FORT SILL
JOINT LAND USE STUDY

Background Report

This study was prepared under contract with the Association of South Central Oklahoma Governments, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Association of South Central Oklahoma Governments and JLUS Partners and does not necessarily reflect the views of the Office of Economic Adjustment.

FORT SILL
JOINT LAND USE STUDY

Background Report

Prepared Under Contract with:

ASCOG

Association of South Central Oklahoma Governments
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P.O. Box 1647
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Prepared by:

Matrix DESIGN GROUP

December 2018

This study was prepared under contract with the Association of South Central Oklahoma Governments, with financial support from the Office of Economic Adjustment, Department of Defense. The content was developed through a collaborative stakeholder process and does not necessarily reflect the views of the Office of Economic Adjustment.

Policy Committee

The Policy Committee (PC) served an active and important role in providing policy direction during the development of the Fort Sill Joint Land Use Study (JLUS). The PC comprised the following individuals:

- Tim Binghom, *Commissioner*
  Kiowa County
- COL Samuel Curtis, *Garrison Commander*
  Fort Sill
- Jennifer Ellis, *Mayor*
  Town of Medicine Park
- Fred Fitch, *Mayor*
  City of Lawton
- Shawn Komahcheet, *Mayor*
  City of Cache
- Johnny Owens, *Commissioner*
  Comanche County
- Jane Payne, *Mayor*
  City of Apache
- K. Daryl Perry, *Mayor*
  Town of Indiahoma
- Larry Thoma, *Mayor*
  City of Elgin
- Dale Winkler, *Councilman*
  Town of Sterling

Technical Working Group

The Technical Working Group (TWG) served a key role in the development of the Fort Sill JLUS, providing the overall advisory support, review, and guidance of the study. The TWG comprised the following individuals:

- Andrew Bennett, *Department of Public Works*
  Fort Sill
- Tony Booth, *Refuge Manager*
  Wichita Mountains Wildlife Refuge
- LDCR Michael Branum, *CPLO*
  Naval Air Station Joint Reserve Base Fort Worth
- Mark Brown, *Physical Security*
  Fort Sill
- Jill Drummond, *Office Administrator*
  Land Legacy Conservancy
- Kent Fletcher, *Environmental Specialist*
  Farmers Electric Company
- Debora Glasgow, *Executive Director*
  Southwest Oklahoma Development Authority
- Bart Hadley, *Assistant City Manager of Operations*
  City of Lawton
- Bob Hanefield, *Physical Facilities Department Director*
  Cameron University
- Afsaneh Jabbar, *Public Works*
  City of Lawton
- Steve Kelly, *Economic Development Planner*
  Association of South Central Oklahoma Governments
- Michael Patton,
  Land Legacy Conservancy
- Donna Prentiss Meeks,
  Apache Nation
- Richard Rogalski, *City Manager*
  City of Lawton
- Ike Sayeed,
  Fort Sill
- Carol Sims,
  Southwest Oklahoma Development Authority
- Jimmy Sirmons
  Altus Air Force Base
- Kyle Smith,
  Lawton Public Schools
- Arun Tilak,
  Cameron University
- Ronnie Ward,
  Association of South Central Oklahoma Governments
- Tom Whaylen,
  Sheppard Military Affairs Commission
- Glen Wheat, *Environmental Quality Department*
  Fort Sill

Technical Working Group (continued)

- Crystal Keys, *Water Program Manager*
  Bureau of Indian Affairs
- Fred Makinney, *Department of Emergency Services*
  Fort Sill
- Lt Col Matthew Manning,
  Sheppard Air Force Base
- Barbara McNally, *Director*
  Lawton-Fort Sill Regional Airport
- Tim Niedecken,
  Southwest Oklahoma Cattleman's Association
- Kevin Ouellette, *Councilman*
  City of Frederick
- Jessica Willis,
  Oklahoma Commissioners of the Land Office
- Chief Douglas Winters,
  Altus Air Force Base
- Ryan Zaborowsky,
  Lockheed Martin Corporation
- Tom Zigler,
  Association of South Central Oklahoma Governments
- Marlin Zimmerman,
  Tinker Air Force Base

JLUS Consultant / Technical Advisors

Matrix Design Group, Inc. was the project consultant hired to conduct the JLUS project through coordination with and assistance from the Association of South Central Oklahoma Governments, the PC, the TWG, the public, and other stakeholders.

Matrix DESIGN GROUP

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Project Manager

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Special Appreciation

Matrix Design Group wishes to recognize all the partners, residents, stakeholders, and community leaders for their participation in the workshops and public meetings.

