with runway alignment indicator lights (SSALR) and PAPI (AirNav 2016).

[1] A runway is typically used in both directions and counted as two separate runways, depending on the direction of the departure. Each direction is labeled as a separate runway and numbered based on its magnetic heading.

Figure 2-2: Cannon AFB Airfield



Day and night operations are conducted at Cannon AFB. Current hours of operation and the schedule for weekend hours or holidays are published by the DoD or Federal Aviation Administration (FAA) in Notices to Airmen (NOTAMs). Extenuating circumstances can result in extended operating hours or temporarily suspended operations. The airfield may be temporarily closed in consideration of landing area conditions, crash crew equipment availability, status of navigational aids, and severe weather conditions.

Melrose AFR is used for air-to-ground, small arms, and electronic combat training mission requirements. A total of 60,010 acres are designated as the Operational Training Area that is accessible only to authorized Air Force personnel and contractors. All weapons safety footprints, maneuver areas, training areas, and administrative and support facilities are located within the Operational Training Area. The remaining 10,968 acres (Land Gift Area) are owned by the State of New Mexico and leased to the Air Force for an additional training area (Air Force 2014). Airspace over the range complex is restricted (R) area 5104A. R-5104A encompasses airspace over the entire Melrose AFR, from the surface to, but not including, 18,000 feet above MSL (Air Force 2014).

2.5 LOCAL ECONOMIC IMPACTS

The military provides direct, indirect, and induced economic benefit to local communities through jobs and wages. Benefits include employment opportunities and increases in local business revenue, property sales, and tax revenue. The economic impact of a military installation is based on annual payroll (jobs and salaries), annual expenditures, and the estimated annual dollar value of jobs created. The military further contributes to the local economy through increased demand for local goods and services and increased household spending by military and civilian employees.

Cannon AFB is the largest employer in Curry County and directly employs a combined workforce of 5,867 military and civilian personnel (Cannon AFB 2016a). In 2016, the installation's annual spending generated $535.1 million in local expenditures including construction, services, and procurement methods, and created an additional 1,874 jobs in the local communities. In total, Cannon AFB has an estimated annual economic impact of nearly $922 million on the local economy. The majority of this economic impact was due to annual payroll and expenditures.

A summary of personnel for Cannon AFB is provided in Table 2-1, and a summary of the economic impact of the base is provided in Table 2-2.

Table 2-1: Personnel by Classification at Cannon AFB

Classification	Total
Active Duty Military	4,634
Reserve and Guard	0
Total Military	**4,634**
Appropriated Fund Civilian Employees	463
Other Civilian Employees	770
Total Civilian	**1,233**
Total Personnel	**5,867**

Source: Cannon AFB 2016b.

Table 2-2: Annual Economic Impact of Cannon AFB

Payroll	($Million)
Military	274.0
Federal Civilian	32.3
Other Civilian	14.0
Total	**320.3**
Expenditures	**($Million)**
Annual Expenditures	535.1
Estimated Annual Dollar Value of Jobs Created	66.9
Annual Payroll	320.3
Total Economic Impact	**922.3**

Source: Cannon AFB 2016b

3 AIRCRAFT OPERATIONS

Flying activities, including where aircraft fly, how high they fly, how many times they fly over a given area, and the time of day they operate, must be fully evaluated to understand the relationship of flight operations and land use. This chapter discusses aircraft based at or transient to Cannon AFB, the types and numbers of operations conducted at the airfield, and the runways and flight tracks used to conduct the operations.

3.1 AIRCRAFT TYPES

3.1.1 BASED AIRCRAFT

Cannon AFB supports both fixed-wing aircraft (propellers or jet-fighters) and rotary-wing aircraft (helicopters) flight operations. Fixed-wing aircraft operations at Cannon AFB are associated with special operations missions related to aerial refueling of Special Operations Forces (SOF) aircraft and the infiltration, exfiltration, and resupply of joint and coalition SOF. The based rotary-wing aircraft operations also support special operations missions and conduct day or night low-level penetration into hostile enemy territory, to accomplish infiltration and exfiltration, aerial gunnery support, and resupply of SOF throughout the world. The C-130 aircraft series (i.e., AC-130W and MC-130J) and the U-28A/PC-12 aircraft account for the majority of flight operations at Cannon AFB (30 and 43 percent of flight operations, respectively). A list of based aircraft at Cannon AFB and the associated flying units are presented in Table 3-1. Transient aircraft operations, which account for approximately 1 percent of total operations at Cannon AFB, are discussed in Section 3.1.2 *Transient Aircraft*.

Table 3-1: Based Aircraft at Cannon AFB

Squadron/Unit	Aircraft Type	Description
9 SOS	MC-130J	Four-engine transport aircraft
16 SOS/551 SOS	AC-130W	Four-engine transport aircraft
20 SOS	CV-22B	Twin-engine combat and utility helicopter
318/SOS	U-28A/PC-12	Single-engine turboprop passenger and cargo aircraft
12 SOS	MQ-9	Single-engine remotely piloted aircraft

3.1.1.1 MC-130J "COMMANDO II"

The MC-130J Commando II is an in-flight refueling and cargo delivery aircraft used by the Air Force for low-altitude missions over hostile territory. The MC-130J is approximately 98 feet long and 39 feet tall, and has a wingspan of 133 feet. The four-engine turboprop aircraft has a maximum takeoff weight of 164,000 pounds and can reach speeds of 415 miles per hour (mph) (Air Force 2011).

3.1.1.2 AC-130W "STINGER II"

The AC-130W Stinger II is a special operations fixed-wing aircraft used for close air support and air interdiction missions. The AC-130W includes enhanced navigation, threat detection, countermeasures, and communications systems and features a precision strike package for gunship mission. The AC-130W is approximately 98 feet long and 39 feet tall, and has a wingspan of 133 feet. The four-engine turboprop aircraft has a maximum takeoff weight of 155,000 pounds and can reach speeds of 300 mph (Air Force 2016a).

3.1.1.3 CV-22B "OSPREY"

The CV-22B Osprey is a twin-engine tiltrotor aircraft, which has the vertical lift capabilities of a helicopter in combination with the long-range fuel efficiency and speed of a turboprop aircraft. The CV-22B is used for long-range combat and resupply missions for SOF. The CV-22B is approximately 57 feet long and 22 feet tall, and has a wingspan of 85 feet. The aircraft has a maximum vertical takeoff weight of 52,870 pounds, a cruising speed of 277 mph. and a combat radius range of 500 nautical miles (Air Force 2016b).

3.1.1.4 U-28A

The U-28A is part of the Air Force Special Operations Command Light Tactical Fixed Wing fleet that addresses mission-specific needs. The U-28A provides a manned fixed-wing capability for improved tactical airborne intelligence, surveillance, and reconnaissance.

The aircraft has a wingspan of 53 feet, a length of 47 feet, and a height of 14 feet. The U-28A can reach speeds of 250 mph, a service ceiling of 30,000 feet, and an operational range of 1,500 nautical miles (Air Force 2012). The U-28A is a modification of the PC-12 Pilatus, which is a single-engine turboprop business/passenger aircraft.

3.1.1.5 MQ-9 "REAPER"

The MQ-9 Reaper is a multi-mission long-range, medium-altitude Remotely Piloted Aircraft (RPA) primarily used for intelligence collection. The secondary role of the aircraft is enemy dynamic targeting to destroy or disable time-sensitive targets. The MQ-9 is approximately 36 feet long and 12 feet tall, and has a wingspan of 66 feet. The MQ-9 has a single turboprop engine that provides 900 horsepower to reach speeds of 230 mph, a service ceiling of 50,000 feet, and an operational range of 1,000 nautical miles (Air Force 2015b).

3.1.2 TRANSIENT AIRCRAFT

Non-assigned aircraft at an airfield are considered transient. These aircraft typically land at other airfields to refuel or to conduct airfield training that cannot otherwise be accomplished at their home airfield. Table 3-2 lists the typical transient aircraft types at Cannon AFB (note: the table is not inclusive of all transit aircraft at Cannon AFB).

Table 3-2: Transient Aircraft

Aircraft Type	Description
C-12	Twin-engine turboprop
C-17	Four-engine large transport aircraft
C-21	Twin-engine jet
F-16 and F-35	Single-engine fighter jet
F-18	Twin-engine fighter jet
B-767	Twin-engine commercial jet
UH-60	Twin-engine medium-lift helicopter
Piston	Aircraft powered by piston engine(s)

3.1.2.1 C-12 "HURON"

The C-12 Huron is a twin-engine turboprop aircraft used for passengers and cargo transport. The aircraft has a maximum speed of 334 mph, a service range of 1,974 nautical miles, and a maximum operational ceiling of 35,000 feet (United States Navy 2009).

3.1.2.2 C-17 "GLOBEMASTER"

The C-17 Globemaster is a large transport aircraft used for strategic delivery of troops and cargo worldwide. The aircraft can operate through small and austere airfields and is capable of landing and takeoff on short and narrow runways. The aircraft has a maximum payload capacity of 170,900 pounds, and the maximum gross takeoff weight is 585,000 pounds. The C-17 has a cruise speed of approximately 450 knots and an unrefueled range of approximately 2,400 nautical miles (Air Force 2015c).

3.1.2.3 C-21

The C-21 is a twin-engine turbofan jet used for cargo and passenger airlift. The C-21 is also used to transport patients during aeromedical evacuations. The aircraft's length is approximately 49 feet with a height of 12 feet and a wingspan of 39.5 feet. The aircraft has a maximum speed of 530 mph and an operational ceiling of 45,000 feet (Air Force 2003).

3.1.2.4 F-16 "FIGHTING FALCON"

The F-16 Fighting Falcon is single-engine multirole fighter jet with a high-performance weapon system used for air-to-air combat and air-to-surface attack operations. The aircraft's length is approximately 49.5 feet with a height of 16 feet and a wingspan of over 32 feet. The aircraft has a maximum speed of 1,500 mph and a maximum range of more than 2,002 miles (Air Force 2015d).

3.1.2.5 F-18 "HORNET"

The F-18 Hornet is a twin-engine multi-mission fighter jet used for air superiority, fighter escort, suppression of enemy air defenses, reconnaissance, forward air control, close and deep air support, and day and night strike missions. The aircraft is equipped with a digital control-by-wire flight control system that provides excellent handling and maneuverability.

3.1.2.6 B-767

The Boeing 767 (B-767) is a large jet airliner with twin turbofan engines. The aircraft was introduced in the 1970s to commercial airlines. B-767 passenger series have since been modified for commercial freight and cargo use. Military derivatives of the B-767 aircraft are used for airborne surveillance, refueling tankers, and cargo and passenger transport.

3.1.2.7 UH-60 "BLACK HAWK"

The UH-60 Black Hawk is a twin-engine medium lift utility helicopter used primarily for transport, air assault, and aeromedical evacuation units. The UH-60 is equipped with a single four-bladed rotor and a single four-bladed tail rotor.

3.1.2.8 F-35 LIGHTNING

The F-35 Lightning II is a single-seat, single-engine, 5th generation fighter aircraft that combines stealth and agility with advanced capabilities and technologies to support multi-service and multi-role operational requirements. All F-35s variants are based on a common airframe and power generation core to meet each branch service's operational needs. The F-35A is the conventional takeoff variant used by the U.S. Air Force. The F-35 is expected to lead the manned tactical airpower of the U.S. Air Force, Navy, and Marine Corps over the coming decades.

3.2 PRE-FLIGHT AND MAINTENANCE RUN OPERATIONS

Pre-flight engine runs and maintenance runs are conducted prior to takeoff to test engines at various power settings and durations and to check for malfunctions. Run-up locations are designated areas along the flight line where pilots or mechanics can conduct last-minute engine checks without obstructing ground traffic. To the maximum extent possible, engine run-up locations are established in areas that minimize noise impacts on base and in the surrounding communities. Additionally, out-of-frame engine testing occurs in a "test cell," which is a building specifically designed to muffle engine noise during testing. A total of 22 maintenance run-up locations are located at Cannon AFB. Engine run-up locations are depicted in Figure 2-2.

Engine runs are not typically conducted between 10:00 p.m. and 7:00 a.m.; however, depending on mission necessity, maintenance engine runs could occur during nighttime hours. The noise associated with pre-flight engine runs and maintenance runs was included in the noise analysis and modeling associated with the noise contours.

3.3 FLIGHT OPERATIONS

An aircraft "operation" is defined as one takeoff or one landing. A complete closed pattern or circuit is counted as two operations because the aircraft crosses over a runway threshold twice, once on arrival and once on departure. Typical flight operations conducted at Cannon AFB include:

- **Departure.** An aircraft takes off to a training area or as part of a training maneuver.
- **Approaches and Arrivals.**
  - **Straight-In/Full-Stop Arrival**. An aircraft lines up on the runway extended centerline, descends gradually, lands, comes to a full stop, and then taxis off the runway.
  - **Overhead Arrival**. An expeditious arrival using visual flight rules (VFR). The aircraft arrives over the airfield at pattern altitude and then breaks (turns), performing a 180-degree turn to enter the landing pattern. Once established in the pattern, the aircraft lowers landing gear and flaps and performs a 180-degree descending turn to land on the runway.
  - **Low Approach**. Runway approach where the pilot descends near the runway, then increases altitude and departs the airfield's airspace without making contact with the runway.
  - **Radar Approach**. An instrument approach is provided with active assistance from air traffic control (ATC). ATC personnel direct the aircraft to align with the runway centerline and glideslope to the runway, continuing until the pilot gains visual contact with the runway environment.
  - **Tactical Assault Landing Procedures.** An approach procedure to simulate a short landing on unprepared surfaces with engines at idle. This approach could occur

under random steep landing and shallow landing depending on the altitude when the approach begins.

- **Patterns.** Patterns refer to operations where the pilot trains in a circuit at the airfield. Patterns are designed with either left- or right-hand turns depending on variables that include airport design/layout and urban development/noise restrictions.

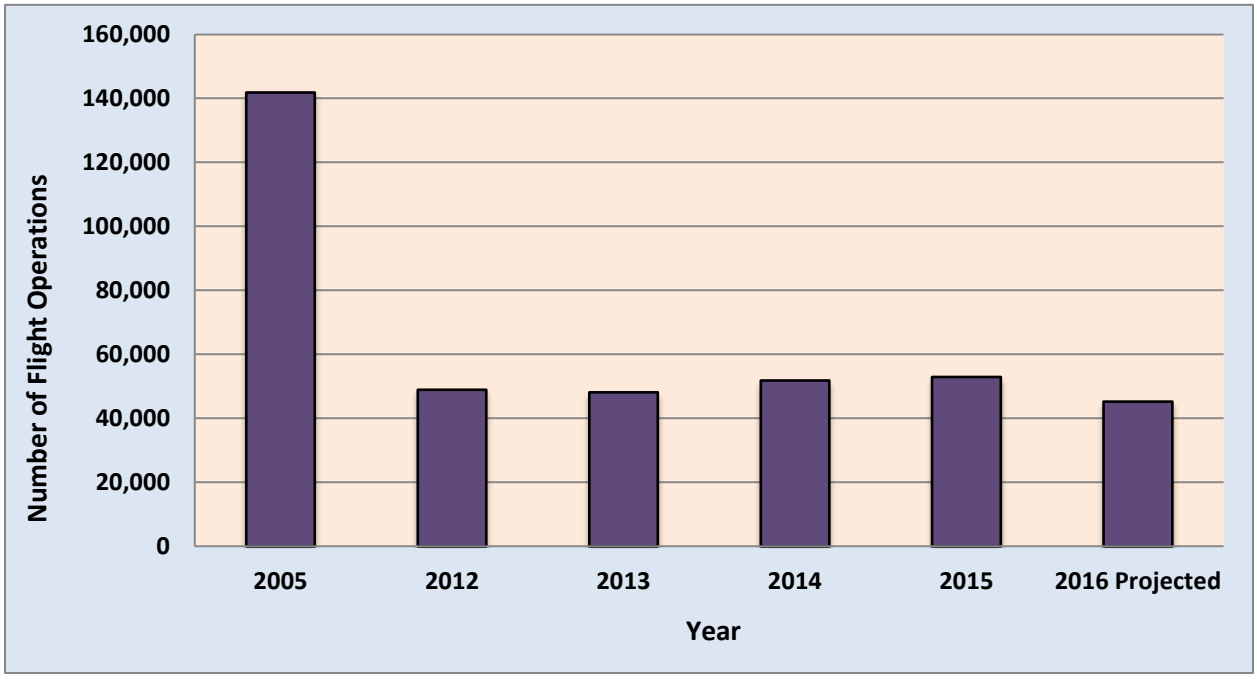
  A pilot can operate an aircraft by VFR or instrument flight rules (IFR). VFR is a standard set of rules that govern the procedures for conducting flight under visual conditions (i.e., pilots remain clear of clouds, avoid other aircraft, and usually fly unassisted by ATC). IFR is a standard set of rules governing the procedures for conducting flights whereby ATC provides for separation between aircraft and is the standard flight rule used outside of the local traffic pattern. Pilots flying IFR do so with the assistance of ATC and aircraft instruments.

  - **Touch and Go.** A touch-and-go landing pattern is a maneuver that involves landing on a runway and taking off again without coming to a full stop. Usually, the pilot then circles the airport in a defined pattern known as a circuit and repeats the maneuver.
  - **Ground Control Approach**. A radar or "talk down" approach directed from the ground by ATC. ATC personnel provide pilots with verbal course and glide slope information, allowing them to make an instrument approach during inclement weather. A box-shaped pattern is normally flown to practice ground control approaches.
  - **Simulated Flameout Pattern Approach**. A practice approach at idle thrust to a runway to simulate the run-down of a jet engine caused by the extinction of the flame in the combustion chamber ("flameout"). The approach may start over a runway at higher altitude and continue on a relatively high and wide downwind leg with continuous turn to final landing or low approach.

3.4 ANNUAL OPERATIONS

Figure 3-1 summarizes flight operations, including assigned and transient aircraft operations, that occurred at Cannon AFB in 2005 (year of the previous AICUZ Study), from 2012 through 2015, and the 2016 projected operations. Total annual operations account for each departure and arrival, including those conducted as part of a pattern operation.

Figure 3-1: Summary of Flight Operations



3.4.1 PROJECTED FLIGHT OPERATIONS

A total of 45,244 annual flight operations are projected at Cannon AFB for the 2017 AICUZ Study, which reflects an approximate 66 percent decrease in flight operations since 2005. Projected operations are based on the maximum mission capacity anticipated over the next three to five years with no deployments. Projected operations are slightly lower in comparison to operations between 2012 and 2016 due to the departure of 551 SOS C-146 operations in late 2016.

Table 3-3 summarizes the projected annual flight operations for Cannon AFB. Consistent with Air Force policy, aircraft operations are modeled on an annual average day basis that is based on 365 flying days per year. Average annual day is used to define the average number of daily airfield operations that would occur during a 24-hour period.

Table 3-3: Projected Annual Flight Operations at Cannon AFB

Aircraft	Departures	Arrivals	Closed Patterns	Total
Assigned Aircraft				
CV-22B	900	900	824	2,624
AC-130W	980	980	6,960	8,920
MC-130J	402	402	3,780	4,584
MQ-9	416	416	7,072	7,904
PC-12/U-28A	3,042	3,042	14,600	20,684
Total	**5,740**	**5,740**	**33,236**	**44,716**
Transient Aircraft				
C-12	20	20	0	40
C-17	38	38	0	76
C-21	9	9	0	18
Single-engine jet (F-16 and F-35)	10	10	32	52
Twin engine jet (F-18)	20	20	64	104
B-767	27	27	0	54
Piston	10	10	0	20
UH-60	82	82	0	164
Total	**216**	**216**	**96**	**528**
Total Assigned and Transient Aircraft Operations				**45,244**

3.5 FLIGHT TRACKS AND RUNWAY UTILIZATION

Each runway has designated flight tracks that provide for the safety, consistency, and control of an airfield. A flight track is a route an aircraft follows while conducting an operation at the airfield, between airfields, or to/from training areas. Flight tracks typically include departures, arrivals, and local area patterns to depict where the aircraft fly in relation to the airfield.

While a flight track is graphically represented in this study as a single line, the actual flight track over the ground is much broader due to aircraft performance, pilot technique, and weather conditions. Flights are idealized representations based on pilot and ATC input. Figures 3-2 through 3-13 illustrate the arrival, departure, and pattern flight tracks for Cannon AFB.

New flight tracks have been added since the 2005 AICUZ Study for the CV-22s, which requires unique flight profiles as a result of the aircraft's dual helicopter and fixed-wing flying capabilities. For the fixed-wing aircraft, excluding CV-22s flying in the fixed-wing mode, the new flight tracks include tactical steep and shallow arrivals, and closed patterns to various runways. By following the tactical steep flight tracks, aircraft maintain very high altitude on the first pass of the runway then descend rapidly in an overhead type arrival over the airfield on the second

pass to or over a specific runway. Under the tactical steep arrival training, aircraft descend vertically 4,000 feet in a very short timeframe. Following the tactical shallow flight tracks, aircraft maintain altitude at 500 feet during the approach and then make a very quick overhead arrival to the cross runways.

Cannon AFB has four runways for flight training (see Figure 2-2). In the near future, several Field Carrier Landing Practice pads will be established adjacent to each runway end for 20 SOS CV-22s to practice landing procedures for Navy carrier operations.

Predominant runway usage at Cannon AFB occurs on Runway 22, which is the designated "calm wind" runway. Together, Runway 04 and Runway 22 account for approximately 65 to 70 percent of all flying operations at Cannon AFB. The remaining runway use is comparably distributed among Runways 13 and 31 with the highest usage at Runway 04. CV-22 rotary-wing operations occur on the airfield taxiways or the runways.

3.6 NOISE ABATEMENT PROCEDURES

The Air Force strives to be a good neighbor and actively pursues operational measures to minimize aircraft noise. Noise abatement procedures apply to flight operations, as well as engine run-up and maintenance operations conducted on station. To the greatest extent possible, flights are routed over sparsely populated areas to reduce the exposure to noise. Through Air Force regulations, commanders are required to periodically review existing traffic patterns, instrument approaches, weather constrictions, and operating practices in relation to populated areas and other local situations.

The Cannon AFB Inflight Guides include detailed noise abatement procedures for departures, patterns, and arrivals, such as:

- Pilots are instructed to avoid noise-sensitive areas for low-level routes.
- Departure and patterns are routed to avoid heavily populated areas as much as possible. The majority of pattern flight tracks avoid housing areas located directly north of the installation.
- Given the low-flying altitude, CV-22 pattern operations are restricted within the southern side of the airfield.

3.7 NOISE COMPLAINTS

On average, Cannon AFB receives approximately 25 complaints each year for operations at the main base and Melrose AFR, including complaints received during special events and air shows. All noise complaints are evaluated to ensure future operations, where possible, do not generate unacceptable noise, and the results from noise investigations are provided back to the complainant as soon as practical. Concerned citizens are encouraged to contact Cannon AFB Public Affairs Office with any noise complaints. Citizens can call the main number at the Public Affairs Office for complaints at 575-784-4131 or file complaints online at www.cannon.af.mil.

Figure 3-2: Modeled Runway 04 Arrival Flight Tracks, Cannon AFB

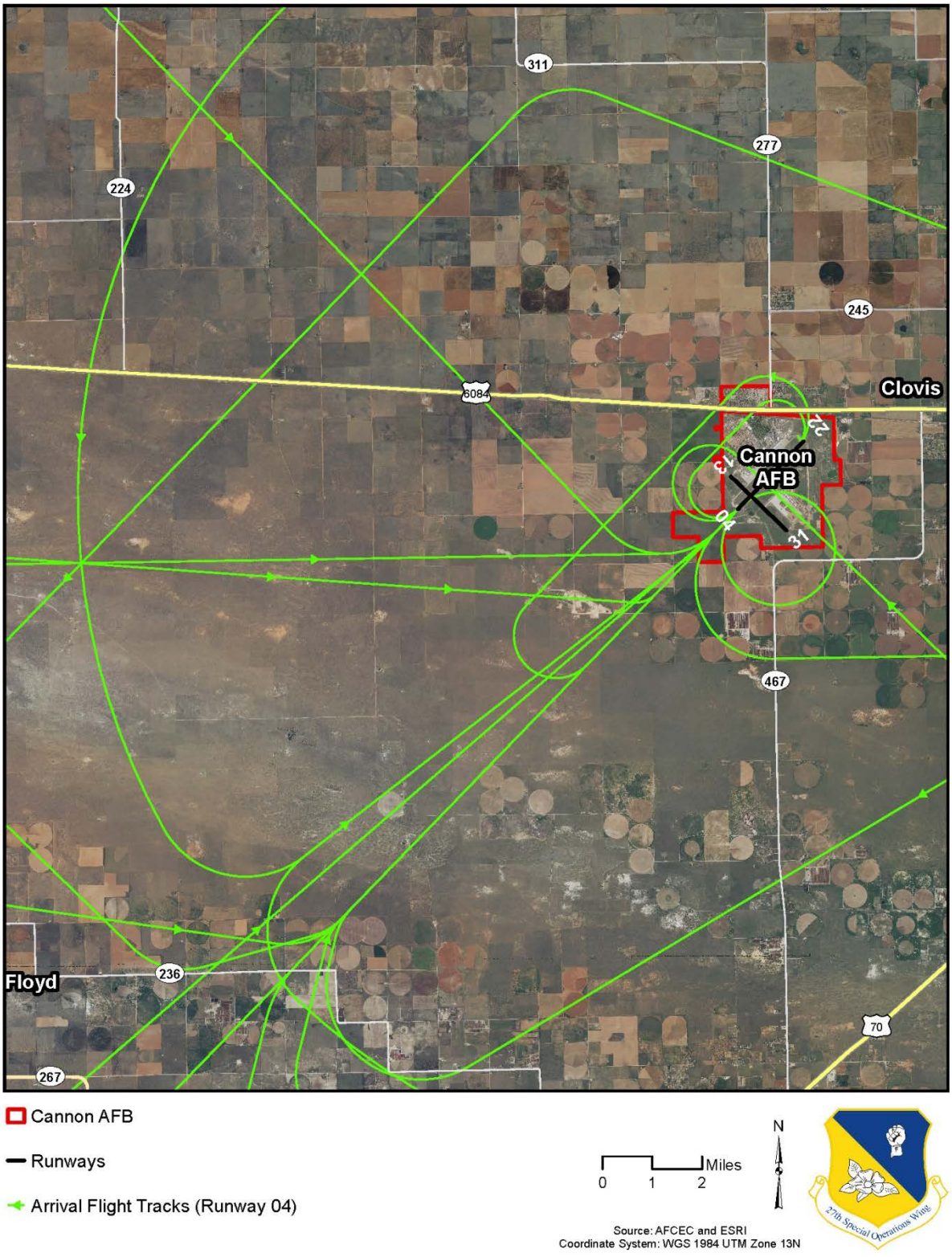


Figure 3-3: Modeled Runway 13 Arrival Flight Tracks, Cannon AFB

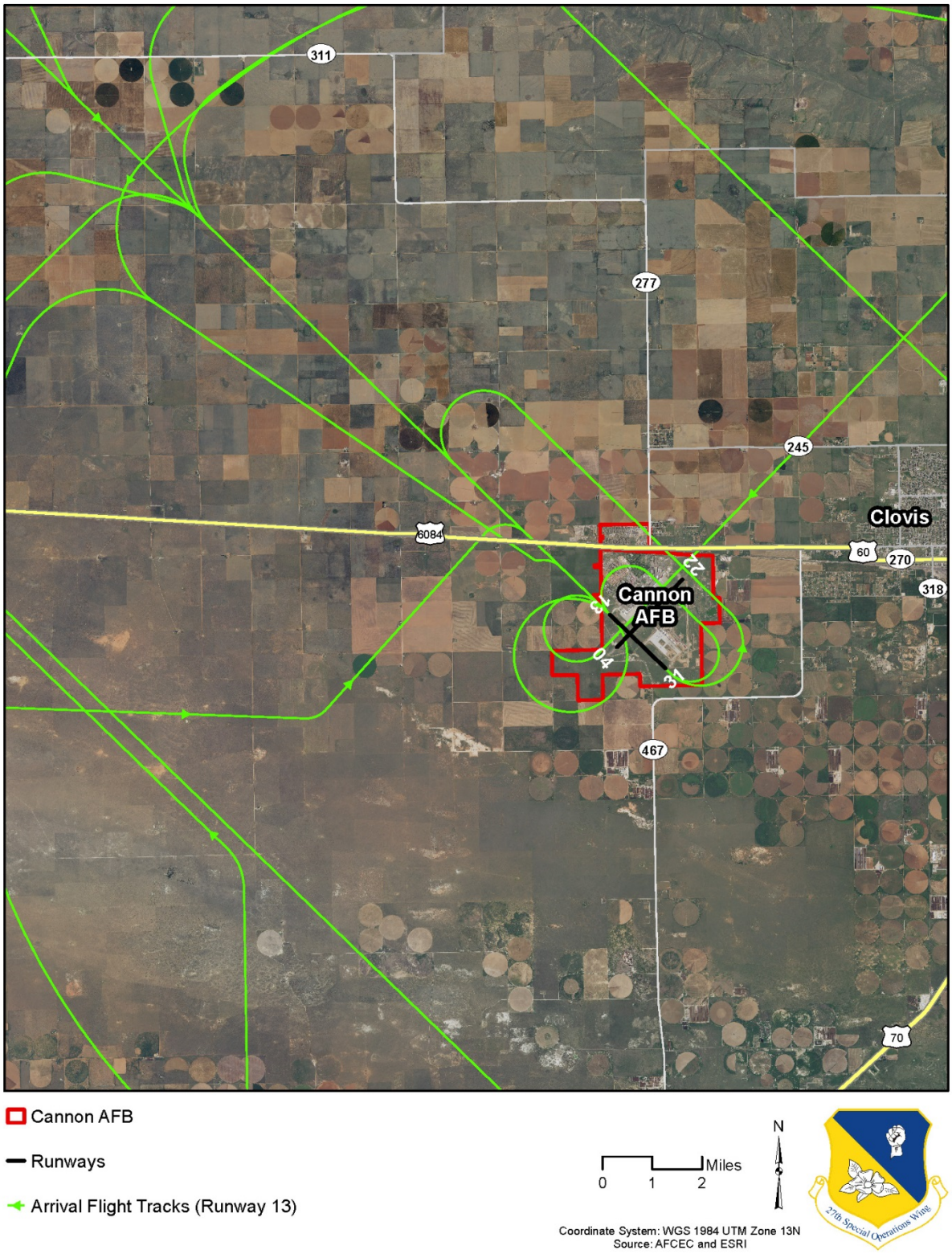


Figure 3-4: Modeled Runway 22 Arrival Flight Tracks, Cannon AFB

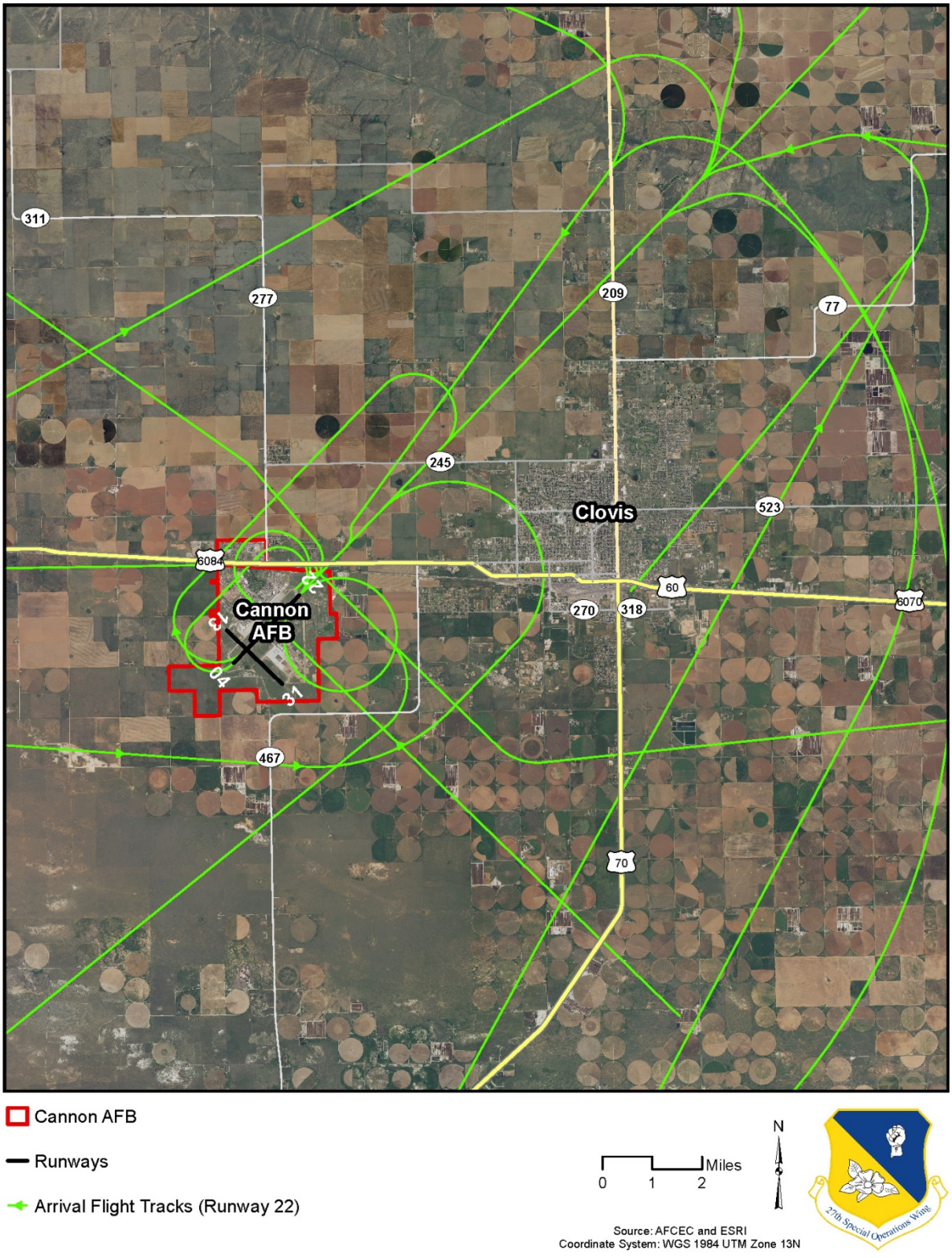


Figure 3-5: Modeled Runway 31 Arrival Flight Tracks, Cannon AFB

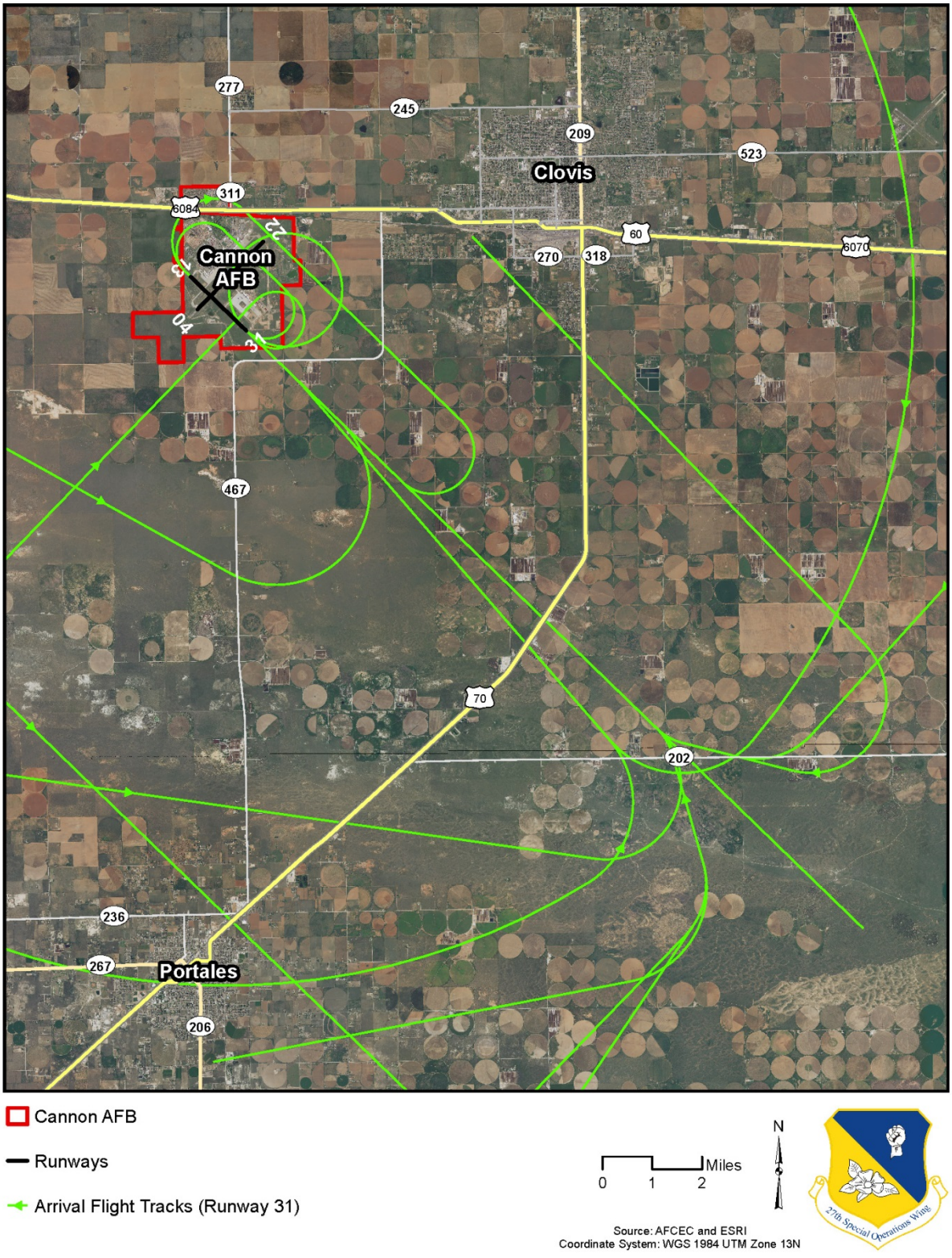


Figure 3-6: Modeled Runway 04 Departure Flight Tracks, Cannon AFB

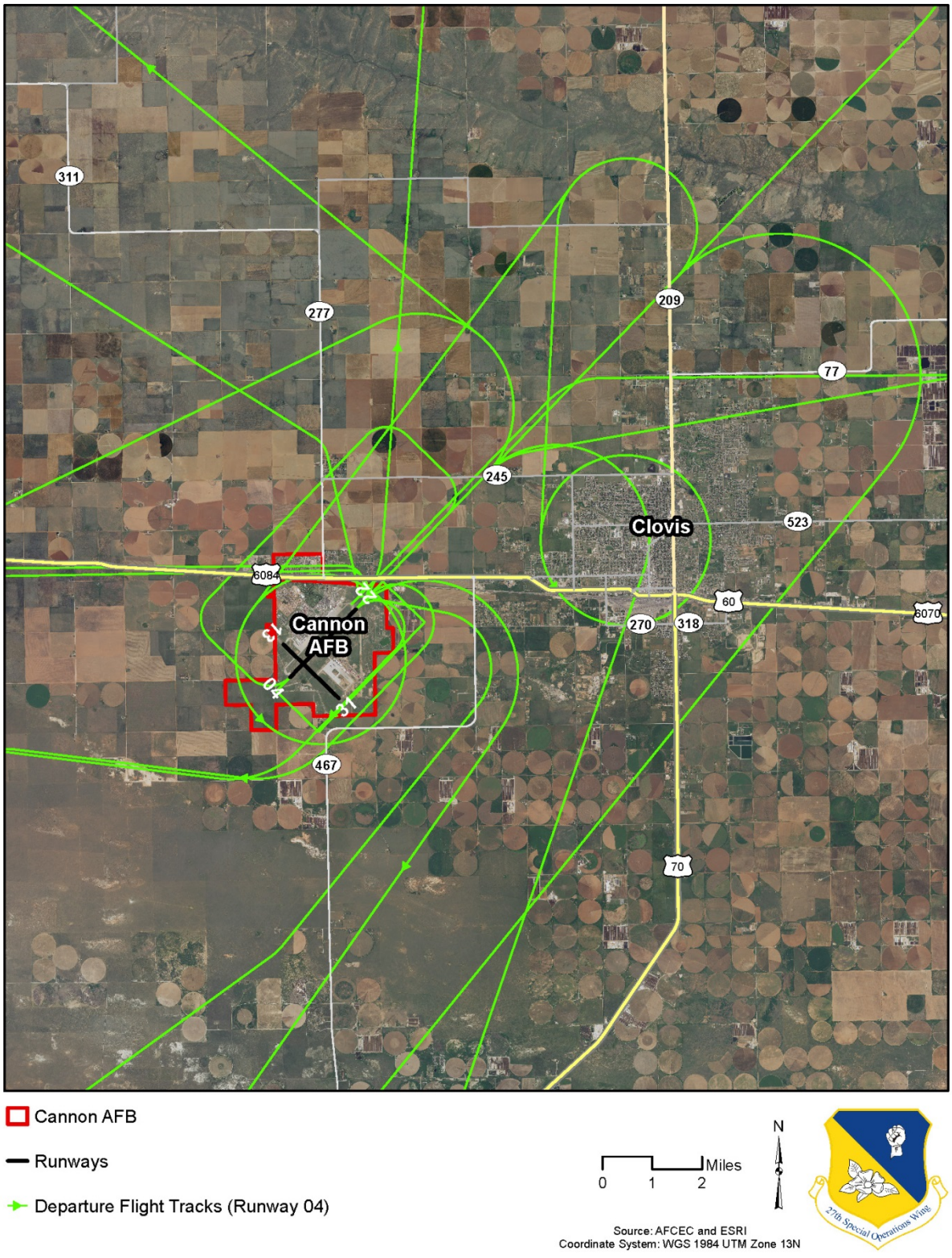


Figure 3-7: Modeled Runway 13 Departure Flight Tracks, Cannon AFB