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Tables and Figures

ACRONYMS

A

ACS	American Community Survey
ACUB	Army Compatible Use Buffer
ADA	Air Defense Artillery
ADNL	A-weighted day-night level
ADT	Average daily traffic
AFB	Air Force Base
AFI	Air Force Instruction
AGL	Above Ground Level
AICUZ	Air Installation Compatible Use Zone
AIRFA	American Indian Religious Freedom Act
AOA	Airport Operations Area
APZ	Accident Potential Zone
AQ	Air Quality
AQI	Air Quality Index
AR	Army Regulation
ASCOG	Association of South Central Oklahoma Governments
ASR	Airport surveillance radar
AT	Anti-Terrorism / Force Protection
ATCT	Air Traffic Control Tower
AUDS	Anti-Unmanned aerial vehicle Defense System
APPPA	Aircraft Pilot and Passenger Protection Act

B

BAH	Basic Allowance for Housing
BIO	Biological Resources
BRAC	Base Realignment and Closure
BUG	Backlight, Uplight, and Glare

C

CAA	Clean Air Act
CDNL	C-weighted Day-Night average noise level
CFR	Code of Federal Regulation
COE	Center of Excellence
COM	Communication / Coordination
CR	Cultural Resources
CWA	Clean Water Act
CZ	Clear Zone

D

DA	Department of the Army
dB	decibel
dBA	A-weight decibel
dBP	Peak decibel

DEQ	Department of Environmental Quality
DES	Department of Emergency Services
DFW	Dallas-Fort Worth International Airport
DNL	Day Night Average A-weighted Sound Level
DoD	Department of Defense
DoDI	Department of Defense Instruction
DSS	Dust, Smoke, Steam

E

e.g.	for example
EA	Environmental Assessment
ED	Energy Development
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance

F

FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FCoE	Fires Center of Excellence
FICUN	Federal Interagency Committee on Urban Noise
FL	Flight Level
FONSI	Finding of No Significant Impact
FSFD	Fort Sill Fire Department
FSI	Frequency Spectrum Interference / Impedance
FSR	Fort Sill Regulation
FW	Fighter Wing
FY	Fiscal Year

G

GDP	Gross Domestic Product
GIS	Geographic Information Systems

H

HIMARS	High Mobility Artillery Rocket System
HPAAF	Henry Post Army Airfield
HTA	Helicopter Training Area

I

i.e.	in other words
ICRMP	Integrated Cultural Resources Management Plan
ICUZ	Installation Compatible Use Zone
IE	Infrastructure Extensions
IED	Improvised Explosive Devise
INRMP	Integrated Natural Resources Management Plan
ITAM	Integrated Training Area Management
IS	Imaginary Surfaces

J

JLUS	Joint Land Use Study
JPADS	Joint Precision Air Drop System

L

LAS	Land, Air, and Sea Spaces
LATS	Lawton Area Transit System
LAW	Lawton-Fort Sill Regional Airport
LEG	Legislative Initiatives
LG	Light and Glare
LMA	Lawton Metropolitan Area
LMAAA	Lawton Metropolitan Area Airport Authority
LMPO	Lawton Metropolitan Planning Organization
LU	Land Use
LUPZ	Land Use Planning Zone

M

MCA	Military Compatibility Area
MCAOD	Military Compatibility Overlay District
MLRS	Multiple Launch Rocket System
mm	millimeter
MOA	Memorandum of Agreement
MRT	Mitigation Response Team
MSL	Mean Sea Level
MTR	Military Training Route
MWR	Morale Welfare and Recreation

N

NAAQS	National Ambient Air Quality Standards
NACo	National Association of Counties
NAS	Naval Air Station
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NGO	Nongovernmental Organization
NHPA	National Historic Preservation Act
NHS	National Highway System
NM	Nautical Mile
NOI	Noise
NOAA	National Oceanic and Atmospheric Administration
NOTAMs	Notice to Airmen
NREB	Natural Resources and Enforcement Branch
NVG	Night Vision Goggles
NWS	National Weather Service
NZ	Noise Zone

O

OAC	Oklahoma Aeronautics Commission
OCWP	Oklahoma Comprehensive Water Plan
ODOT	Oklahoma Department of Transportation
ODWC	Oklahoma Department of Wildlife Conservation
OE/AAA	Obstruction Evaluation / Airport Airspace Analysis
OEA	Office of Economic Adjustment
OK	Oklahoma
OKC	Will Rogers World Airport
ONMP	Operational Noise Management Plan
OS	Oklahoma Statutes
OWRB	Oklahoma Water Resources Board

P

PAM	Pamphlet
PAO	Public Affairs Office
PC	Policy Committee
PIF	Partners in Flight
PM	Particulate Matter
PS	Public Services

R

RA	Restricted Airspace
RAPCON	Radar Approach Control
RC	Roadway Capacity
RCMP	Range Complex Master Plan
REPI	Readiness Environmental Protection and Integration
RF	Radio Frequency
ROC	Radar Operations Center