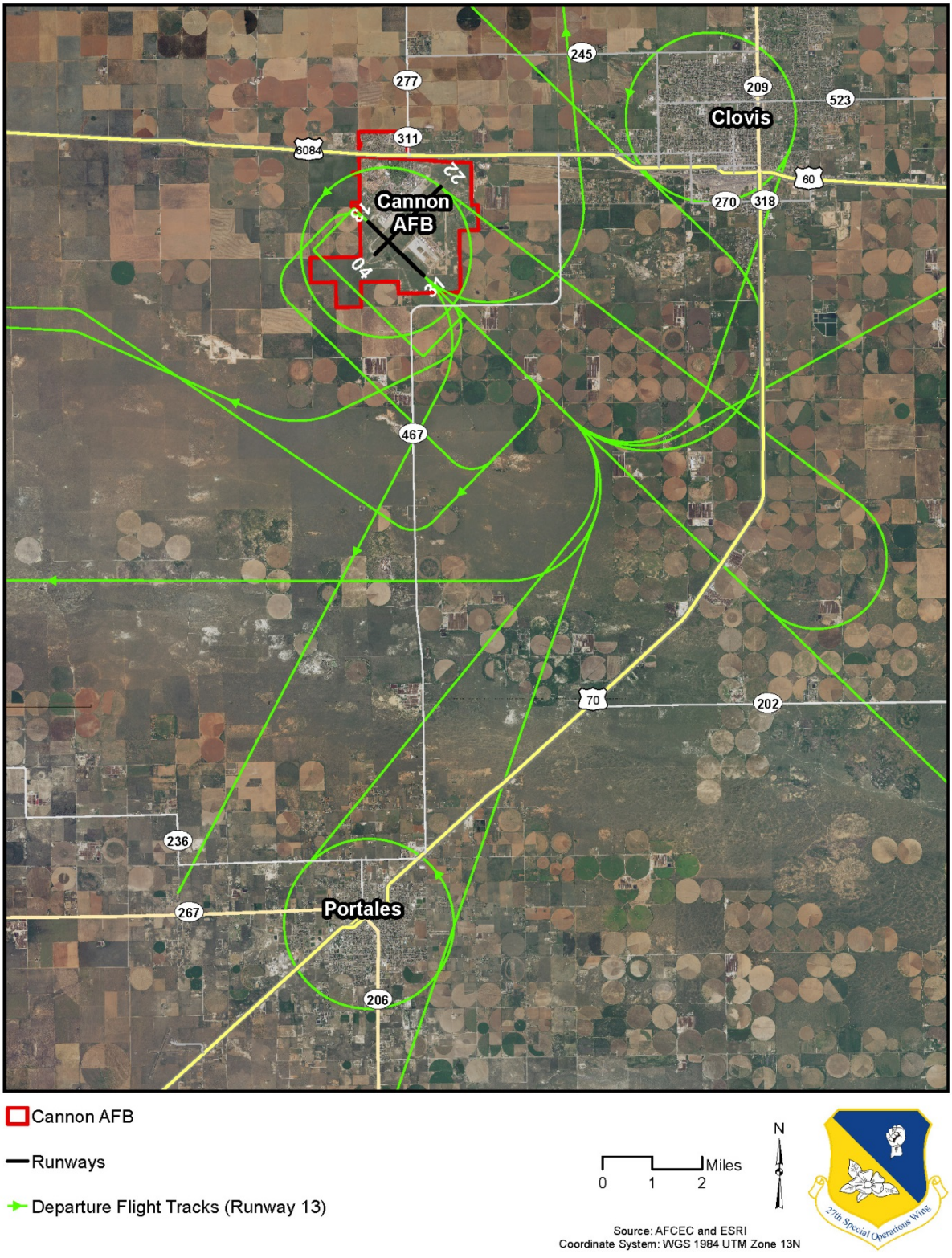


Figure 3-8: Modeled Runway 22 Departure Flight Tracks, Cannon AFB

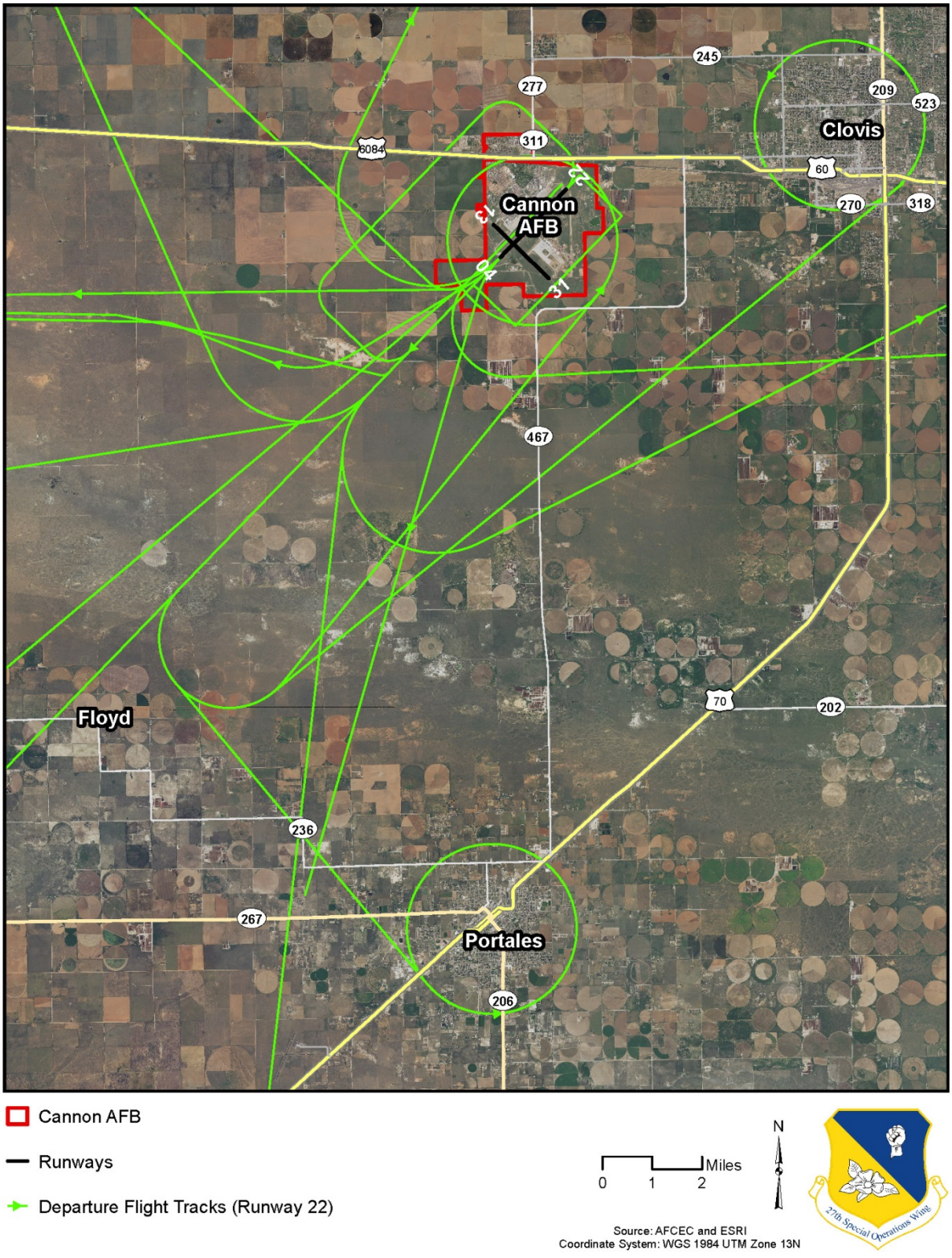


Figure 3-9: Modeled Runway 31 Departure Flight Tracks, Cannon AFB

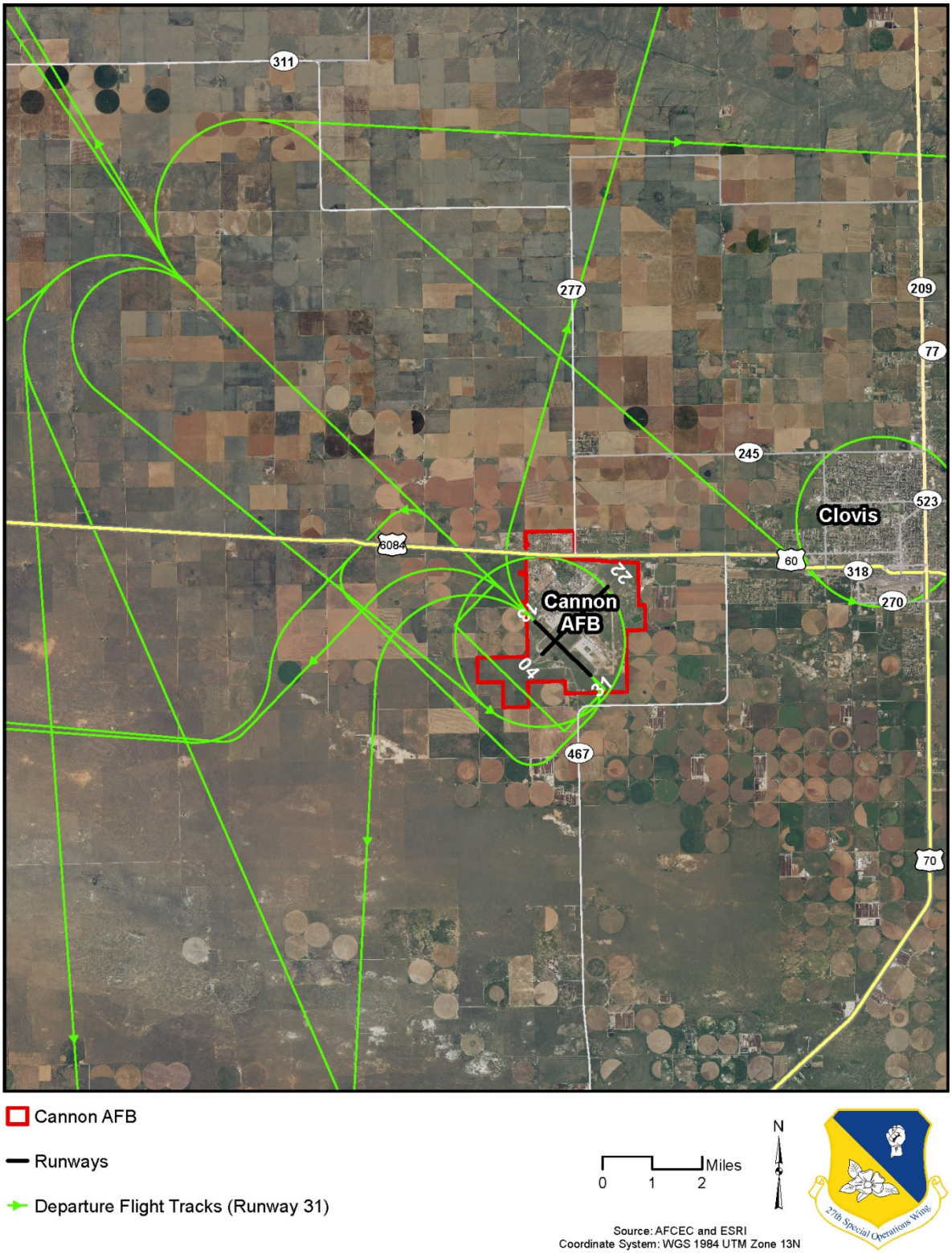


Figure 3-10: Modeled Runway 04 Pattern Flight Tracks, Cannon AFB

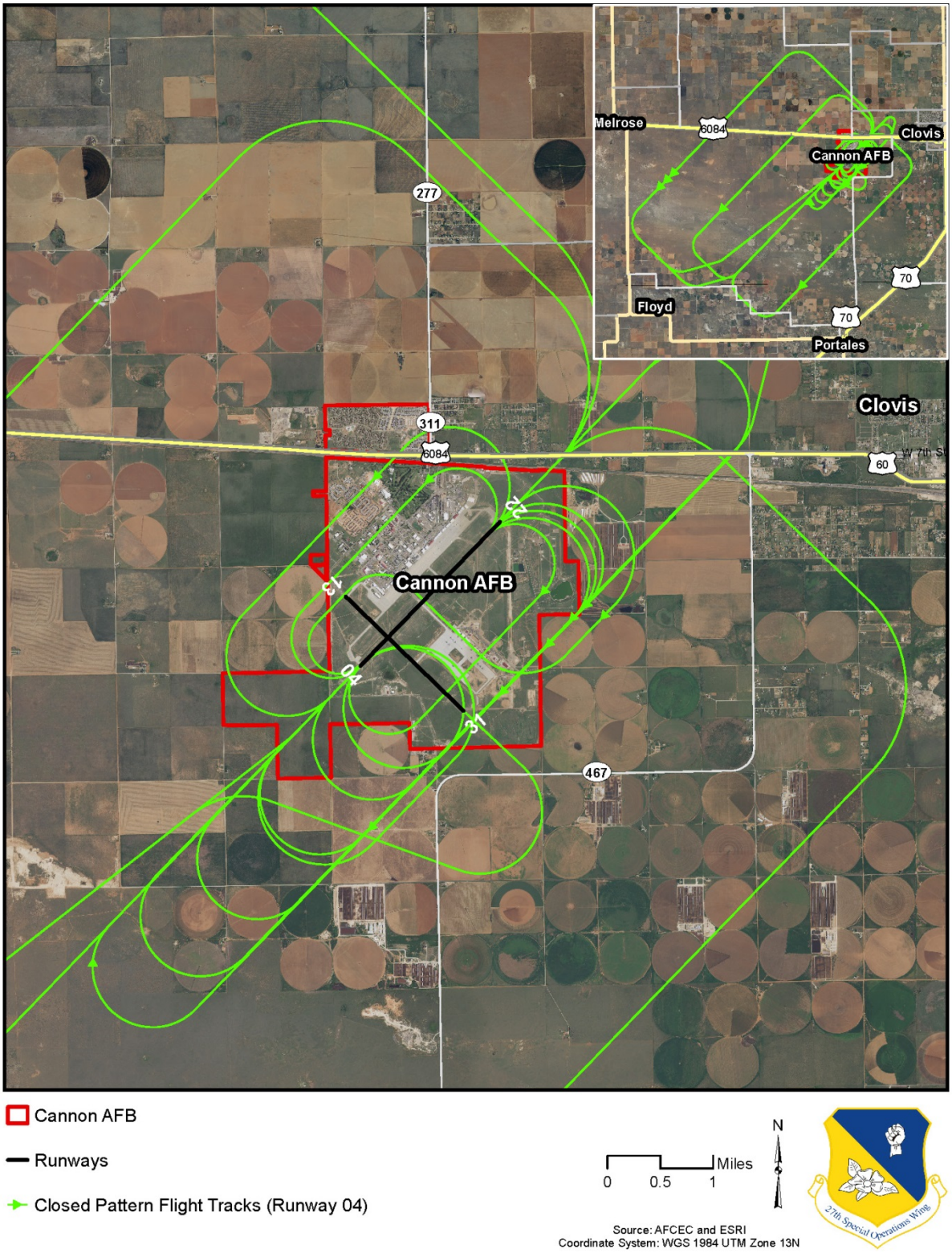


Figure 3-11: Modeled Runway 13 Pattern Flight Tracks, Cannon AFB

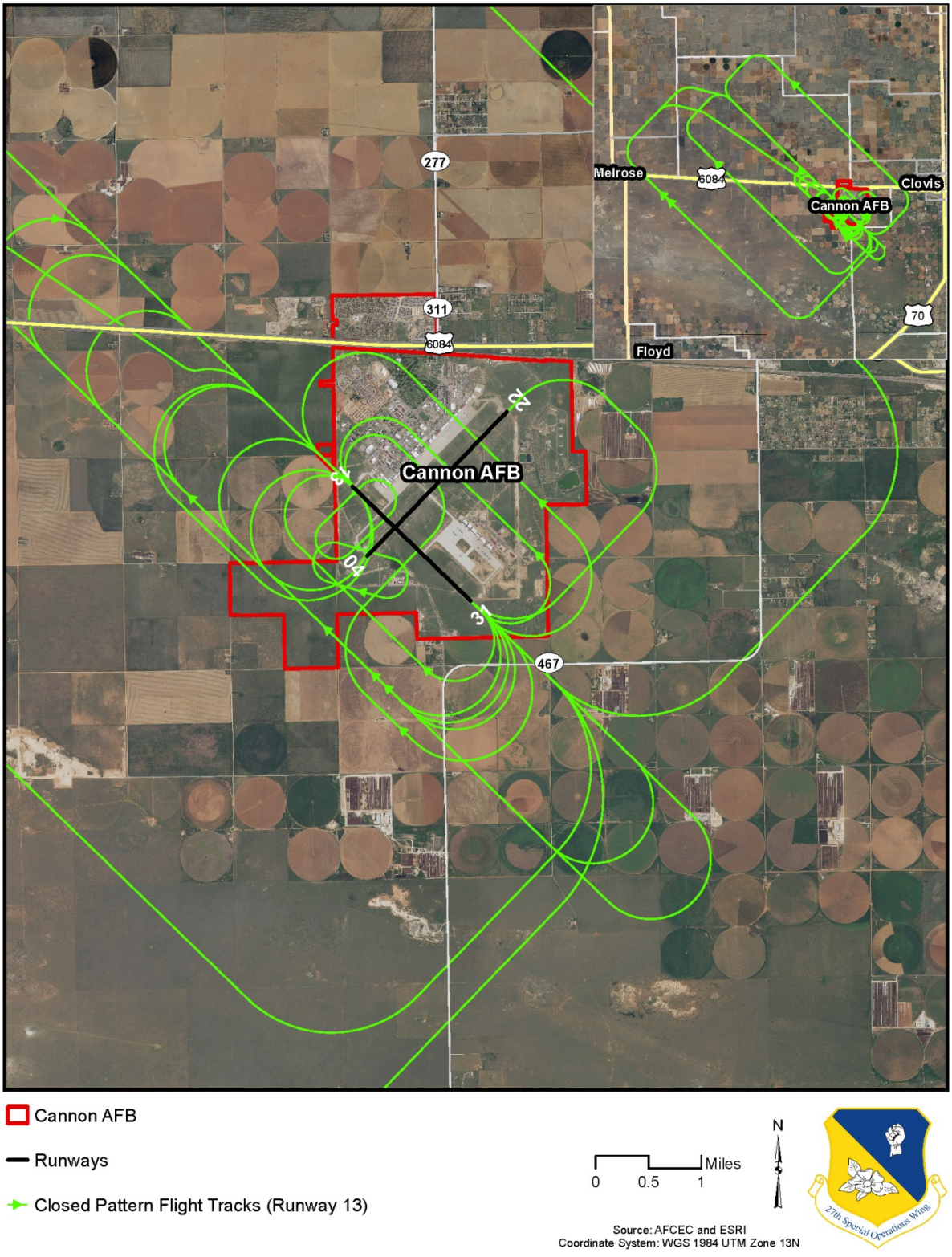


Figure 3-12: Modeled Runway 22 Pattern Flight Tracks, Cannon AFB

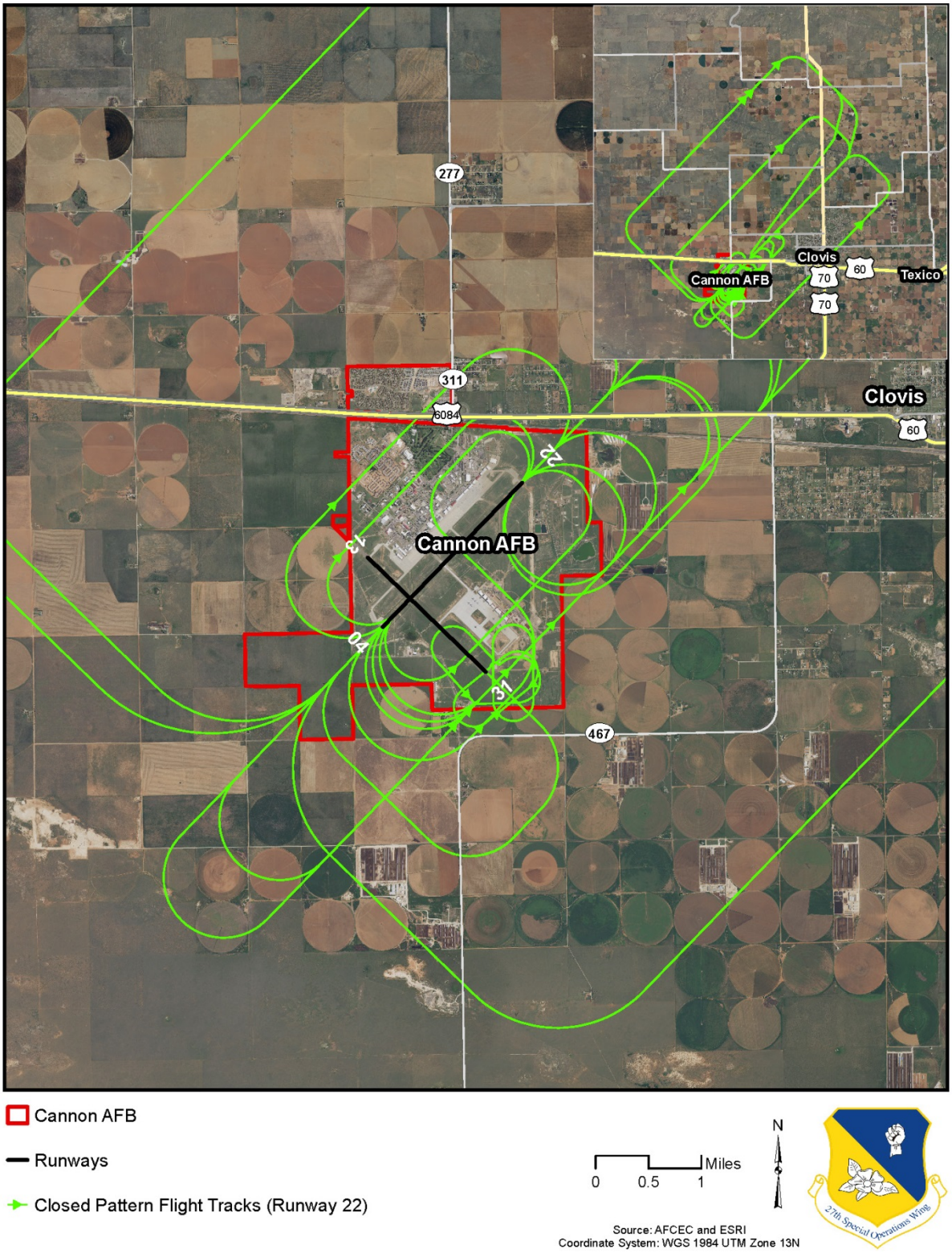
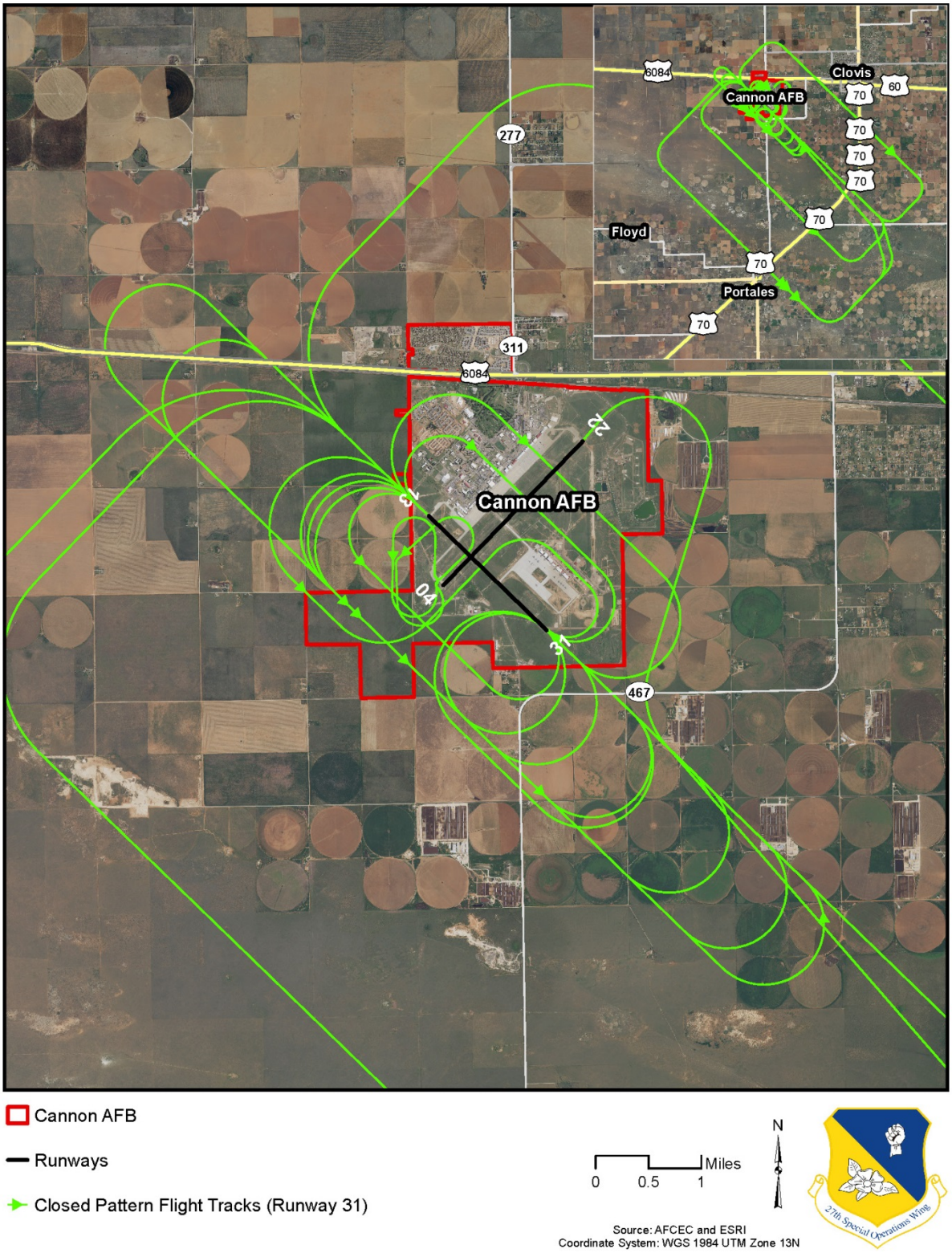


Figure 3-13: Modeled Runway 31 Pattern Flight Tracks, Cannon AFB



4 AIRCRAFT NOISE

How an installation manages aircraft noise can play a key role in shaping an installation's relationship with the adjacent communities. Aircraft noise management is also a key factor in local land use planning. Because noise from aircraft operations may significantly affect areas surrounding the installation, the Air Force has defined noise zones using the guidance provided in the AICUZ Instruction. The AICUZ noise contours are based on aircraft type, type of flight operations (i.e., arrivals, departures, and patterns), and time of day that aircraft are flown.

4.1 WHAT IS SOUND/NOISE?

Sound is vibrations in the air, which can be generated by a multitude of sources that include roadway traffic, a barking dog, a radio—or aircraft operations. The vibrations are known as compression waves. Just like a pebble dropped into a pond creates ripples, the compression waves—formed of air molecules pressed together—radiate out, decreasing with distance. If these vibrations reach our eardrum at a certain rate and intensity, we perceive it as sound. When the sound is unwanted, we refer to it as noise. Generally, sound becomes noise to a listener when it interferes with normal activities. Sound has three components: intensity, frequency, and duration.

- Intensity or loudness is related to sound pressure change. As the vibrations oscillate back and forth, they create a change in pressure on the eardrum. The greater the sound pressure change, the louder it seems.
- Frequency determines how the pitch of the sound is perceived. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches. Sound frequency is measured in terms of cycles per second or hertz (Hz). While the range of human hearing goes from 20 to 20,000 Hz, we hear best in the range of 1,000 to 4,000 Hz. For environmental noise, we use A-weighting, which focuses on this range, to best represent human hearing. A-weighted decibels may be written as "dBA"; however, if it is the only weighting being discussed, the "A" is generally dropped.
- Duration is the length of time the sound can be detected.

4.2 HOW IS SOUND PERCEIVED?

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because such large numbers become awkward to use, we measure noise in decibels (dB), which uses a logarithmic scale that doubles the noise energy every three dB.

Figure 4-1 is a chart of A-weighted sound levels from common sources. A sound level of 0 dB is the approximate threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort, while sound levels between 130 and 140 dB are felt as pain.

Figure 4-1 Sound Levels of Typical Sources and Environments

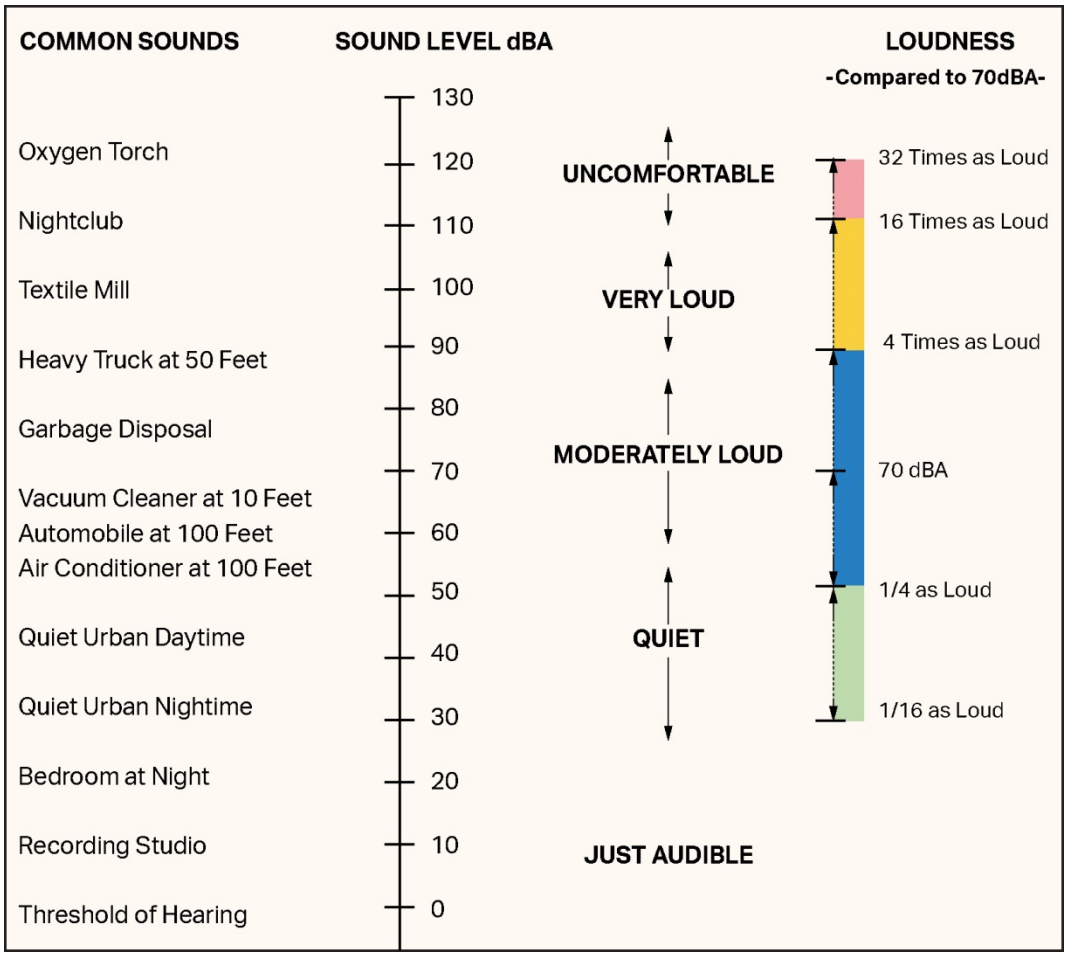


Table 4-1 tabulates the subjective responses with change in (single-event) sound level. While noise energy doubles or halves with every three-dB change, we do not perceive all that noise energy. It takes a 10-dB increase or decrease for our ear to perceive a doubling or halving of loudness.

Table 4-1: Subjective Responses to Changes in A-weighted Decibels (dBA)

Change	Change in Perceived Loudness
1 dB	Requires close attention to notice
3 dB	Barely perceptible
5 dB	Quite noticeable
10 dB	Dramatic, perceived as twice or half as loud
20 dB	Striking, fourfold change

4.3 THE DAY-NIGHT AVERAGE SOUND LEVEL

When we hear an aircraft fly overhead, the question may be asked, "How loud was that?" While we may often find ourselves concerned over the loudness of a sound, there are other dimensions to the sound event that draw our interest. For instance, does one overflight draw the same interest as two separate overflights–or as 20 overflights? Also, does the 30-second engine run-up prior to takeoff draw the same interest as a 30-minute maintenance run? Additionally, is an overflight more noticeable at 2 p.m. or at 2 a.m. when the ambient noise is low and people are trying to sleep?

The length and number of events—the total noise energy—and the time of day play key roles in our perception of noise. To reflect these concerns, the Air Force uses the standard noise metric called the day-night average sound level (DNL). DNL is a standard noise metric created by the United States Environmental Protection Agency to describe the effects of noise on humans, and is used throughout the United States.

DNL, when used as a metric for aircraft noise, represents the accumulation of noise energy from all aircraft noise events in a 24-hour period. Because aircraft operations at military airfields fluctuate from day to day, the DNL value is typically based on an entire year of operations and thus represents the annual average day of aircraft events. Additionally, for all operations between 10:00 p.m. and 7:00 a.m., 10 dB are added to each event to account for the intrusiveness of nighttime operations.

DNL is not a level of noise heard at any given time, but represents long term exposure. Scientific studies of community response to numerous types of environmental noise have found strong correlation between the level of annoyance and the level of average noise exposure measured in DNL.

DNL is depicted visually as a noise contour that connects points of equal value. The noise contours in this document are depicted in five-dBA increments (60, 65, 70, 75, 80, and 85 DNL). The area between two noise contours is the noise exposure area. Calculated noise contours do

not represent exact measurements. Noise levels inside a contour may be similar to those outside a contour line. When the contour lines are close, the change in noise level is greater. When the contour lines are far apart, the change in noise level is gradual.

4.4 NOISE CONTOURS

Noise contours provide the installation, local community planning organizations, and the general public with maps of the modeled noise-related impacts of aircraft operations. Noise contours, when overlaid on local land use maps, can help identify areas of incompatible land uses and help plan for future development around an air installation.

4.4.1 CANNON AFB AICUZ NOISE CONTOURS

The 2017 AICUZ noise contours align with the runways and follow the dominate flight tracks for arrivals, departures, and patterns at each airfield; noise propagates outward from those paths. As expected, the highest noise levels are concentrated over the airfield and along the runways. Touch-and-go patterns and departures have the greatest effect on the shape of the noise contours. Departures and the ascending portion of pattern operations require a greater power setting, which generates greater noise and influences the shape of the contours. Figure 4-2 presents the 2017 AICUZ noise contours based on 2016 projected operations at Cannon AFB. Figure 4-3 shows a comparison of the 2017 AICUZ noise contours and the 2005 AICUZ noise contours.

The contours on Runways 04/22 extend approximately one mile to the southwest and two miles to the northeast from each runway end, and the contours on Runways 13/31 extend approximately one-half mile from each runway end. Given the relatively limited usage of Runways 13/31, the contours on Runways 13/31 are smaller in comparison to the contours on Runways 04/22. The longer contours north of Runway 22 are driven by the higher percentage of arrivals, departures, and pattern operations on Runway 22. Closed pattern operations on the dominant flight tracks on Runways 04/22 contribute to the shallow 65 DNL dB contour band that is one mile southeast and parallel to Runway 22. The concentration of high noise contours (80 DNL dB and 85 DNL dB contours) to the southeast of Runway 22 are contributed to concentrated high-power engine maintenance and pre-flight engine run-ups from AC-130W and MC-130J aircraft.

Figure 4-2: 2017 Cannon AFB AICUZ Noise Contours with Gradient Shading

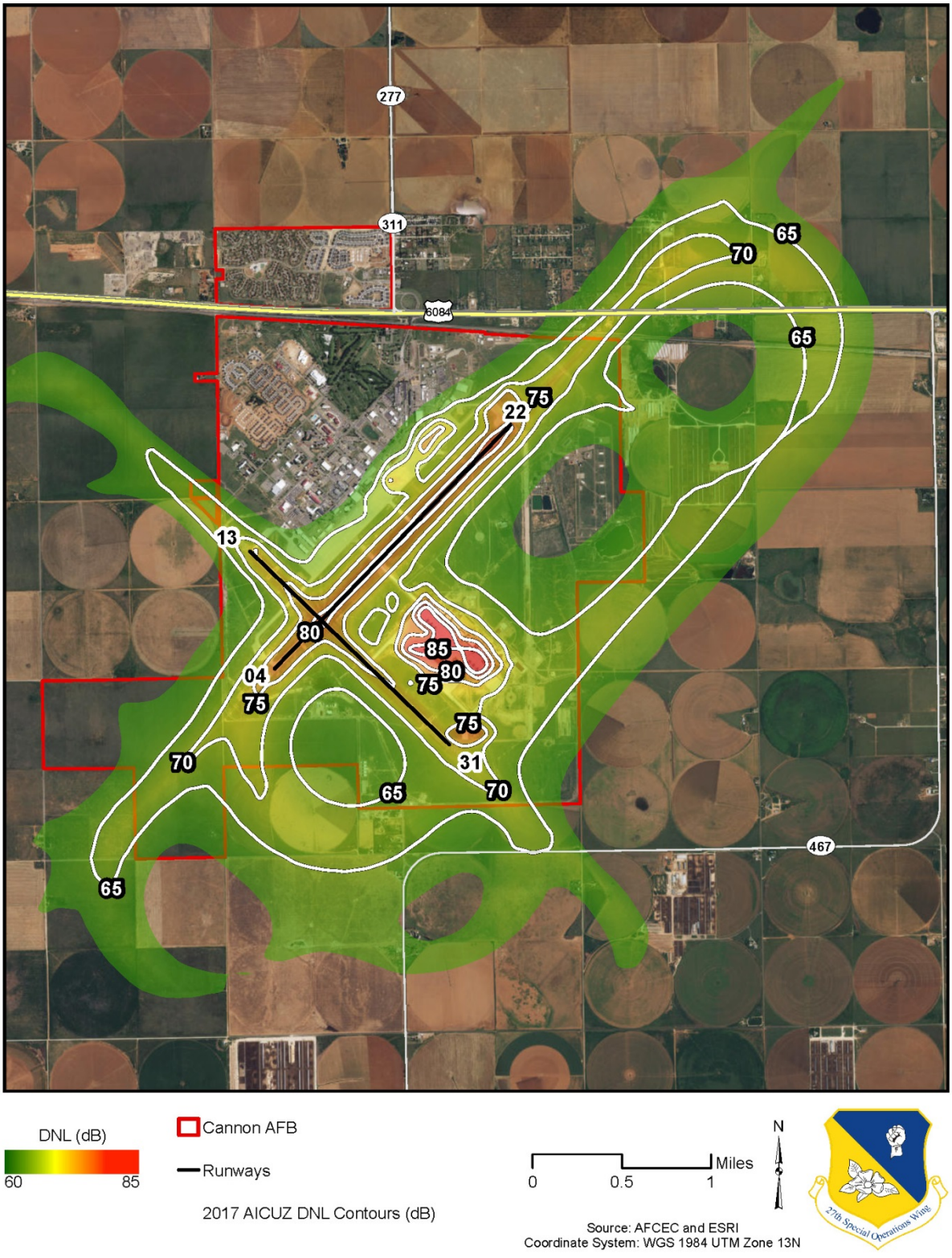


Figure 4-3: Comparison of the 2005 and 2017 Noise Contours, Cannon AFB

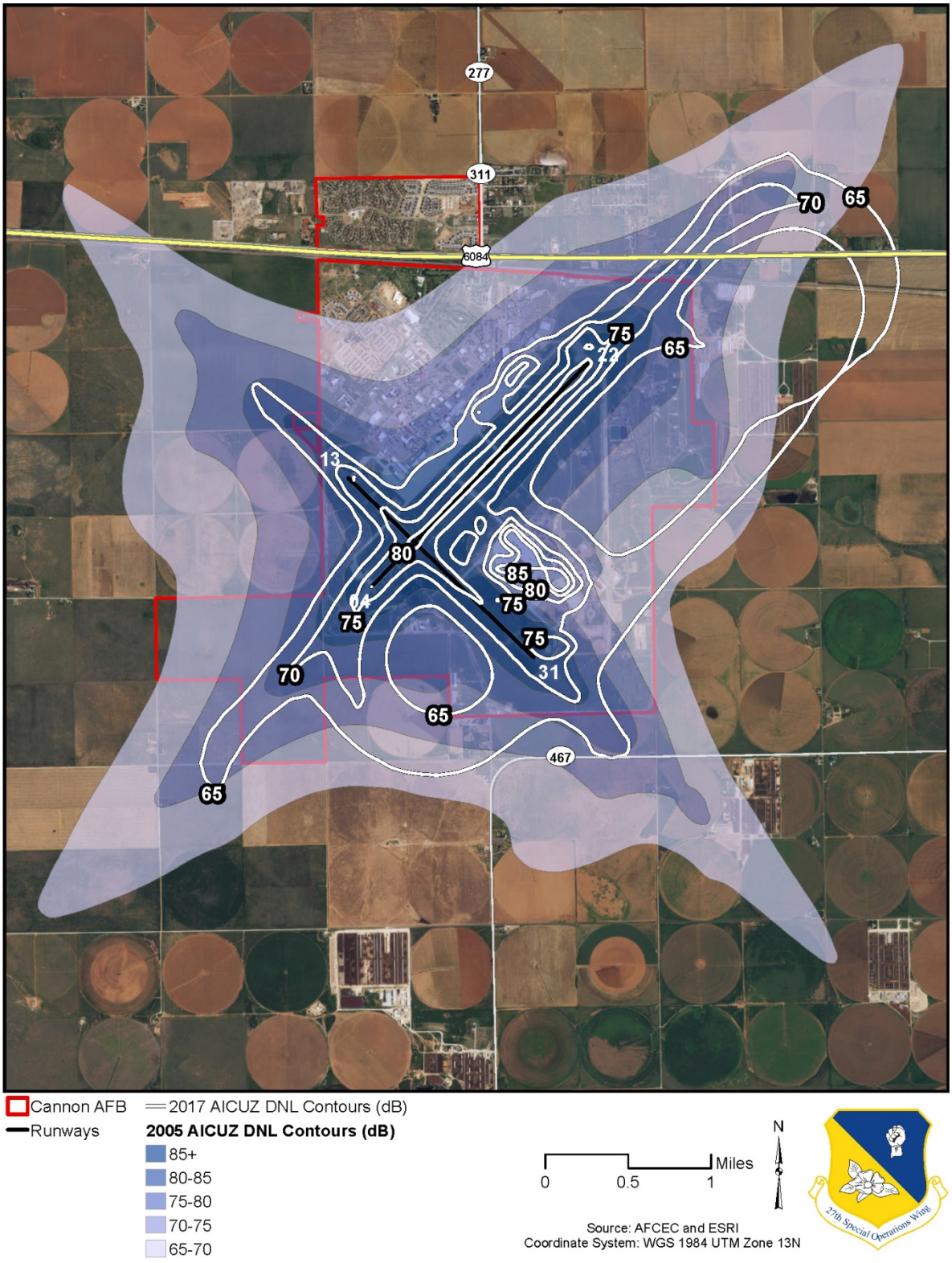


Table 4-2 presents the off-base land acreage and estimated population within the Cannon AFB AICUZ 2017 noise zones; the population estimates are based on 2010 Census block-level data (United States Census Bureau 2010). A geometric proportion method was used to determine the estimated population within the contour bands. This method assigns population based on the portion of a census block that falls within the contour. The population across census blocks is assumed evenly distributed.

Table 4-2: Off-Base Land Area and Estimated Population within the 2017 AICUZ Noise Contours at Cannon AFB

Noise Zone	Acres	Population
65 to 69 dB DNL	898	45
70 to 74 dB DNL	85	6
75+ dB DNL	0	0
TOTAL	**983**	**51**

Notes:

dB decibel
DNL day-night average sound level

Because flight operations have been reduced substantially at Cannon AFB in comparison to the 2005 AICUZ operations, the overall off-base noise exposure area (65 dB DNL and greater) is approximately 4,338 acres less than the 2005 AICUZ noise exposure area.

As shown in Figure 4-3, differences in noise exposure areas occur:

- Essentially in all directions where the 2005 AICUZ noise contours extend farther from the runways, with the exception of the area northeast of Runway 22
- To the northeast of Runway 22 where the 2017 noise contours follow the pattern flight tracks
- To the northwest of Runways 04/22 where the 2017 noise contours are shallower along the runway

Generally, flight patterns have changed significantly at Cannon AFB since the 2005 AICUZ Study. The difference in the geographic extent of the noise contours is attributed to a reduction in annual operations (an approximate 66 percent decrease), changes in runway utilization, modified flight tracks to avoid noise-sensitive areas (particularly modifications of pattern flight tracks), changes in types of aircraft flown at Cannon AFB, and/or improvements of operational parameters such as new aircraft models equipped with quieter engines.

Specific changes in operations since the 2005 AICUZ Study include:

- Departure of all F-16 fighter jets
- Departure of the C-145/C-146 to Duke Field in late 2016
- Introduction of the MQ-9, PC-12, and U-28A

- Replacing older model of the C-130 aircraft with the AC-130W and C-130J
- Transition from the MQ-1 to MQ-9
- New helicopter closed-pattern flight operations for CV-22
- Changes in flight tracks for pattern operations to avoid on- and off-base noise-sensitive areas
- Increase in nighttime flight operations

5 COMMUNITY AND AIRCRAFT SAFETY

As development increases near an airfield, more people may be exposed to the potential risks from nearby aircraft operations. Airfield safety is a shared responsibility between the Air Force and the surrounding communities, each playing a vital role in its success. Cooperation between the Air Force and the community results in strategic and effective land use planning and development around military airfields. Accordingly, the Air Force has established a flight safety program and has designated areas of accident potential around its air installations to assist in preserving the health, safety, and welfare of the people living near the airfield. This AICUZ Study provides the information needed, in part, to reach the shared safety goal.

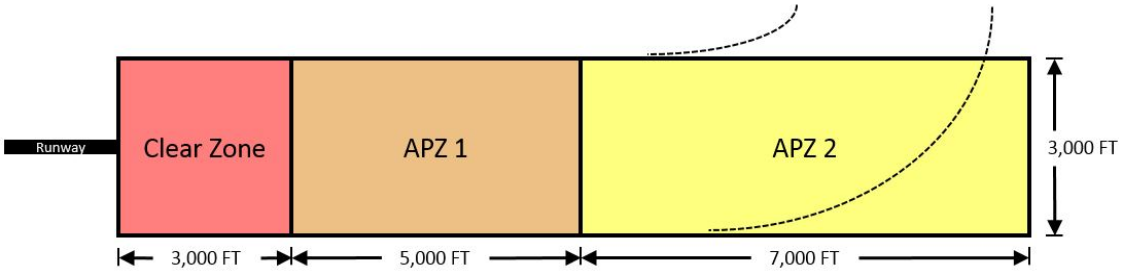
Identifying safety hazards and areas of accident potential can help communities with land use compatibility planning for airfield operations. As part of the AICUZ Program, the Air Force defines areas of accident potential, imaginary surfaces, and hazards to aircraft flight.