S

§	Section
SA	Safety Zones
SARNAM	Small Arms Range Noise Assessment Model
SDWA	Safe Drinking Water Act
SDZ	Surface Danger Zone
SHPO	State Historic Preservation
SRP	Sustainable Range Program
SWODA	Southwestern Oklahoma Development Authority

T

TBD	to be determined
TWG	Technical Working Group

U

UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UFC	Unified Facilities Criteria
US	United States
USACE	US Army Corps of Engineers
USAHAS	United States Avian Hazard Advisory System
USFWS	US Fish and Wildlife Service

V

V	Vibration
VFR	Visual Flight Rules
VO	Vertical Obstructions

W

WASH	Wildlife Aircraft Strike Hazard
WMWR	Wichita Mountain Wildlife Refuge
WPZ	Weapons Danger Zone
WQQ	Water Quality / Quantity

INTRODUCTION 1

Inside Chapter 1...

Wichita Mountains Wildlife Refuge

The Fort Sill Military Reservation (Fort Sill) is located in south central Oklahoma. Fort Sill is situated approximately 90 miles southwest of Oklahoma City and approximately 50 miles north of Wichita Falls, Texas. The City of Lawton, Oklahoma, borders Fort Sill to the south. Fort Sill occupies approximately 94,000 acres, and is characterized by mountains, rolling hills, and prairie in Comanche County, Oklahoma. The JLUS Study Area encompasses all land in the vicinity of Fort Sill that have actual or potential impacts on military operations at the installation.

The participating jurisdictions in this JLUS are the Towns of Indiahoma, Medicine Park, and Sterling, Cities of Apache, Cache, Elgin, Frederick, and Lawton, Comanche and Kiowa Counties, and the Kiowa Nation. An organized engagement and proactive communication and planning process between the military, the surrounding communities, and other stakeholder entities that own or manage land or resources in the region is needed to ensure that future growth around Fort Sill is coordinated and compatible with military training activities.

1.1 What is a Joint Land Use Study?

A JLUS is a planning process accomplished through the collaborative efforts of a comprehensive list of stakeholders in a defined study area in order to identify compatible land uses and growth management practices in communities close to active military installations. These stakeholders include local jurisdictions, state, and federal officials, residents, business owners, nongovernmental organizations, and the military.

The intent of the process is to establish and encourage a working relationship among military installations and their neighboring jurisdictions to act as a team to prevent and/or reduce compatibility issues associated with future mission expansion and local growth. Compatibility in relation to military readiness can be defined as the balance or compromise between community needs and interests and military needs and interests. The goal of compatibility planning is to promote an environment where both community and military can coexist successfully.

A JLUS results in a set of recommendations or potential strategies that can be implemented by identified stakeholders to promote compatible development and relationships between the military and neighboring communities for the present and future. As such, a JLUS may become an adopted plan for establishing compatible land use standards but does not itself enact any new regulations or policies.

Although primarily federally funded by the Department of Defense (DOD), Office of Economic Adjustment (OEA), a JLUS is produced by and for local communities. The project management entity for the Fort Sill JLUS is the Association of South Central Oklahoma Governments (ASCOG).

This JLUS is important to preserve long-term land use compatibility between Fort Sill, and surrounding jurisdictions, and to better protect the health, safety, and welfare of surrounding jurisdictions and the civilian and military community at Fort Sill. The JLUS is representative of collaboration between Fort Sill; the State of Oklahoma; and the Counties of Comanche and Kiowa; the Cities of Apache, Cache, Elgin, Frederick, and Lawton; and the Towns of Indiahoma, Medicine Park, and Sterling for the purpose of planning for compatible land use, while ensuring the continued presence of the military.

JLUS Goal

The goal of the Fort Sill JLUS is to protect the viability of current and future military missions and operations, while simultaneously guiding community growth, sustaining the environmental and economic health of the region, and protecting public health, safety, and welfare.

JLUS Objectives

To achieve this goal, three primary JLUS objectives were identified.

Understanding. Convene community and military representatives to identify, confirm, and understand compatibility issues and concerns in an open forum, considering both community and military needs and perspectives. This includes increasing public awareness, education, and opportunities for input organized in a cohesive outreach program.

Collaboration. Encourage cooperative land use and resource planning by Fort Sill and surrounding communities so that future community growth and development are compatible with Fort Sill's missions and operations, while seeking ways to reduce operational impacts on land within the JLUS Study Area.

Actions. Provide a set of mutually supported tools, activities, and procedures (strategies) that local jurisdictions, agencies, and Fort Sill can implement in order to avoid and reduce compatibility issues. The strategies proposed include both operational measures to mitigate installation impacts on surrounding communities, and local government and agency approaches to reduce community impacts on military operations. These strategies will help decision makers resolve compatibility issues and prioritize projects within the annual budgeting process of their respective entity / jurisdiction.