5.1 CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

In the 1970s and 1980s, the DoD conducted studies of historical accident and operations data throughout the military to identify patterns of accident occurrence. The studies showed that most aircraft accidents occur on or near the runway, diminishing in likelihood with distance from the runway. Based on these studies, the DoD identified Clear Zones (CZs) and Accident Potential Zones (APZs) as areas where an aircraft accident is most likely to occur if an accident were to take place; however, these zones are not a predictors of accidents. The studies identified three areas—the CZ, APZ I, and APZ II—that, because of accident potential, should be considered for density and land use restrictions. These zones are illustrated in Figure 5-1 and described below:

- **Clear Zone.** The CZ is the square area beyond the end of the runway and centered on the runway centerline, extending outward 3,000 feet. A CZ is required for all active runways and should remain undeveloped.
- **APZ I.** APZ I is the rectangular area beyond the CZ. APZ I is 3,000 feet in width and 5,000 feet in length along the extended runway centerline.
- **APZ II.** APZ II is the rectangular area beyond APZ I. APZ II is 3,000 feet in width and 7,000 feet in length along the extended runway centerline.

Figure 5-1: Accident Potential Zones for Class B Runways



Within the CZs, most land uses are considered incompatible with military aircraft operations. For this reason, it is the Air Force's policy, where possible, to acquire real property interests on land in the CZs to ensure incompatible development does not occur. Within APZ I and APZ II, various land uses are compatible; however, higher-density uses (e.g., schools, apartments, churches, etc.) should be restricted because of the greater risk in these areas. Existing land uses in the CZs and APZs at each airfield and recommendations for addressing incompatibility issues are discussed in Chapter 6 *Compatibility Analysis*.

5.1.1 CLEAR ZONES AND ACCIDENT POTENTIAL ZONES FOR CANNON AFB

Figure 5-2 depicts the CZs and APZs for Runways 04/22 and 13/31 at Cannon AFB. Table 5-1 tabulates the off-base land acreage and estimated population within the CZs and APZs.

Table 5-1: Off-Base Land Acreage and Estimated Population within the APZs and CZs at Cannon AFB

Zone	Land Acreage	Population
CZ	164.2	5
APZ I	1,139.3	50
APZ II	1,928.8	61
TOTAL	3,232.3	116

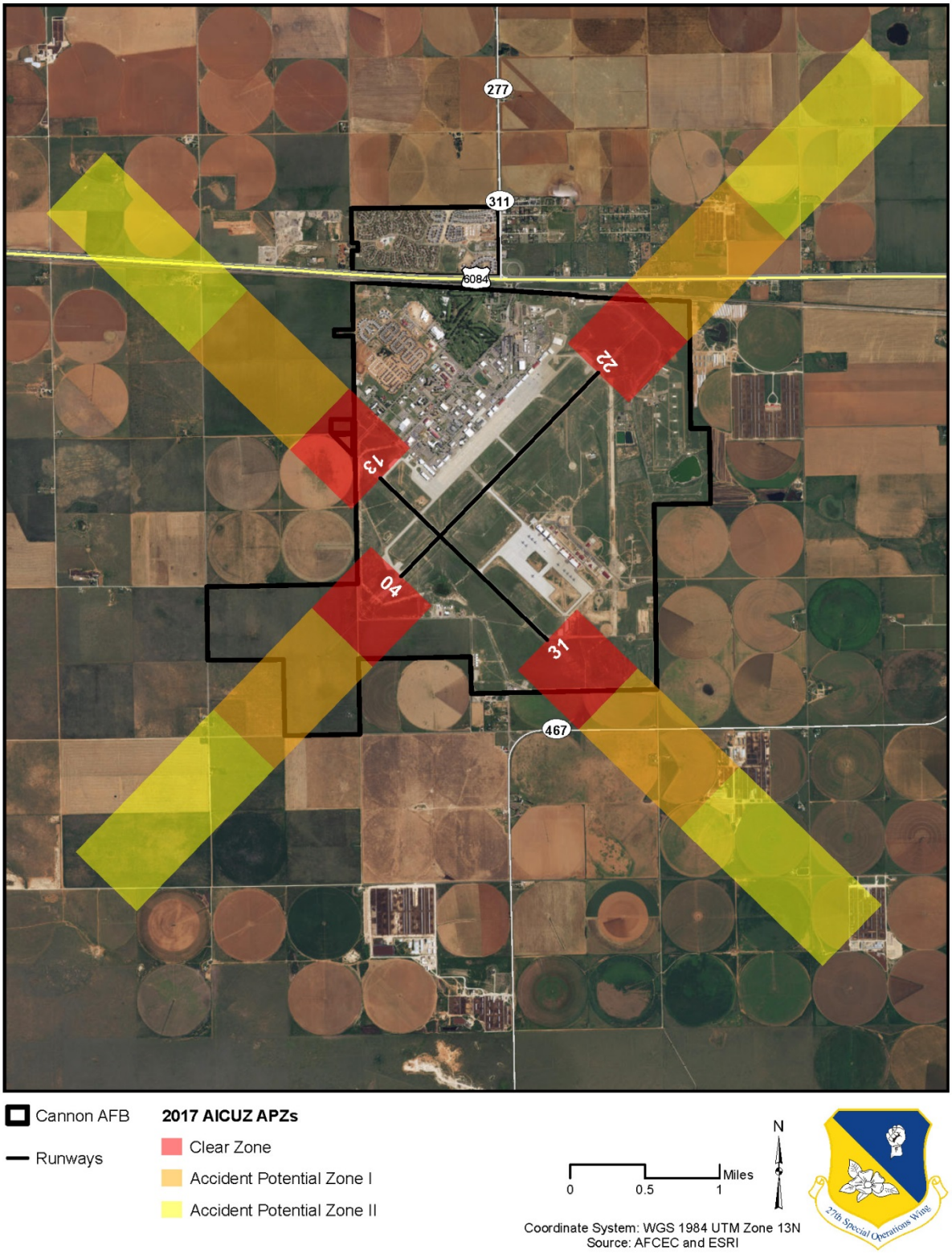
Notes:

APZ Accident Potential Zone
CZ Clear Zone

All CZs at Cannon AFB measure 3,000 feet long and 3,000 feet wide (1,500 feet to either side of the runway centerline), in compliance with AFI 32-7063 (Air Force 2015a) and Unified Facilities Criteria (UFC) 3-260-01 (DoD 2008). All runways at Cannon AFB have one set of APZs. APZ I measures 5,000 feet in length from the CZ and is 3,000 feet in width. APZ II measures 7,000 feet in length from APZ I and is 3,000 feet in width.

The Cannon AFB CZs extend beyond the installation boundary, and the Air Force does not own all the property in the CZs. Both the county and Cannon AFB have protective easements for property in the CZs. Easements and areas of incompatible developments are further discussed in Chapter 6 *Compatibility Analysis*.

Figure 5-2: 2017 AICUZ Clear Zones and Accident Potential Zones for Cannon AFB



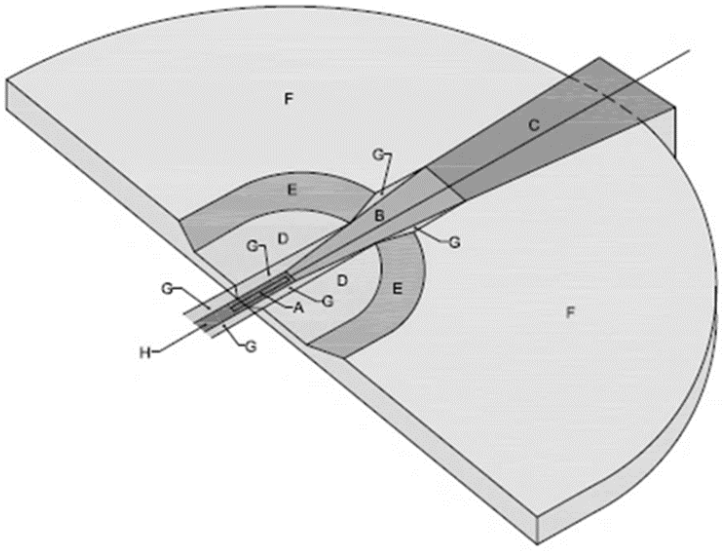
5.2 IMAGINARY SURFACES

The DoD and FAA identify a complex series of imaginary planes and transition surfaces that define the airspace needed to remain free of obstructions around an airfield. Obstruction-free imaginary surfaces help ensure safe flight approaches, departures, and pattern operations. Obstructions include natural terrain and man-made features, such as buildings, towers, poles, wind turbines, cell towers, and other vertical obstructions to airspace navigation.

Fixed-wing runways and rotary-wing runways/helipads have different imaginary surfaces. Imaginary surfaces for fixed-wing runways are briefly described in Table 5-2 and illustrated in Figure 5-3. Figure 5-4 depicts the runway airspace imaginary surfaces specific to Cannon AFB.

In general, no above-ground structures are permitted in the primary surface of CZs, and height restrictions apply to transitional surfaces and approach and departure surfaces. Height restrictions are more stringent as one approaches the runway and flight path.

Figure 5-3: Imaginary Surfaces for Air Force Class B Fixed-Wing Runways



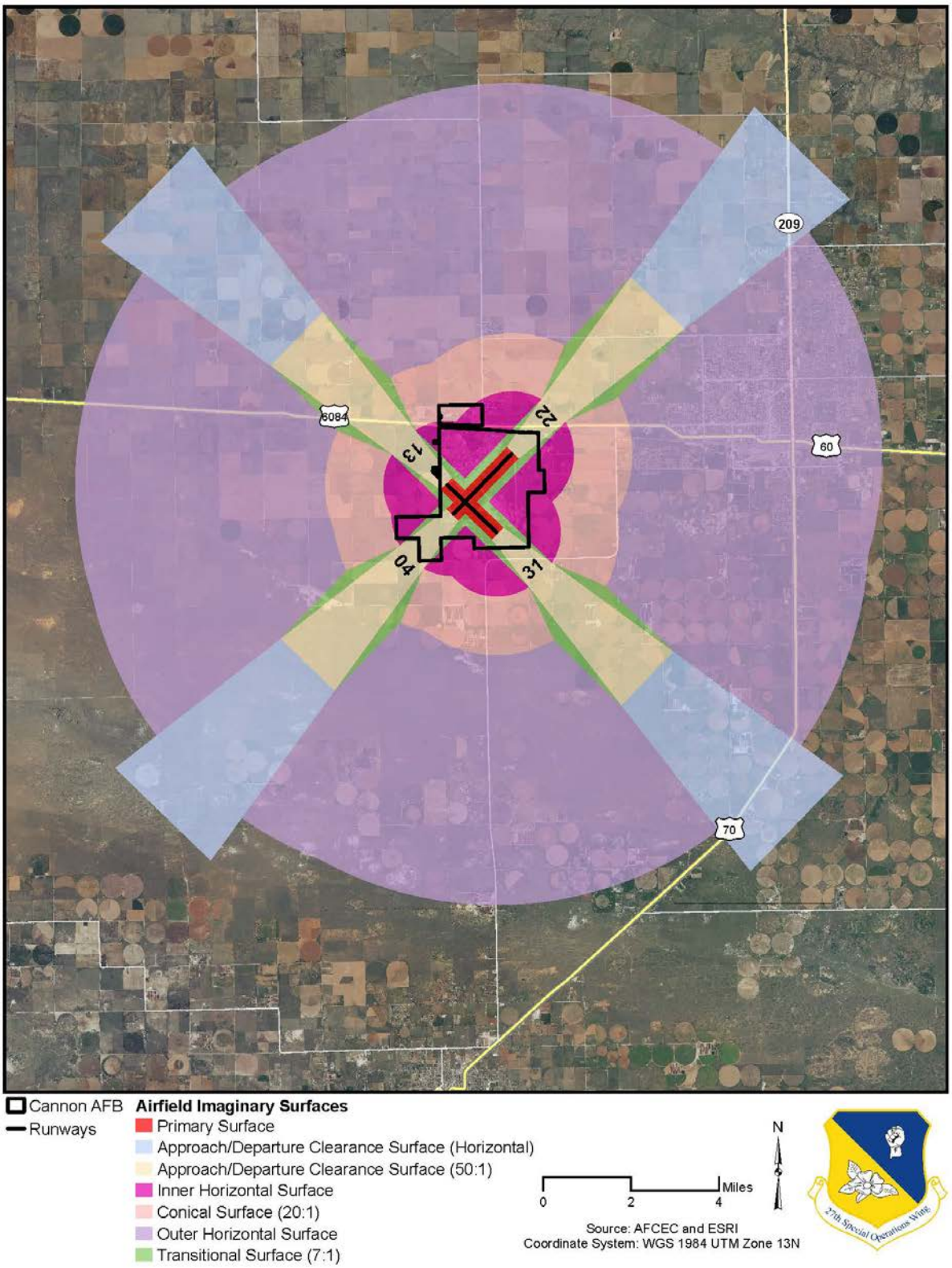
LEGEND
A. Primary Surface
B. Approach-Departure Clearance Surface (50:1 Slope Ratio)
C. Approach-Departure Clearance Surface (Horizontal)
D. Inner Horizontal Surface (45.72m [150'] Elevation)
E. Conical Surface (20:1 Slope Ratio)
F. Outer Horizontal Surface (152.40m [500'] Elevation
G. Transitional Surface (7:1 Slope Ratio)
H. Runway

Table 5-2: Description of Imaginary Surfaces

Planes and Surface	Geographical Dimensions
Primary Surface	An imaginary surface symmetrically centered on the runway, extending 200 feet beyond each runway end, that defines the limits of the obstruction clearance requirements in the vicinity of the landing area. The width of the primary surface is 2,000 feet, or 1,000 feet on each side of the runway centerline.
Approach-Departure Clearance Surface	This imaginary surface is symmetrically centered on the extended runway centerline, beginning as an inclined plane (glide angle) at the end of the primary surface (200 feet beyond each end of the runway), and extending for 50,000 feet. The slope of the approach-departure clearance surface is 50:1 until it reaches an elevation of 500 feet above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 feet from the starting point. The width of this surface at the runway end is 2,000 feet, flaring uniformly to a width of 16,000 feet at the end point.
Inner Horizontal Surface	This imaginary surface is an oval plane at a height of 150 feet above the established airfield elevation. The inner boundary intersects with the approach-departure clearance surface and the transitional surface. The outer boundary is formed by scribing arcs with a radius of 7,500 feet from the centerline of each runway end and interconnecting these arcs with tangents.
Conical Surface	This is an inclined imaginary surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation. The slope of the conical surface is 20:1. The conical surface connects the inner and outer horizontal surfaces.
Outer Horizontal Surface	This imaginary surface is located 500 feet above the established airfield elevation and extends outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.
Transitional Surface	This imaginary surface extends outward and upward at right angles to the runway centerline and extended runway centerline at a slope of 7:1. The transitional surface connects the primary and the approach-departure clearance surfaces to the inner horizontal, the conical, and the outer horizontal surfaces.

Source: DoD 2008

Figure 5-4: Imaginary Surfaces and Transition Planes for Cannon AFB



5.3 HAZARDS TO AIRCRAFT FLIGHT ZONES

Certain land uses and activities around an airfield can pose potential hazards that can obstruct or interfere with aircraft arrivals and departures, pilot vision, communications, or aircraft electronics. Evaluating and addressing the causes of flight hazards before mishaps occur can help eliminate these sources and prevent future mishaps. The Air Force has defined a "Hazards to Aircraft Flight Zone" (HAFZ) that includes the area within the imaginary surfaces. Unlike noise and safety zones, the AICUZ guidelines do not provide specific land use compatibility recommendations for the HAFZ; instead, the HAFZ is used as a "consultation zone." Developers and local planning bodies are encouraged to consult with the Air Force to evaluate proposed projects in the HAFZ to ensure compatibility with military operations. Potential hazards to flight operations are discussed in the following sections.

5.3.1 HEIGHT OBSTRUCTIONS

Tall objects can pose significant hazards to flight operations or interfere with navigational equipment (including radar). Aircraft operations can be constrained by the surrounding natural terrain and manmade features such as buildings, towers, poles, and other potential vertical obstructions to navigation. FAA regulation, Title 14 of the Code of Federal Regulations (CFR), Part 77 *Objects Affecting Navigable Airspace*, outlines a notification procedure for proposed construction or alteration of objects near airports that could affect navigable airspace. City and county agencies responsible for approving construction permits should require developers to submit accurate measurements and calculations for any project in the vicinity of a military airfield to verify that the proposed project meets the height restriction criteria of 14 CFR Part 77.17. Height obstructions are a current compatibility issue and are further discussed in Section 6.4 *Compatibility Concerns*. City and County agencies may also consider requiring a "Determination of No Hazard" issued by the FAA for any tall objects within this zone.

5.3.2 VISUAL INTERFERENCE

Industrial or agricultural sources of smoke, dust, or steam in the airfield vicinity can obstruct the pilot's vision during takeoff, landing, or other periods of low-altitude flight. These concerns can often be mitigated with close coordination between the base and the landowner. For example, irrigating before plowing can greatly reduce dust concerns.

5.3.3 LIGHTING

Bright lights, either direct or reflected, in the airfield vicinity can impair a pilot's vision, especially at night. A sudden flash from a bright light causes a spot or "halo" to remain at the center of the visual field for a few seconds or more, rendering a person virtually blind to all other visual input. This is particularly dangerous at night when the flash can diminish the eye's adaption to darkness. Partial recovery of this adaptation is usually achieved in minutes, but full adaptation typically requires 40 to 45 minutes.

Specific examples of light emissions that can interfere with the safety of nearby aviation operations include the following:

- Lasers that emit in the visible spectrum can be potentially harmful to a pilot's vision during both day and night.
- The increasing use of energy-efficient Light Emitting Diode (LED) lights also poses potential conflicts in areas where pilots use Night Vision Goggles (NVGs). NVGs can exaggerate the brightness of these lights, interfering with pilot vision.
- The use of red LED lights to mark obstructions can produce an unintended safety consequence because red LED lights are not visible on most NVG models, rendering them invisible to NVG users in the area.

Light pollution is a current compatibility issue and is further discussed in Section 6.4 *Compatibility Concerns*.

5.3.4 BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD

Wildlife represents a significant hazard to flight operations. Wildlife, birds in particular, are drawn to different habitat types found in the airfield environment, including hedges, grass, brush, forest, water, and even the warm pavement of the runways. Although most bird/wildlife aircraft strike hazard (BASH) occurrences do not result in a total loss of aircraft, they can cause structural and mechanical damage to aircraft, as well as loss of flight time. Most collisions with wildlife occur when the aircraft is at an elevation of less than 3,000 feet; due to the speed of the aircraft, these collisions can happen with considerable force (FAA 2007).

To reduce the potential of a BASH occurrence, the Air Force recommends locating land uses that attract birds farther away from the airfield's most active movement areas. These land uses include transfer stations, landfills, golf courses, wetlands, stormwater ponds, and dredge disposal sites. Wildlife in search of resources, such as food, water, and shelter, will flock to the aforementioned areas, increasing the probability of BASH occurrences. Design modifications also can be used to reduce the attractiveness of these types of land uses to birds and other wildlife. BASH occurrences are a current issue and are further discussed in the following section.

5.3.4.1 BASH OCCURRENCES AT CANNON AFB

Cannon AFB reported 525 bird strikes between 2009 and 2016, of which 40 strikes have caused damages totaling $2,317,067. The majority of bird strikes occur in July, August, and September (Loomacres Wildlife Management Company 2016). BASH occurrences were higher during years with increased rainfall that led to more vegetation and water sources for birds and animals.

Areas of standing water also attract waterfowl, shorebirds, and wading birds. North Playa, an on-base pond located approximately one mile east of the runway, is one of the largest bodies of water within five miles of the base and provides roosting areas for migratory waterfowl. North Playa is used to hold effluent water from the wastewater treatment facility to water the golf course during the summer. The golf course ponds are located near Runways 04/22, and birds fly across the runway between North Playa and the golf course ponds. South Playa is a drainage pond located south of Runway 04, and runoff water from the airfield can take several weeks to evaporate after a heavy rainfall. The vegetation, tall grass, and water supply attract waterfowl,

coyotes, and jack rabbits, especially when the area floods. Several large lakes are also located under low-level training routes.

Cannon AFB has a high population of prairie dogs and rabbits that create burrow holes around the airfield. Burrowing owls, which are federally protected under the Migratory Bird Treaty Act, use abandoned burrows for nesting. Because burrowing owls use the rabbit habitat to nest, these areas are protected and cannot be removed. Rabbits and prairie dogs are not inherently dangerous to flight operations unless they are on the taxiways or runways; however, they attract large predators such as hawks, vultures, foxes, and coyotes that can affect flight operations and impede safety conditions. Agricultural lands near the base also provide habitat for a variety of small animals and rodents that are prey for larger animals and raptors.

5.3.4.2 BASH MANAGEMENT

The BASH program is managed by the Wing Safety Office, and Cannon AFB employs a full-time BASH Biologist (contracted through the United States Department of Agriculture), to develop management strategies and determine actions to reduce bird densities. BASH management strategies focus on reducing favorable habitat and initiating bird avoidance behavior from specified areas. The base implements several methods to control the bird population, including habitat modification to deter birds from entering or returning to resting and feeding areas, noise makers, pyrotechnics, and depredation in accordance with federal permits. Cannon AFB has implemented an Avian Hazard Advisory System that provides advisory reports based on historical data for bird avoidance model. Flight operations are scheduled and adjusted to avoid known bird migration patterns and reduce the potential for bird/wildlife aircraft strikes. BASH occurrences have reduced with the implementation of the BASH program and full-time BASH Coordinator.

5.3.5 ELECTROMAGNETIC INTERFERENCE

Electromagnetic Interference (EMI) is defined by the American National Standards Institute as any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. EMI may be caused by atmospheric phenomena, such as lightning or precipitation static, and by non-telecommunications equipment, such as vehicles and industrial machinery.

New generations of military aircraft are highly dependent on complex electronic systems for navigation and critical flight and mission-related functions. Consequently, care should be taken in siting any activities that create EMI. Electronic devices, such as cell phones, FM radios, television reception, and garage door openers, can also generate EMI. Many of these sources are low-level emitters of EMI; however, when multiple sources are combined, they have an additive quality. In some cases, the source of interference occurs when consumer electronics use frequencies set aside for military use.

5.4 WIND FARMS

Wind turbines may restrict training operations, reduce the quality of training, and compromise pilot safety if sited near military airfields and in the direct course of low-level training routes. Wind turbines may significantly affect the effectiveness of military air defense radar systems, navigation systems, weather radar systems, and ATC radar systems, while compromising security, aviation safety, and military readiness. Factors contributing to radar interference include the radar cross-section of a wind turbine, the number of turbines and their configuration, and Doppler-shift. Compatibility issues related to wind farm development near Cannon AFB and Melrose AFR are further discussed in Section 6.4 *Compatibility Concerns*.

6 LAND USE COMPATIBILITY ANALYSIS

The AICUZ area of influence or the "AICUZ footprint" of an airfield is the combination of noise contours, CZs, APZs, and the HAFZ, and is used as the basis for the land use compatibility analysis. The AICUZ footprint defines the minimum acceptable area in which land use control measures are recommended to protect the public's health, safety, and welfare and to preserve the flying mission of the base. The AICUZ footprint, combined with the guidance and recommendations set forth in the AICUZ Study, are the fundamental tools necessary for the planning process. To guide compatible development near Cannon AFB, local municipalities should incorporate the 2017 AICUZ footprint into land use studies, regulations, and planning initiatives (Figure 6-1).

6.1 LAND USE COMPATIBILITY GUIDELINES AND CLASSIFICATIONS

To establish long-term land use compatibility for lands in the vicinity of military air installations, the DoD has developed guidelines, based on the Federal Highway Administration's Standard Land Use Coding Manual, for compatible development and land use within an airfield's AICUZ APZs and noise zones. These guidelines are used by DoD personnel for on-base planning and for engaging with the local community to foster compatible land use development. Suggested land use compatibility guidelines within the CZs, APZs, and noise zones are shown in Table A-1 and Table A-2 of Appendix A. These are the minimum requirements for land use compatibility, and some bases may require stricter guidelines.

Table 6-1 provides common land use classifications and their compatibility recommendations within AICUZ noise zones and APZs. Land use classifications in this table are generalized and do not represent the local communities' land use designations. Land use compatibility conditions are categorized as the following: Compatible, Compatible with Restrictions, Not Compatible, and Not Compatible with Exceptions. Land uses deemed "Compatible with Restrictions" or "Not Compatible with Exceptions" may require noise attenuation measures in the design and construction of structures or density limitations for land in CZs and APZs to be considered "compatible."

Figure 6-1: 2017 Composite AICUZ Map, Cannon AFB

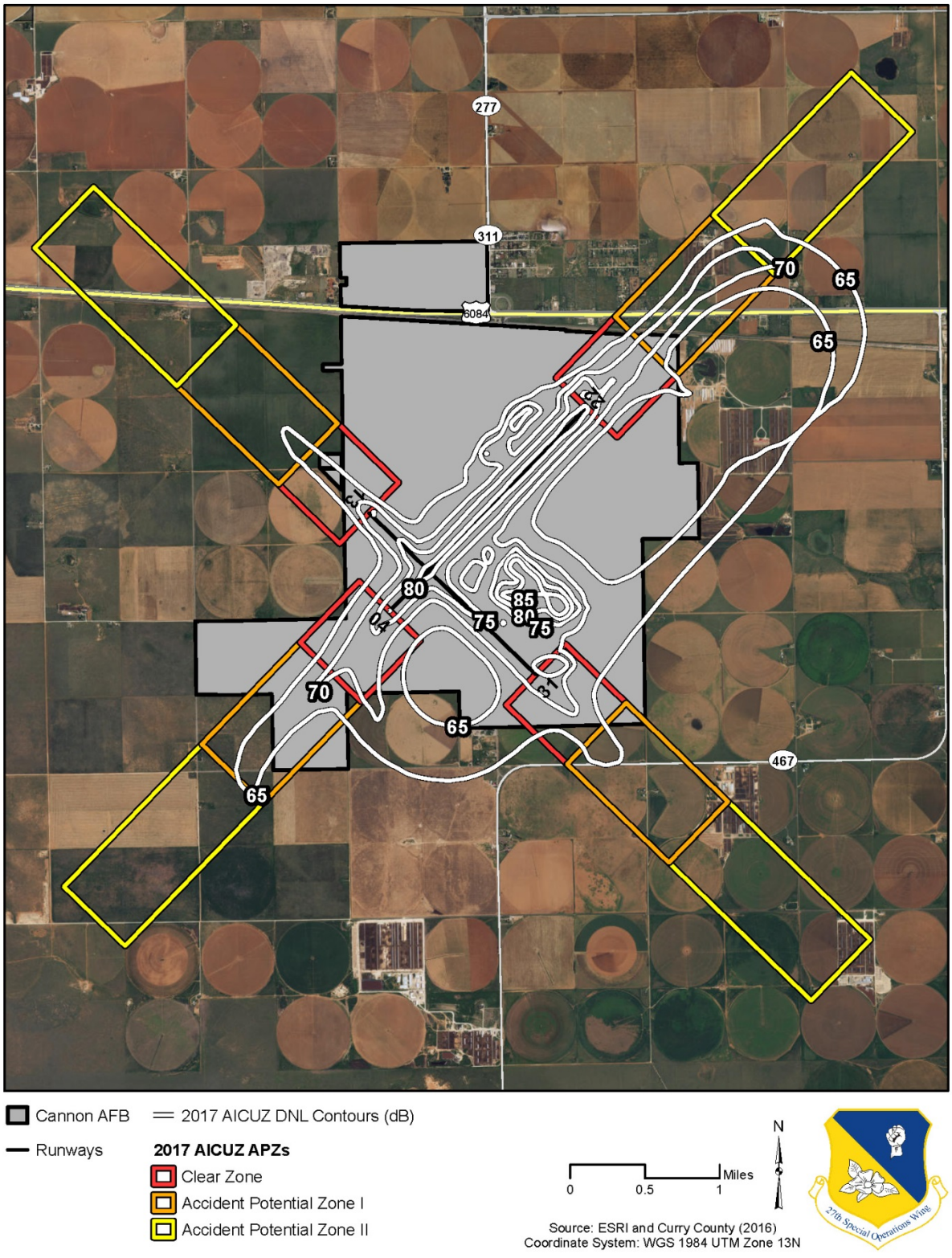


Table 6-1: Land Use Classification and Compatibility Guidelines

Land Use	Noise Zones (dB DNL)						CZ	APZ I	APZ II
	<65	65-69	70-74	75-79	80-84	85+			
Residential	Yes	No[1]	No[1]	No	No	No	No	No	No[1]
Commercial	Yes	Yes	Yes[2]	Yes[2]	No	No	No	Yes[2]	Yes[2]
Industrial	Yes	Yes	Yes	Yes	Yes[2]	No	No	Yes[2]	Yes[2]
Public Assembly/Public Use	Yes	Yes[2]	Yes[2]	Yes[2]	No	No	No	No	Yes[2]
Outdoor Parks and Recreation Areas	Yes	Yes[2]	Yes[2]	Yes[2]	No	No	No	Yes[2]	Yes[2]
Agriculture, Open Area, Low Density Development	Yes	Yes[2]	Yes[2]	Yes[2]	Yes[2]	Yes[2]	No	Yes[2]	Yes[2]
Undesignated	Yes	No	No	No	No	No	No	No	No

Source: Adapted from AFI 32-7063 (Air Force 2015a)

Notes:

This generalized land use table provides an overview of recommended land use. Specific land use compatibility guidelines are provided in Appendix A.

[1] Incompatible with Exceptions

[2] Compatible with Restrictions

APZ Accident Potential Zone

CZ Clear Zone

dB decibel

DNL day-night average sound level

6.2 PLANNING AUTHORITIES

6.2.1 NEW MEXICO MILITARY PLANNING COMMISSION

The Office of Military Base Planning and Support and the Military Base Planning Commission was created under the New Mexico Statutes Annotated Section 9-15-48 through 9-15-51. The sunset dates were extended through July 2022. The duties of the Military Base Planning Commission include:

- Evaluate information about the federal government's considerations, plans, policies, and initiatives relating to military base realignment and closure.
- Evaluate information relating to the impact of federal military base realignment and closure plans on the state's economy and the military base area's local economy.
- Work with and provide assistance to established community organizations that have as their purpose the support of the long-term viability of the military bases in their local area.

- Ensure collaboration among the community organizations and an understanding of the joint efforts between the military bases in the state.
- Provide assistance to the state's congressional delegation on matters relating to federal base realignment and closure plans.
- Advise the governor on measures necessary to ensure the continued presence of military bases in the state.

6.2.2 EASTERN PLAINS COUNCIL OF GOVERNMENT

The Eastern Plains Council of Government (EPCOG) is a regional planning agency that was established to assist local governments within the seven-county region in planning for common needs, cooperating for mutual benefit, and coordinating for sound regional development. EPCOG is also responsible for regional planning activities including economic development, transportation, community development, and housing.

EPCOG is a voluntary association of counties and municipal governments within the seven counties of Planning and Development District IV. Curry County, Roosevelt County, the City of Clovis, and the Village of Melrose are members of EPCOG. EPCOG is a political subdivision of the State of New Mexico, but does not have regulatory authority as granted to cities, counties, or other local governments. EPCOG prepares a Comprehensive Development Strategy that is updated every five years. The last Comprehensive Development Strategy was released in 2012.

6.2.3 CLOVIS/CURRY COUNTY CHAMBERS OF MILITARY AFFAIRS COMMITTEE

The Military Affairs Committee “Committee of 50” maintains a strong working relationship between the citizens of Clovis and Curry County and Cannon AFB to support and grow the mission of the Air Force. The Committee meets with state government officials and Congressional representatives in Washington D.C. to promote Cannon AFB and the importance of the base to the country and to the local community.

6.2.4 CURRY COUNTY AND CLOVIS JOINT USE AGREEMENTS

Cannon AFB is located within the jurisdiction of Curry County, and Curry County has minimal land use regulations; the County does not have zoning regulations. Cannon AFB and Melrose AFR are federal facilities and are not subject to county land use regulations; however, military operations are considered when planning for future development. In New Mexico, cities can influence land use decisions within their extra territorial zone (ETZ) through subdivision applications and building permit review. Curry County offers a two-tiered ETZ, which allows the City of Clovis to review subdivision and platting applications within one mile of the city limits, and building permit applications within two to five miles of the city limits.

6.2.5 COMPREHENSIVE PLANS

A Comprehensive Plan guides future development and growth, establishes long-range planning policies, and provides the framework for land use regulations. Comprehensive Plans are decision-making tools to evaluate proposed development and/or land use activities in context

with the community's long-range planning policies. Components of a Comprehensive Plan may include future land use, annexation, transportation, infrastructure, conservation, recreation and open space, intergovernmental coordination, and capital improvements.

- **2015 Curry County Comprehensive Plan** – The Curry County Comprehensive Plan was recently updated in 2015. The goal of the plan is to "maintain the rural traditions of Curry County, while planning for future growth and diversification of the economy" (Curry County 2015). The plan addresses changes in the mission at Cannon AFB since 2007.
- **2007 City of Clovis Comprehensive Plan** – The City of Clovis Comprehensive Plan identifies policies to guide to future growth and development within a five- to 20-year planning horizon. Plan elements include land use, economic development, housing, hazard mitigation, and infrastructures (City of Clovis 2007).
- **2007 Curry County and City of Clovis Joint Action Guide** – The Curry County and City of Clovis Joint Action Guide 2007 "identifies issues common to both the County and City and makes recommendations on what general steps the County and City can cooperatively take to address the issue" (Consensus Planning Engineers, Inc. 2007).
- **Draft Curry County Land Use Plan** – With the completion of the Comprehensive Plan update, the Curry County Commission has initiated the land use planning process. The Curry County Land Use Plan will provide policy guidance where federal planning processes may impact private lands.

6.2.6 JOINT LAND USE STUDY

Through the Office of Economic Adjustment, the DoD developed the Joint Land Use Study Program to enhance coordination between military installations and their surrounding communities and to address existing and future compatibility issues. The Joint Land Use Study Program is a collaborative land use planning effort between the military, cities, counties, and local interest groups and organizations. In 2011, Community and Air Force leaders completed a Joint Land Use Study for Cannon AFB and Melrose AFR. Participating members included officials from the City of Clovis, City of Portales, Roosevelt County, Curry County, Air Force leaders and personnel, local farmers and ranchers, and local business owners.

The Joint Land Use Study provides recommendations for long-term compatible development policies and implementation actions responding to Cannon AFB mission and training requirements. The Joint Land Use Study provides compatible development guidelines for properties located in the accident potential zones and noise zones. These compatibility guidelines are not mandatory.

6.2.7 BUILDING CODES

Building codes, which are enforced through local ordinances, are standards applied to the construction, modification, and/or use of buildings. Although building codes will not prevent incompatible development, they can help reduce impacts. The Construction Industries Division

is a state agency that conducts construction inspections and issues building permits. This agency also grants certification of occupancy.

6.3 LAND USE AND PROPOSED DEVELOPMENT

The land use compatibility analysis identifies existing and future land uses near Cannon AFB and Melrose AFR to determine compatibility conditions. Existing land use is assessed to determine current land use activity, while future land plans are used to project development and potential growth areas. Existing land use and parcel data provided by local communities were evaluated to ensure an actual account of land use activity regardless of conformity to zoning classification or designated planning or permitted use. Additionally, local management plans, policies, ordinances, and zoning regulations were evaluated to determine the type and extent of land use allowed in specific areas.

6.3.1 EXISTING LAND USES SURROUNDING CANNON AFB

Cannon AFB is in a rural area of Curry County and is generally surrounded by agricultural and ranching lands. Base housing is on the north side of U.S. Highway 60/84. Low density commercial development is also directly north of the base and U.S. Highway 60/84, and a few mobile homes are located on U.S. Highway 60/84 west of Curry Road. Dairy farms are on the east side of the base, and agricultural lands are to the west and south sides of the base.

To the east of Cannon AFB, the city of Clovis is the closest urbanized area. Residential and commercial development is mostly in the north and east portions of Clovis, while industrial and manufacturing is in the southern portion of the city adjacent to the railroad yards. Several churches are located in the eastern portion of the city on Norris Street. The Civic Center and the Curry County Event Center were recently constructed in the east portion of the city.

Cannon AFB is outside of the city limits and extra territorial zoning area of Clovis. Cannon AFB is within the unincorporated area of Curry County, which does not have zoning restrictions; therefore, compatibility with zoning was not applicable.

Existing land uses within the Cannon AFB 2017 AICUZ APZs and noise contours are illustrated in Figures 6-2 and 6-3, respectively. The predominant land uses within the Cannon AFB 2017 AICUZ APZs and noise contours are agricultural. Table 6-2 summarizes the total acreage of land uses within the 2017 AICUZ APZs and noise zones. Areas of specific land use compatibility concerns within the Cannon AFB AICUZ APZs and noise contours are further evaluated in Section 6.4.1 *Cannon AFB Land Use Compatibility Concerns*.

Figure 6-2: Existing Land Uses within the Cannon AFB 2017 AICUZ APZs

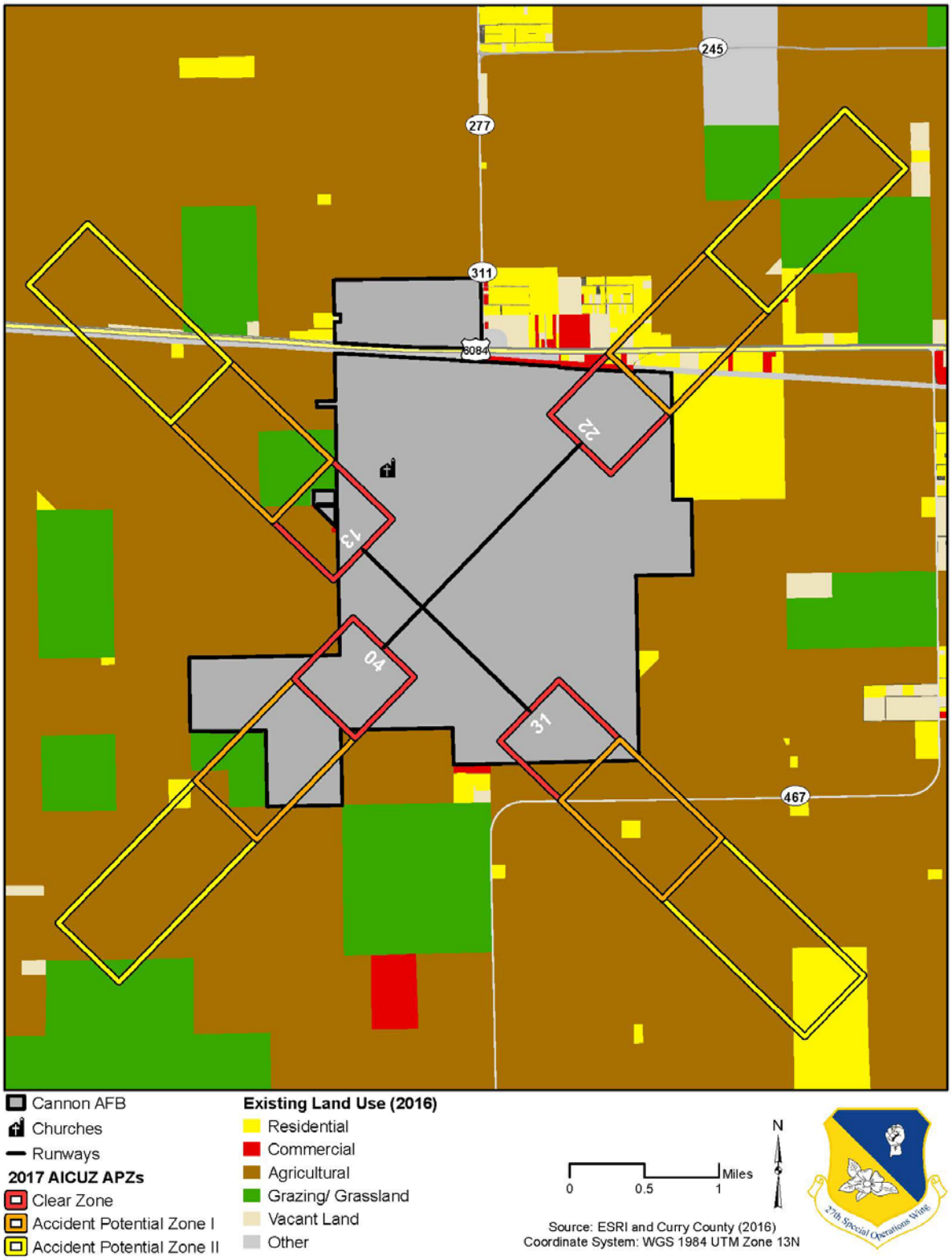


Figure 6-3: Existing Land Uses within the Cannon AFB 2017 Noise Contours

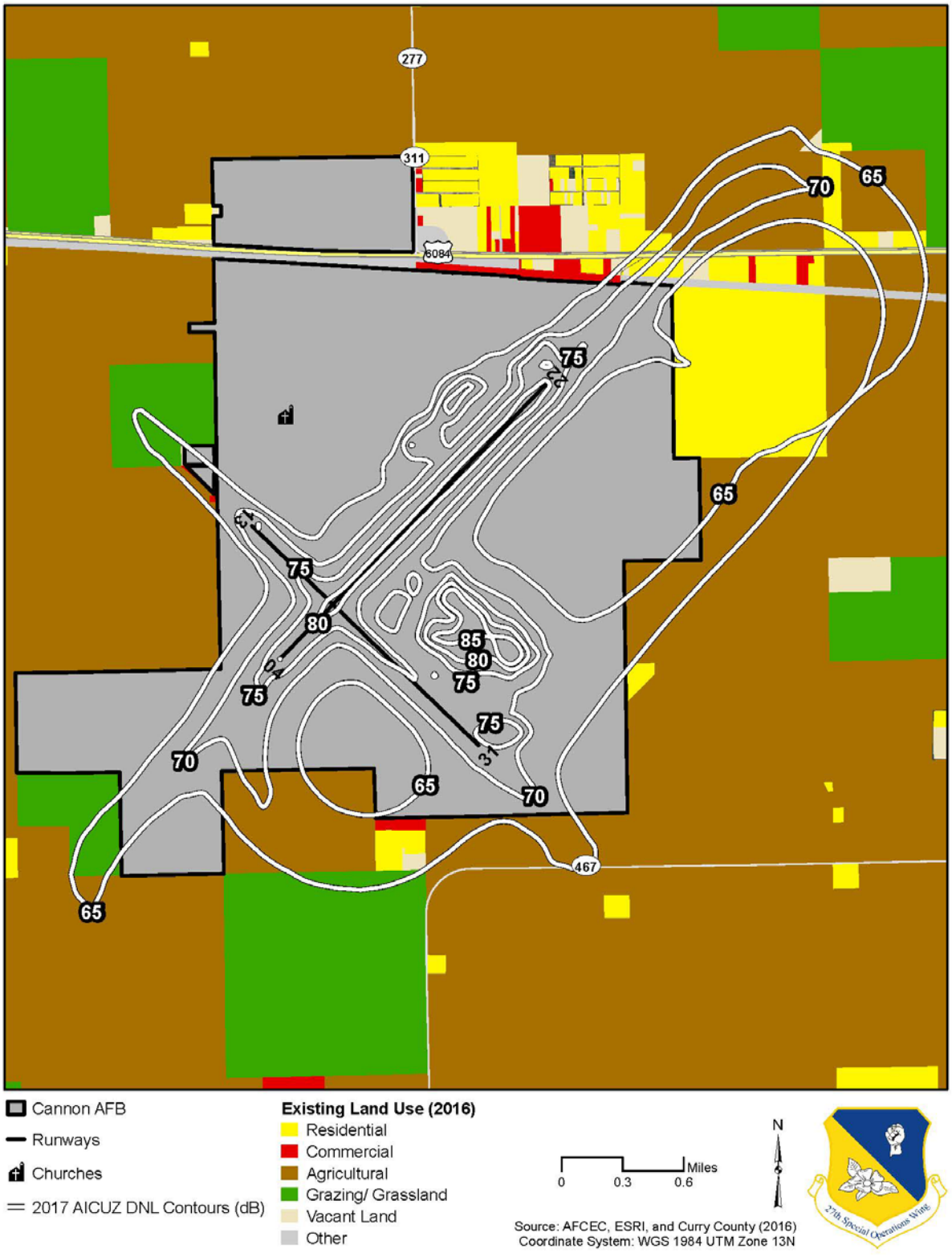


Table 6-2: Existing Off-Base Land Uses within the Cannon AFB AICUZ Footprint

Land Use	Noise Zones (acres)				APZs (acres)		
	65-70 dB	70-75 dB	75-80 dB	80-85 dB	CZ	APZ I	APZ II
Residential	96.7	8.5	0.0	0.0	2.8	86.6	150.2
Commercial	15.6	0.0	0.0	0.0	10.6	4.6	0.0
Agricultural	671.7	72.2	0.0	0.0	125.1	812.5	1589.1
Grassland	20.1	0.0	0.0	0.0	23.3	200.1	151.5
Vacant/Undeveloped	84.9	1.0	0.0	0.0	2.3	20.5	12.1
Other	8.4	3.1	0.0	0.0	0.0	11.4	38.1

Notes:

APZ Accident Potential Zone
CZ Clear Zone
dB decibel

6.3.1.1 EXISTING LAND USES SURROUNDING MELROSE AFR

Melrose AFR[2] is in a very sparsely populated area. Approximately 25 residences are within a five-mile radius of the range, mostly along Sundale Valley Road. The surrounding area is rural and primarily consists of state lands and agriculture and ranching land. The closest towns are Melrose to the northeast and Floyd to the south.

Melrose AFR is in the unincorporated areas of Roosevelt and Curry counties, which do not have zoning restrictions; therefore, compatibility with zoning was not applicable.

6.3.2 FUTURE LAND USES

Development increased in Curry County in 2005 with the introduction of the new mission at Cannon AFB and the construction of the Southwest Cheese Company plant. No new development has occurred around Cannon AFB in several years, and the surrounding area is expected to remain as ranching and agriculture lands. Future development in Curry County is expected to occur mostly in the city of Clovis. Clovis continues to grow to the north and to the northeast. Development is projected to grow on Llano Estacado Street (Highway 245), similar to the development on Prince Street. Several residential areas, including Rain Tree, Birch Homes, and Stone Hedge subdivisions, are developing in the northeast portion of the city between Norris Street and Humphrey Road and Llano Estacado Boulevard and Wilhite Road. Additionally, the City of Clovis has approved a housing development near Gattis Middle School. In 2015, Curry Road North was repaved to provide better access to the base. More development is expected to occur along Curry Road North. The Clovis Industrial Park, which is located east of Cannon AFB at the intersection of Curry Road K and Kimberly Road, has approximately 230 acres of land available for future development. A biodiesel facility is under construction at the industrial park.

[2] AICUZ noise contours and safety area for Melrose AFR were not developed as part of this AICUZ Study; therefore, only general land use compatibility issues are addressed for Melrose AFR.

No new developments are proposed around the base; however, the Ute Pipeline Project is a planned 151-mile distribution pipeline that will transport water from the Ute Lake Reservoir to Curry and Roosevelt counties. The project will improve water availability, which could encourage growth. A portion of the pipeline will run along the northern boundary of Cannon AFB.

Similarly, no development or population growth is projected near Melrose AFR. The surrounding area is expected to continue to develop as ranching and agriculture lands.

6.4 COMPATIBILITY CONCERNS

Land use compatibility conditions determined in the analysis are derived from the Air Force's land use compatibility guidelines for both AICUZ noise zones and APZs provided in AFI 32-7063 (Appendix A). To assess whether existing land use is compatible with flight operations at Cannon AFB, the 2017 AICUZ planning noise contours and the 2017 AICUZ APZs were overlaid on property parcel data, land use data, and/or aerial photographs. The land use compatibility analysis of these areas includes an assessment of developed properties, as well as the identification of properties that are currently vacant or have development potential. Generally, vacant property, in its present state, is compatible with the land use compatibility guidance; however, if vacant properties are developed, they may not remain compatible. Areas of compatibility concern within the AICUZ APZs and noise contours at Cannon AFB are illustrated in Figure 6-4. Additional compatibility concerns for Cannon AFB and Melrose AFR, such as wind energy development and light pollution, are discussed in Sections 6.4.2 and 6.4.3.

6.4.1 CANNON AFB LAND USE COMPATIBILITY CONCERNS

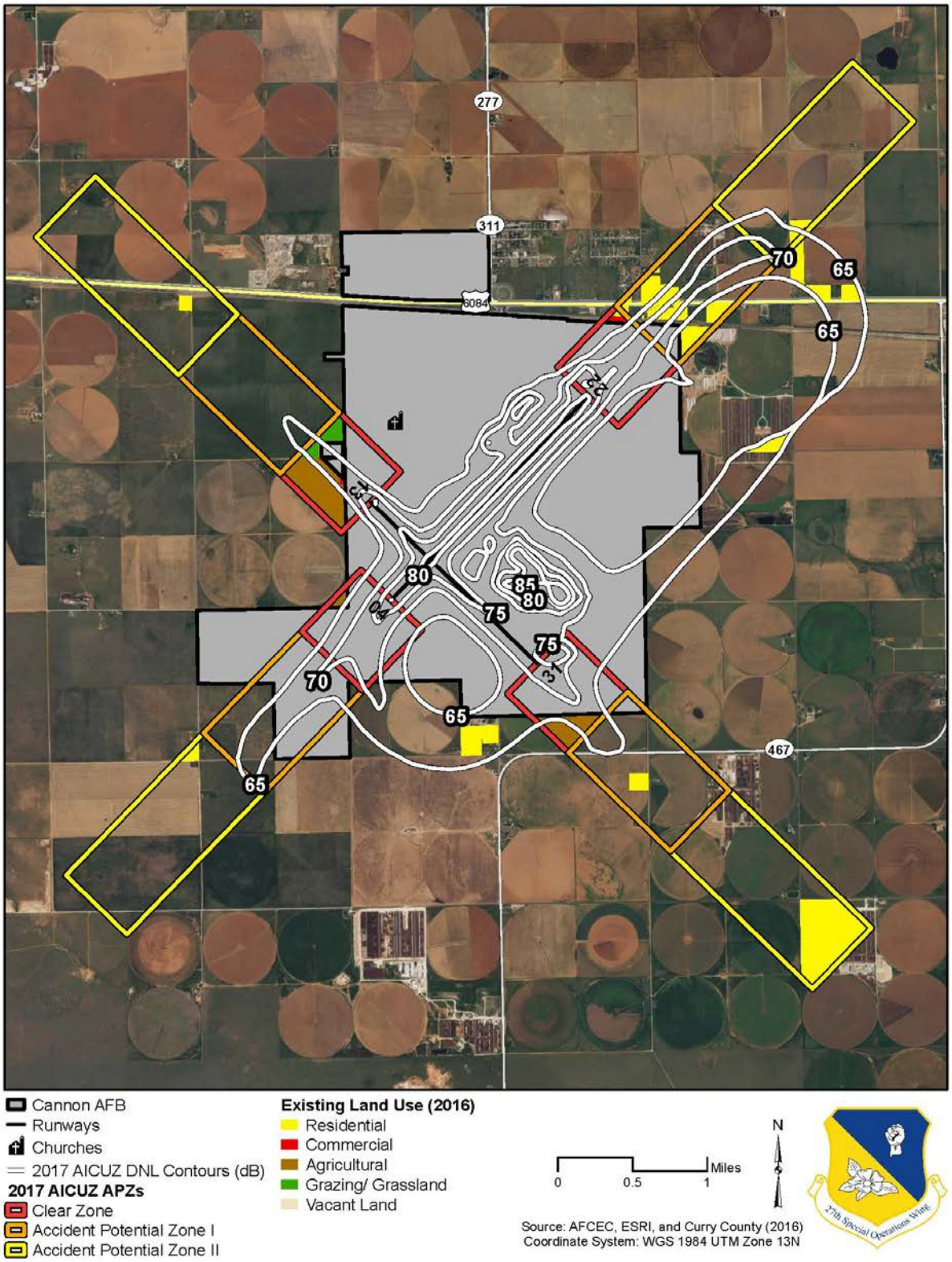
Easement Inventory

Between 1978 and 1995, Curry County and Cannon AFB have purchased easements around Cannon AFB to restrict incompatible development and height restrictions in the CZs and APZs. Curry County deeded easements to Cannon AFB in 1995; however, transition of ownership and terms of the easements are not fully documented in the easement records. Without a complete easement inventory, Cannon AFB cannot determine which easements have adequate use, lighting, and height restrictions to support mission and training requirements.

Enforcement of the easement is the responsibility of the easement owner. Because the status and terms of the easement are unknown, Cannon AFB is unable to monitor and enforce land use restrictions. Additionally, easements have not been identified for all property in the CZs and APZs. Approximately three acres of land in the APZ II of Runway 13 is not identified under an easement contract. In 2012, Curry County purchased easements on property from Curry County Road to Curry Road 7 to restrict development that may be incompatible with flight operations. The county has a lease agreement on these properties for 99 years.

Cannon AFB has not acquired easements for any property in the noise contours, nor does Curry County have any land use regulations to prevent incompatible development within the noise contours.

Figure 6-4: Areas of Compatibility Concerns, Cannon AFB



Clear Zones

Approximately 164 acres of off-base property are located within the CZs at Cannon AFB. The Air Force should own and maintain all the land within the airfield CZs by acquiring sufficient fee and/or easement rights to guarantee that these designated areas are protected from incompatible development and remain vacant. Most land uses in the CZs are considered incompatible with military aircraft operations, and the CZs should remain free of any potential obstructions. Any structure or obstruction within the CZs, whether permanent or temporary, is a safety threat. Cannon AFB has acquired restrictive easements for off-base property in the CZs; however, terms of the easements may not reflect current operational needs or effectively restrict future development that could be incompatible.

Off-base property in the CZs of Runway 13 (northwest runway), Runway 31 (southeast runway), and Runway 04 (southwest runway) is classified as agricultural or grazing/grassland. Approximately 2.8 acres of residential, 10.6 acres of commercial, and 2.3 acres of vacant land use are located in the CZ of Runway 04 (northeast runway) (Curry County 2016). Additionally, the Burlington Northern and Santa Fe railroad traverses through the CZ of Runway 22. No churches or schools are identified in any of the CZs.

Two on-base buildings are located in the CZ of Runway 13 (northwest runway), and the installation's fence and perimeter road (Aderholt Loop) traverse through the CZ. Cannon AFB has flashing lights to signal and stop traffic when aircraft are approaching. Curry Road R runs through the APZs and CZ of Runway 13. The county has closed the road.

Accident Potential Zones

Land to the north of Cannon AFB is generally more developed than property to the east, west, and south of the airfield. The majority of land use in the Runway 22 (northeast runway) APZ II is agricultural and grassland. A small area of residential use is in the APZ II and within the 65- to 69-dB DNL noise contour area. Residential and commercial areas are in lower portion of the Runway 22 APZ I and the 65- to 69-dB DNL and the 70- to 74-dB DNL noise contours. A small area of residential development is also located in the 65- to 69-dB DNL noise contours to the east of the base. Pockets of mobile homes are located to the north of the base on U.S. Highway 60/84, and potentially within the footprint of the Runway 22 APZ I and noise contours.

Minimal areas of incompatibility are identified to the west and to the south of the base. One residential area is identified in the APZ II of Runway 13 (northwest runway) and one residential area is identified in the APZ II of Runway 04 (southwest runway). Residential development is located in the APZ I and APZ II of Runway 31(southeast runway) and in the 65- to 69-dB DNL noise zone between Runway 04 (southwest runway) and Runway 31(southeast runway).

Residential land use is incompatible within APZ I, and the maximum density for single-family housing in APZ II is one to two dwelling units per acre. Existing residential development in APZ II does not exceed the density limits. Single-family residential land use is discouraged within the 65- to 69-DNL noise zone and strongly discouraged within the 70- to 74-DNL noise zone. Mobile homes are incompatible in all APZs and all noise zones. No churches or schools are identified in any of APZs or noise zones.

While the majority of land in the AICUZ footprint is agricultural use and no new developments are proposed around the base, the county does not have land use regulations to control future development. Cannon AFB has acquired restrictive easements for off-base property in the APZs; however, terms of the easements may not reflect current operational needs or effectively restrict future development that could be incompatible. There are no land use regulations to prevent incompatible development in the noise zones. Water quality improvement projects, such as the Ute Pipeline Project, and availability may drive or deter regional economic and population growth in the area. Vacant land may be vulnerable to development pressures and future incompatibility concerns. Future growth along U.S. Highway 60/84 could increase development near the AICUZ footprint of Runway 13 and Runway 22.

6.4.2 WIND ENERGY DEVELOPMENT COMPATIBILITY CONCERNS

Renewable energy development such as wind energy facilities can reduce the availability of training areas and obstruct flight operations. Wind turbines located in or near training areas may encroach upon low-level flight aviation training and testing. Several low-level military training routes (MTRs) go from Cannon AFB to Melrose AFR. Wind turbines sited in conflict with MTRs and designated special use airspace can reduce training quality and compromise pilot safety. Obstructions may ultimately lead to costly changes in training and flight paths. As wind energy development increases throughout New Mexico, future training may be significantly restricted or ineffective.

14 CFR Part 77 identifies the maximum allowable height of a structure in the vicinity of an airport and requires FAA notification prior to construction or alteration as described in Part 77.9. Airspace restrictions within the airfield imaginary surfaces are not always enforced, and the FAA cannot monitor all construction activities that may obstruct air navigation. Although the FAA may issue a Notice of Presumed Hazard, they do not have regulatory authority to prohibit development. Height obstructions, such as wind turbines, are monitored by the FAA through the Obstruction Evaluation/Airport Airspace Analysis notification process; however, the process is focused on communication and not enforcement.

Wind turbines can also impact radar and communication systems. The cross-section of the turbine blades is larger than many target aircraft and can block the radar signal and create a “shadow” where target aircraft may not be detected. When rotating turbines are within or close to the radar line-of-sight, the radar signal may be reflected from the rotating blades causing false targets or flashes. Additionally, the magnitude of the impact on radar depends upon the placement and number of turbines within the radar line-of-sight. When turbines are closely aligned, radar waves reflect/diffract from multiple rotating blades, distorting the target aircraft signals and increasing the shadow effect. Increased shadowing impacts the ability to detect low-flying aircraft. Loss of communication from radar interference raises safety concerns for aircraft control and command, and continual interference may limit the development of training activities and future capabilities. As wind energy development increases near the range, continual communication and radar interference may compromise training standards.

New Mexico has 1,112 megawatts (MW) of installed wind energy capacity with 14 wind energy projects online and 1,300 MW of wind capacity under construction (American Wind Energy Association 2016). The State of New Mexico passed a Renewable Portfolio Standard that requires investor-owned utilities to generate 20 percent renewable energy by 2020 and rural electric cooperatives to generate 10 percent renewable energy by 2020. Several wind farms are proposed or under construction near Melrose AFR and Cannon AFB training areas. Developers are proposing to build a wind farm north of Melrose AFR and Cannon AFB with turbines that are less than 200 feet tall, which would not be subject to FAA review and regulations.

The planned Tres Amigas Superstation will be the first national interconnection for renewable energy and will be constructed north of Clovis. The Superstation will connect America's three power grids: Eastern Interconnection, Western Interconnection, and Texas Interconnection. Right-of-way has been purchased along Sugar Beets Road, east of Cannon AFB, for planned transmission lines. The Tres Amigas Superstation and statewide transmission improvements will likely escalate wind energy development in New Mexico. Wind energy is also a significant economic incentive for landowners that can sell development rights on their properties to private developers for the placement of wind turbines and transmission lines.

Counties in New Mexico do not issue permits or business licenses for wind energy development; permits are processed through the state. Additionally, Curry and Roosevelt counties do not have zoning or regulate land use. A wind farm was proposed in Roosevelt County near the Melrose Bombing Range. While this wind farm was not approved, the counties do not currently have land use authority to regulate future development that may be incompatible with military operations. Through the DoD Readiness and Environmental Protection Integration (REPI) program, Cannon AFB is actively working with the New Mexico Governor and Legislature, conservation organizations, and local landowners to acquire easements to help prevent incompatible wind energy development near the range.

The military can only advise against proposed incompatible development and does not have the authority to restrict development. The Secretary of Defense established the DoD Siting Clearinghouse in 2010 to address compatibility concerns between military missions and energy development proposals. However, fragmented coordination among military services during requests for review of proposed cases and limited land-use decision authority may lead to incompatible siting of wind farms. Although the FAA reviews proposed wind farm sites to determine potential hazards to flight operations, a "Notice of Presumed Hazard" does not prohibit construction.

6.4.3 LIGHT POLLUTION COMPATIBILITY CONCERNS

High-intensity light sources near training areas and along approach/departure flight paths may also affect pilot vision and night operations. Light pollution from urban development, such as commercial and industrial land uses, creates excessive glare and illumination. Pilots conduct NVG training at Melrose AFR, and the glare and illumination cause a "wash-out" effect that interferes with NVG training. The reflection and glare from solar panels that are built along

military flight paths can also impact pilots' vision, which is distracting and can potentially cause accidents.

Roosevelt and Curry counties lack zoning and building ordinances to control development and lighting around Cannon AFB and Melrose AFR. Future development near these training areas could prohibit or restrict night operations, including NVG training, and compromise pilot safety and training quality standards. Development pressures could ultimately prevent pilots from meeting training requirements. Encroachment from continued development may result in new approach procedures and new flight corridors and/or reduction in flight operations.

7 IMPLEMENTATION

Implementation of the AICUZ Study must be a joint effort between Cannon AFB and surrounding communities. This AICUZ Study provides the best source of information to ensure land use planning decisions made by the local municipalities are compatible with installation operations in the future. This chapter discusses the roles of all the partners in the collaborative planning.

7.1 AIR FORCE ROLE

The goal of the Air Force AICUZ Program is to minimize the noise and safety concerns on the surrounding communities, and the role of Cannon AFB is to advise these communities on potential effects from base operations on the safety, welfare, and quality of life of their citizens.

Cannon AFB perceives its AICUZ responsibilities as encompassing the areas of flying safety, noise abatement, and participation in the land use planning process. Recommended actions for Cannon AFB include:

- Maintain aircraft and train aircrews to help ensure that the chances of an accident are remote; however, accidents do occur despite the best aircrew training and aircraft maintenance.
- Air Force should ensure that, wherever possible, flights are routed over sparsely populated areas as to reduce the exposure of lives and property to a potential accident.
- Air Force should periodically review existing traffic patterns, instrument approaches, weather conditions, and operating practices, and evaluate these factors in relationship to populated areas and other local situations. This is done to limit, reduce, and control the impact of flying operations noise on surrounding communities.
- Cannon AFB should establish a community forum between the installation and surrounding stakeholders to discuss land use and other issues of concern; these meetings should be held on a quarterly basis. Wing Commander should provide periodic updates with county and city officials to foster leadership-to-leadership interaction.
- Cannon AFB should promote communication between the county and base and provide contact information to county and city officials of new leadership at the base.

Preparation and presentation of this AICUZ Study is one phase of continuing Air Force participation in the local planning process. As the local communities update their land use plans, the Air Force must be ready to provide additional input when needed.

Implementation of the AICUZ Program objectives is a continuous process that requires ongoing participation and action even after initial compatibility policies are adopted. Cannon AFB should provide the AICUZ Study to the local communities for reference as the communities update their land use plans. Cannon AFB personnel are prepared to engage with the surrounding

communities to discuss proposed development plans and land use policies as they may affect, or may be affected by, the base. They also are available to provide information, criteria, and guidelines to state, regional, and local planning bodies; civic associations; and similar groups to assist them in planning efforts and to ensure Cannon AFB input is offered in the early stages of any long-range planning initiatives.

Encroachment Partnering

Title 10 United States Code Section 2684a authorizes the Secretary of Defense or the Secretary of a military department to enter into agreements with an eligible entity or entities to address the use or development of real property in the vicinity of, or ecologically related to, a military airfield or military airspace, to limit encroachment or use of the property that would be incompatible with the mission of the airfield, or place other constraints on military training, testing, and operations. Eligible entities include a state, a political subdivision of a state, and a private entity that has as its principal organizational purpose or goal the conservation, restoration, or preservation of land and natural resources, or a similar purpose or goal.

Encroachment partnering agreements provide for an eligible entity to acquire fee title, or a lesser interest, in land for the purpose of limiting encroachment on the mission of a military airfield and/or to preserve habitat off the airfield to relieve current or anticipated environmental restrictions that might interfere with military operations or training at the airfield. The DoD can share the real estate acquisition costs for projects that support the purchase of fee simple, conservation, or other restrictive easements for such property. The eligible entity negotiates and acquires the real estate interest for encroachment partnering projects with a voluntary seller. The eligible entity must transfer the agreed-upon restrictive easement interest to the United States of America upon the request of the Secretary of Defense.

Under the Readiness and Environmental Protection Integration (REPI) Program, the DoD provides funding to military services in support of partnerships that promote compatible land use and ensure the future use of military training areas. the Air Force is pursuing compatible land use partnerships to identify areas around the base and Melrose AFR where land acquisition, in the form of either outright fee-simple purchase or conservation easements/covenants, would be mutually beneficial for both parties. By forming partnerships, the Air Force can be eligible for funding to share the costs of land acquisition and conservation easement efforts through the REPI Program. REPI funds cannot be used to acquire property rights in the CZs.

7.2 STATE/REGIONAL ROLES

Cannon AFB can work with the New Mexico Military Planning Commission to propose state-wide regulations that prohibit development that may interfere or compromise flight operations and training. The New Mexico Military Planning Commission can assess potential compatibility concern between local communities and military installations throughout the state. The Commission evaluates state policies and advises the governor on measures to support the

operational capabilities of military installations while ensuring economic benefits to local communities.

Regional planning agencies can help control incompatible growth by aiding and influencing local governments in the development of policies, plans, and regulations necessary for the physical and economic expansion of the region.

7.3 LOCAL GOVERNMENT ROLE

The development and use of lands outside of military installations is beyond the control of the Air Force. Local governments have the authority to implement regulations and policies to control development and direct growth to ensure land use activity is compatible within the AICUZ footprint. While local planning regulations and policies may include land use restrictions in the AICUZ APZs, the planning noise contours are seldom recognized. Local governments should recognize their responsibility in providing land use control in those areas encumbered by the AICUZ footprint by incorporating AICUZ information into their planning policies and regulations.

Adoption of the following recommendations during the revision of relevant land use planning or zoning regulations will strengthen this relationship, increase the health and safety of the public, and help protect the integrity of the installation's flying mission:

- Recommend local government planners consider AICUZ policies and guidelines when developing or revising comprehensive plans and use AICUZ overlay maps and Air Force Land Use Compatibility Guidelines (see Appendix A) to evaluate existing and future land use proposals.
- Recommend local governments review their capital improvement plan, infrastructure investments, and development policies to ensure they do not encourage incompatible land use patterns near Cannon AFB or Melrose AFR, with particular emphasis on utility extension and transportation planning.
- Recommend local governments implement height and obstruction ordinances that reflect current Air Force and 14 CFR Part 77 requirements.
- Recommend fair disclosure ordinances be enacted to require disclosure to the public for those AICUZ items that directly relate to aircraft operations at Cannon AFB and Melrose AFR.
- Encourage the adoption, or modification, of building codes to ensure that any new construction in the vicinity of Cannon AFB and Melrose AFR has the recommended noise-level reduction measures incorporated into the design and construction of structures.
- Recommend proposals for tall structures such as wind turbines and communication towers be monitored to ensure that new construction does not pose a hazard to navigable airspace around Cannon AFB and Melrose AFR.
- Recommend AICUZ land use guidelines for development density in APZs are reflected in local government plans and ordinances.

- Encourage local governments to consult with Cannon AFB on planning and zoning actions that have the potential to affect base operations.
- Invite Air Force leadership to participate as an ex officio member on boards, commissions, and regional councils addressing long-range development and other planning policy. Cannon AFB is participating in the preparation of the draft Curry County Land Use Plan.
- Continue to inform Cannon AFB of planning and zoning actions that have the potential to affect base operations. Develop a working group representing city planners, county planners, and base planners to meet at least quarterly to discuss AICUZ concerns and major development proposals that could affect airfield operations.

7.4 COMMUNITY ROLES

Neighboring residents and base personnel have a long-established history of working together for the mutual benefit of the Cannon AFB mission and local community. Adoption of the following recommendations will strengthen this relationship, ensure the health and safety of the public, and help protect the integrity of the installation's flying mission:

Real Estate Professionals

- Be informed of where the noise zones and CZs/APZs encumber land near the base.
- Invite base representatives to local real estate and broker association chapter meetings to discuss the AICUZ Program goal and objectives.
- Disclose to prospective buyers when property is located within CZs/APZs or noise zone greater than 65 dB DNL.
- Require Realtor Multiple Listing Services to disclose noise zones and CZs/APZs on all listings.

Developers

- Be informed of where the noise zones and CZs/APZs encumber land near the base. Consult with Cannon AFB on proposed developments within the AICUZ area of influence.
- Ensure that new construction within the AICUZ area of influence has the recommended noise level reductions incorporated into design and construction codes.

Local Citizens

- Participate in local forums with the base to learn more about the base's missions.
- Become informed about the AICUZ Program and learn about the program's goals, objectives, and value in protecting the public's health, safety, and welfare.

- Ask local real estate professionals, city planners, and base representatives about noise and accident potential when considering purchase or lease of properties near Cannon AFB.

Whereas the base and community are physically separated by a fence, Air Force activities can affect the community and, conversely, community activities can affect the Air Force mission. Collaborative planning, forging partnerships, open communications, and close relationships help the Air Force and its neighbors achieve their mutual goals.

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APPENDICES

Appendix A Land Use Compatibility Tables

Appendix B Key Terms

APPENDIX A LAND USE COMPATIBILITY TABLES

Land use compatibility recommendations in Tables A-1 and A-2 are from AFI 32-7063 (Air Force 2015a) and reflect the Air Force's minimum compatibility requirements; however, individual circumstances at each base may require more stringent guidelines as prudent.

Table A-1: Land Use Compatibility Recommendations in APZs and CZs

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY			
		CLEAR ZONE Recommendation[1]	APZ-I Recommendation[1]	APZ-II Recommendation[1]	DENSITY Recommendation[1]
10	**Residential**				
11	Household Units				
11.11	Single units: detached	N	N	Y[2]	Maximum density of two dwelling units/acre
11.12	Single units: semi-detached	N	N	N	
11.13	Single units: attached row	N	N	N	
11.21	Two units: side-by-side	N	N	N	
11.22	Two units: one above the other	N	N	N	
11.31	Apartments: walk-up	N	N	N	
11.32	Apartment: elevator	N	N	N	
12	Group quarters	N	N	N	
13	Residential hotels	N	N	N	
14	Mobile home parks or courts	N	N	N	
15	Transient lodgings	N	N	N	
16	Other residential	N	N	N	
20	**Manufacturing [3]**				
21	Food and kindred products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
22	Textile mill products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
23	Apparel and other finished products; products made from fabrics, leather and similar materials; manufacturing	N	N	N	
24	Lumber and wood products (except furniture); manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
25	Furniture and fixtures; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY			
		CLEAR ZONE Recommendation[1]	APZ-I Recommendation[1]	APZ-II Recommendation[1]	DENSITY Recommendation[1]
26	Paper and allied products; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
27	Printing, publishing, and allied industries	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
28	Chemicals and allied products; manufacturing	N	N	N	
29	Petroleum refining and related industries	N	N	N	
30	**Manufacturing[3] (continued)**				
31	Rubber and miscellaneous plastic products; manufacturing	N	N	N	
32	Stone, clay, and glass products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
33	Primary metal products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
34	Fabricated metal products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks	N	N	N	
39	Miscellaneous manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
40	**Transportation, communication, and utilities[3, 4]**				
41	Railroad, rapid rail transit, and street railway transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
42	Motor vehicle transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
43	Aircraft transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
44	Marine craft transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
45	Highway and street right-of-way	Y[5]	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
46	Automobile parking	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY			
		CLEAR ZONE Recommendation[1]	APZ-I Recommendation[1]	APZ-II Recommendation[1]	DENSITY Recommendation[1]
47	Communication	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
48	Utilities[7]	N	Y[6]	Y[6]	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
48.5	Solid waste disposal (landfills, incinerators, etc.)	N	N	N	
49	Other transportation, communication, and utilities	N	Y[6]	Y	See Note 6 below
50	**Trade**				
51	Wholesale trade	N	Y	Y	Maximum FAR of 0.28 in APZ I and 0.56 in APZ II
52	Retail trade – building materials, hardware, and farm equipment	N	Y	Y	See Note 8 below
53	Retail trade – including, discount clubs, home improvement stores, electronics superstores, etc.	N	N	Y	Maximum FAR of 0.16 in APZ II
53	Shopping centers-Neighborhood, Community, Regional, Super-regional[9]	N	N	N	
54	Retail trade – food	N	N	Y	Maximum FAR of 0.24 in APZ II
55	Retail trade – automotive, marine craft, aircraft, and accessories	N	Y	Y	Maximum FAR of 0.14 in APZ I and 0.28 in APZ II
56	Retail trade – apparel and accessories	N	N	Y	Maximum FAR of 0.28 in APZ II
57	Retail trade – furniture, home furnishings, and equipment	N	N	Y	Maximum FAR of 0.28 in APZ II
58	Retail trade – eating and drinking establishments	N	N	N	
59	Other retail trade	N	N	Y	Maximum FAR of 0.16 in APZ II
60	**Services[10]**				
61	Finance, insurance, and real estate services	N	N	Y	Maximum FAR of 0.22 in APZ II
62	Personal services	N	N	Y	Office uses only. Maximum FAR of 0.22 in APZ II.
62.4	Cemeteries	N	Y[11]	Y[11]	
63	Business services (credit reporting; mail, stenographic, reproduction; advertising)	N	N	Y	Maximum FAR of 0.22 in APZ II

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY			
		CLEAR ZONE Recommendation[1]	APZ-I Recommendation[1]	APZ-II Recommendation[1]	DENSITY Recommendation[1]
63.7	Warehousing and storage services[12]	N	Y	Y	Maximum FAR of 1.0 in APZ I; 2.0 in APZ II
64	Repair services	N	Y	Y	Maximum FAR of 0.11 APZ I; 0.22 in APZ II
65	Professional services	N	N	Y	Maximum FAR of 0.22 in APZ II
65.1	Hospitals, nursing homes	N	N	N	
65.1	Other medical facilities	N	N	N	
66	Contract construction services	N	Y	Y	Maximum FAR of 0.11 APZ I; 0.22 in APZ II
67	Government services	N	N	Y	Maximum FAR of 0.24 in APZ II
68	Educational services	N	N	N	
68.1	Child care services, child development centers, and nurseries	N	N	N	
69	Miscellaneous services	N	N	Y	Maximum FAR of 0.22 in APZ II
69.1	Religious activities (including places of worship)	N	N	N	
70	**Cultural, entertainment, and recreational**				
71	Cultural activities	N	N	N	
71.2	Nature exhibits	N	Y[13]	Y[13]	
72	Public assembly	N	N	N	
72.1	Auditoriums, concert halls	N	N	N	
72.11	Outdoor music shells, amphitheaters	N	N	N	
72.2	Outdoor sports arenas, spectator sports	N	N	N	
73	Amusements – fairgrounds, miniature golf, driving ranges; amusement parks, etc.	N	N	Y[20]	
74	Recreational activities (including golf courses, riding stables, water recreation)	N	Y[13]	Y[13]	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II
75	Resorts and group camps	N	N	N	
76	Parks	N	Y[13]	Y[13]	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II
79	Other cultural, entertainment, and recreation	N	Y[11]	Y[11]	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY			
		CLEAR ZONE Recommendation[1]	APZ-I Recommendation[1]	APZ-II Recommendation[1]	DENSITY Recommendation[1]
80	**Resource production and extraction**				
81	Agriculture (except live- stock)	Y[4]	Y[14]	Y[14]	
81.5-81.7	Agriculture-Livestock farming, including grazing and feedlots	N	Y[14]	Y[14]	
82	Agriculture-related activities	N	Y[15]	Y[15]	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
83	Forestry activities[16]	N	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
84	Fishing activities[17]	N[17]	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
85	Mining activities[18]	N	Y[18]	Y[18]	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
89	Other resource production or extraction	N	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
90	**Other**				
91	Undeveloped land	Y	Y	Y	
93	Water areas[19]	N[19]	N[19]	N[19]	

Key:

Y (Yes) – Land use and related structures compatible without restrictions.

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Y[x] – Yes with restrictions. The land use and related structures generally are compatible. However, see note(s) indicated by the superscript.

N[x] – No with exceptions. The land use and related structures are generally incompatible. However, see note(s) indicated by the superscript.

Notes:

1 "Yes" or a "No" designation for compatible land use is to be used only for general comparison. Within each, uses exist where further evaluation may be needed in each category as to whether it is clearly compatible, normally compatible, or not compatible due to the variation of densities of people and structures. To assist air installations and local governments, general suggestions as to FARs are provided as a guide to density in some categories. In general, land use restrictions that limit occupants, including employees, of commercial, service, or industrial buildings or structures to 25 per acre in APZ I and 50 per acre in APZ II are considered low density. Outside events should normally be limited to assemblies of not more than 25 people per acre in APZ I, and maximum assemblies of 50 people per acre in APZ II. Recommended FARs are calculated using standard parking generation rates for various land uses, vehicle occupancy rates, and desired density in APZs I and II. For APZ I, the formula is FAR = 25 people per acre/ (Average Vehicle Occupancy × Average Parking Rate × (43,560/1,000)). The formula for APZ II is FAR = 50/ (Average Vehicle Occupancy × Average Parking Rate × (43,560/1,000)).

2 The suggested maximum density for detached single-family housing is two dwelling units per acre. In a PUD of single-family detached units, where clustered housing development results in large open areas, this density could possibly be increased slightly provided the amount of surface area covered by structures does not exceed 20 percent of the PUD total area. PUD encourages clustered development that leaves large open areas.

3 Other factors to be considered: Labor intensity, structural coverage, explosive characteristics, air-pollution, electronic interference with aircraft, height of structures, and potential glare to pilots.

4 No structures (except airfield lighting and navigational aids necessary for the safe operation of the airfield when there are no other siting options), buildings, or above-ground utility and communications lines should normally be located in Clear Zone areas on or off the air installation. The Clear Zone is subject to the most severe restrictions.

5 Roads in the graded portion of the Clear Zone are prohibited. All roads within the Clear Zone are discouraged, but if required, they should not be wider than two lanes and the rights-of-way should be fenced (frangible) and not include sidewalks or bicycle trails. Nothing associated with these roads should violate obstacle clearance criteria.

6 No aboveground passenger terminals and no aboveground power transmission or distribution lines. Prohibited power lines include high-voltage transmission lines and distribution lines that provide power to cities, towns, or regional power for unincorporated areas.

7 Development of renewable energy resources, including solar and geothermal facilities and wind turbines, may affect military operations through hazards to flight or electromagnetic interference. Each new development should be analyzed for compatibility issues on a case-by-case basis that considers both the proposal and potentially affected mission.

8 Within SLUCM Code 52, maximum FARs for lumberyards (SLUCM Code 521) are 0.20 in APZ-I and 0.40 in APZ-II; the maximum FARs for hardware, paint, and farm equipment stores, (SLUCM Code 525), are 0.12 in APZ I and 0.24 in APZ II.

9 A shopping center is an integrated group of commercial establishments that is planned, developed, owned, or managed as a unit. Shopping center types include strip, neighborhood, community, regional, and super-regional facilities anchored by small businesses, a supermarket or drug store, discount retailer, department store, or several department stores, respectively.

10 Ancillary uses such as meeting places and auditoriums are not recommended.

11 No chapels or houses of worship are allowed within APZ I or APZ II.

12 Big box home improvement stores are not included as part of this category.

13 Facilities must be low intensity, and provide no playgrounds, etc. Facilities such as club houses, meeting places, auditoriums, and large classes are not recommended.

14 Activities that attract concentrations of birds, creating a hazard to aircraft operations, should be excluded.

15 Factors to be considered: labor intensity, structural coverage, explosive characteristics, and air pollution.

16 Lumber and timber products removed due to establishment, expansion, or maintenance of Clear Zone lands owned in fee will be disposed of in accordance with applicable DoD guidance.

17 Controlled hunting and fishing may be permitted for the purpose of wildlife management.

18 Surface mining operations that could create retention ponds that may attract waterfowl and present BASH, or operations that produce dust or light emissions that could affect pilot vision are not compatible.

19 Naturally occurring water features (e.g., rivers, lakes, streams, or wetlands) are pre-existing, nonconforming land uses. Naturally occurring water features that attract waterfowl present a potential BASH. Actions to expand naturally occurring water features or construction of new water features should not be encouraged. If construction of new features is necessary for storm water retention, such features should be designed so that they do not attract waterfowl.

20 Amusement centers, family entertainment centers, or amusement parks designed or operated at a scale that could attract or result in concentrations of people, including employees and visitors, greater than 50 people per acre at any given time are incompatible in APZ II.

APZ Accident Potential Zone
BASH bird/wildlife aircraft strike hazards
DoD Department of Defense
FAR floor to area ratio
PUD planned unit development
SLUCM Standard Land Use Coding Manual, United States Department of Transportation

Table A-2: Recommended Land Use Compatibility for Noise Zones

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
10	**Residential**					
11	Household units	N[1]	N[1]	N	N	N
11.11	Single units: detached	N[1]	N[1]	N	N	N
11.12	Single units: semidetached	N[1]	N[1]	N	N	N
11.13	Single units: attached row	N[1]	N[1]	N	N	N
11.21	Two units: side-by-side	N[1]	N[1]	N	N	N
11.22	Two units: one above the other	N[1]	N[1]	N	N	N
11.31	Apartments: walk-up	N[1]	N[1]	N	N	N
11.32	Apartment: elevator	N[1]	N[1]	N	N	N
12	Group quarters	N[1]	N[1]	N	N	N
13	Residential hotels	N[1]	N[1]	N	N	N
14	Mobile home parks or courts	N	N	N	N	N
15	Transient lodgings	N[1]	N[1]	N[1]	N	N
16	Other residential	N[1]	N[1]	N	N	N
20	**Manufacturing**					
21	Food and kindred products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
22	Textile mill products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
24	Lumber and wood products (except furniture); manufacturing	Y	Y[2]	Y[3]	Y[4]	N
25	Furniture and fixtures; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
26	Paper and allied products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
27	Printing, publishing, and allied industries	Y	Y[2]	Y[3]	Y[4]	N
28	Chemicals and allied products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
29	Petroleum refining and related industries	Y	Y[2]	Y[3]	Y[4]	N

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		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
30	**Manufacturing (continued)**					
31	Rubber and misc. plastic products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
32	Stone, clay, and glass products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
33	Primary metal products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
34	Fabricated metal products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y[2]	Y[3]	Y[4]	N
40	**Transportation, communication, and utilities**					
41	Railroad, rapid rail transit, and street railway transportation	Y	Y[2]	Y[3]	Y[4]	N
42	Motor vehicle transportation	Y	Y[2]	Y [3]	Y[4]	N
43	Aircraft transportation	Y	Y[2]	Y[3]	Y[4]	N
44	Marine craft transportation	Y	Y[2]	Y[3]	Y[4]	N
45	Highway and street right-of-way	Y	Y	Y	Y	N
46	Automobile parking	Y	Y	Y	Y	N
47	Communication	Y	Y[6]	Y	N	N
48	Utilities	Y	Y[2]	Y[3]	Y[4]	N
49	Other transportation, communication and utilities	Y	255	305	N	N
50	**Trade**					
51	Wholesale trade	Y	Y[2]	Y[3]	Y[4]	N
52	Retail trade – building materials, hardware, and farm equipment	Y	25	30	Y[4]	N
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	25	30	N	N
54	Retail trade – food	Y	25	30	N	N
55	Retail trade – automotive, marine craft, aircraft, and accessories	Y	25	30	N	N

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		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
56	Retail trade – apparel and accessories	Y	25	30	N	N
57	Retail trade – furniture, home furnishings, and equipment	Y	25	30	N	N
58	Retail trade – eating and drinking establishments	Y	25	30	N	N
59	Other retail trade	Y	25	30	N	N
60	**Services**					
61	Finance, insurance and real estate services	Y	25	30	N	N
62	Personal services	Y	25	30	N	N
62.4	Cemeteries	Y	Y[2]	Y[3]	Y[4,11]	Y[6,11]
63	Business services	Y	25	30	N	N
63.7	Warehousing and storage	Y	Y[2]	Y[3]	Y[4]	N
64	Repair services	Y	Y[2]	Y[3]	Y[4]	N
65	Professional services	Y	25	30	N	N
65.1	Hospitals, other medical facilities	25	30	N	N	N
65.16	Nursing homes	N[1]	N[1]	N	N	N
66	Contract construction services	Y	25	30	N	N
67	Government services	Y[1]	25	30	N	N
68	Educational services	25	30	N	N	N
68.1	Child care services, child development centers, and nurseries	25	30	N	N	N
69	Miscellaneous services	Y	25	30	N	N
69.1	Religious activities (including places of worship)	Y	25	30	N	N
70	**Cultural, entertainment, and recreational**					
71	Cultural activities	25	30	N	N	N
71.2	Nature exhibits	Y[1]	N	N	N	N
72	Public assembly	Y	N	N	N	N
72.1	Auditoriums, concert halls	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y[7]	Y[7]	N	N	N
73	Amusements	Y	Y	N	N	N

SLUCM NO.	LAND USE	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
74	Recreational activities (including golf courses, riding stables, water recreation)	Y	25	30	N	N
75	Resorts and group camps	Y	25	N	N	N
76	Parks	Y	25	N	N	N
79	Other cultural, entertainment, and recreation	Y	25	N	N	N
80	**Resource production and extraction**					
81	Agriculture (except live-stock)	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
81.5-81.7	Agriculture-Livestock farming including grazing and feedlots	Y[8]	Y[9]	N	N	N
82	Agriculture-related activities	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
83	Forestry activities	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
84	Fishing activities	Y	Y	Y	Y	Y
85	Mining activities	Y	Y	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y	Y	Y

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25, 30, or 35 – The numbers refer to noise level reduction (NLR) levels. NLR (outdoor to indoor) is achieved through the incorporation of noise attenuation into the design and construction of a structure. Land use and related structures are generally compatible; however, measures to achieve NLR of 25, 30, or 35 must be incorporated into design and construction of structures. However, measures to achieve an overall noise reduction do not necessarily solve noise difficulties outside the structure and additional evaluation is warranted. Also, see notes indicated by superscripts where they appear with one of these numbers.

Notes:

1 General

a Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged in DNL 65-69 and strongly discouraged in DNL 70-74. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, nonconforming land uses.

b Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 decibels (dB) in DNL 65-69 and 30 dB in DNL 70-74 should be incorporated into building codes and be considered in individual approvals; for transient housing, an NLR of at least 35 dB should be incorporated in DNL 75-79.

c Normal permanent construction can be expected to provide an NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation, upgraded sound transmission class ratings in windows and doors, and closed windows year-round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.

d NLR criteria will not eliminate outdoor noise problems. However, building location, site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures that only protect interior spaces.

2 Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

3 Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

4 Measures to achieve NLR of 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

5 If project or proposed development is noise sensitive, use indicated NLR; if not, land use is compatible without NLR.

6 Buildings are not permitted.

7 Land use is compatible provided special sound reinforcement systems are installed.

8 Residential buildings require NLR of 25

9 Residential buildings require NLR of 30.

10 Residential buildings are not permitted.

11 Land use that involves outdoor activities is not recommended, but if the community allows such activities, hearing protection devices should be worn when noise sources are present. Long-term exposure (multiple hours per day over many years) to high noise levels can cause hearing loss in some unprotected individuals.

dB decibel

DNL day-night average sound level

CNEL Community Noise Equivalent Level (normally within a very small decibel difference of DNL)

NLR noise level reduction

SLUCM Standard Land Use Coding Manual, United States Department of Transportation

APPENDIX B KEY TERMS

- **Day-Night Average Sound Level (DNL) –** DNL is a composite noise metric accounting for the sound energy of all noise events in a 24-hour period. To account for increased human sensitivity to noise at night, a 10-dB penalty is applied to events occurring during the acoustical nighttime period (10:00 p.m. through 7:00 a.m.). Noise metrics are discussed in Chapter 4 *Aircraft Noise*.
- **Decibel –** Decibel (abbreviated as dB) is the unit used to measure the intensity of a sound.
- **Flight Profiles –** Flight profiles consist of aircraft conditions (i.e., altitude, speed, power setting, etc.) defined at various locations along each assigned flight track.
- **Flight Track –** A flight track is the route an aircraft follows while conducting an operation at the airfield, between airfields, or to/from training areas. The flight track locations represent the various types of arrivals, departures, and closed patterns accomplished at Cannon AFB. Flight tracks are graphically represented as single lines, but actual flight tracks may vary due to aircraft performance, pilot technique, and weather conditions.
- **Operation –** An aircraft operation is defined as one takeoff or one landing. A complete closed pattern or circuit is counted as two operations because it has a takeoff component and a landing component. A sortie is a single military aircraft flight from the initial takeoff through the termination landing. The minimum number of aircraft operations for one sortie is two operations, one takeoff (departure) and one landing (approach).