The Fort Sill JLUS is a proactive approach to encourage increased communication and foster relationships among all JLUS stakeholders and partners.

1.2 Why Prepare a Joint Land Use Study?

Although military installations and nearby communities may be separated by a fence line, they often share natural and manmade resources such as land, airspace, water, and infrastructure. Despite the many positive interactions among local jurisdictions, agencies, and the military, and because so many resources are shared, the activities or actions of one entity can pose unintended negative impacts on another, resulting in conflicts. As communities develop and expand in response to growth and market demands, land use approvals have the ability to locate potentially incompatible development closer to military installations and operational / training areas. The result can initiate new, or exacerbate existing, land use and other compatibility issues, often referred to as encroachment, which can have negative impacts on community safety, economic development, and sustainment of military activities and readiness. This threat to military readiness activities is currently one of the military's greatest operational challenges.

Collaboration and joint planning among military installations, local communities, and agencies protects the long-term viability of existing and future military missions. Working together also enhances the health of local economies before incompatibility becomes an issue. Recognizing the close relationship that should exist between installations and adjacent communities, the DOD Office of Economic Adjustment (OEA) implemented the JLUS program in an effort to mitigate existing and future conflicts and enhance communication and coordination among all affected stakeholders. This program aims to preserve the sustainability of local communities within the JLUS Study Area while protecting current and future operations and training missions at Fort Sill.

Regional Economic and Local Importance

Fort Sill contributes nearly $2 billion annually to the Lawton-Southwest Oklahoma region. This economic impact is characterized by salaries, contracts, and the purchase of goods and services. Fort Sill is the third largest employer in Southwest Oklahoma, supporting over 16,500 military personnel and their family members and employing over 7,000 civilian personnel.

It is important for communities to partner with Fort Sill on relevant and long-range planning projects to facilitate the future viability of both the military training mission and the economic impact that the installation provides now and into the future. The JLUS process strives to deepen the understanding of and enhance the mutual benefit shared between Fort Sill and the Southwest Oklahoma Region.

Military Strategic Importance

Fort Sill is vital to both the nation's defense as well as the regional economy. Fort Sill is the home of the U.S. Army Fires Center of Excellence (COE), an organization combining the U.S. Army Artillery Center and School and the U.S. Army Air Defense Artillery (ADA) Center and School. Principal operational units at Fort Sill include the 75th and 214th Fires Brigades, the 428th and 434th Field Artillery Brigades, and the 30th and 31st ADA Brigades. Fort Sill is also one of the five locations for Army Basic Combat Training. As the home of the U.S. Army Fires COE, the installation mission is to train soldiers and develop field artillery and ADA leaders, design and develop fire support for the force, support unit training and readiness, mobilize and deploy operating forces, and maintain installation infrastructure and services.

Local Communities Working Together

Fort Sill working alongside the surrounding communities has not only improved the quality of life of soldiers but also local residents through adopting best practices for a host of community topics including Emergency Services, Housing, Education, Retail, and Employment. Fort Sill leadership and soldiers are active in the religious aspect of the surrounding communities attending local churches and volunteering their time in church events and philanthropy.

Fort Sill leadership is truly dedicated and committed to continuously strengthening and support of the Lawton-Fort Sill region's surrounding communities and organizations. They are is actively involved in numerous educational and community boards including the Lawton-Fort Sill Chamber of Commerce Legislative Affairs Committee, which works closely with the military to understand and identify local priorities and encourage state and federal legislative support.

This Co-Op Program creates joint opportunities for the military and community volunteers including organizations and units on Fort Sill, numerous local and regional businesses, and community schools to continuously improve the quality of life in the region.

1.3 Stakeholder and Public Outreach

The JLUS process was designed to create a locally relevant plan that builds consensus and obtains support from the various stakeholders involved. To achieve the JLUS goals and objectives, the JLUS process utilized a stakeholder and public outreach program that included a variety of opportunities for interested parties to contribute to its development.

Stakeholders

An early step in any planning process is the identification of stakeholders. Stakeholders include individuals, groups, organizations, and governmental entities interested in, affected by, or affecting the outcome of the JLUS project. Informing and involving them early in the project is essential in identifying their compatibility issues so that they can be resolved through the development of integrated strategies and actions.

Stakeholders identified for the Fort Sill JLUS included, but were not limited to:

- Local jurisdictions (Towns of Indiahoma, Medicine Park, and Sterling; Cities of Apache, Cache, Elgin, Frederick, and Lawton; and Comanche and Kiowa Counties);
- DOD officials (including OEA representatives) and military installation personnel;
- Local, regional, and state planning, regulatory, and land management agencies;
- Landholding and regulatory federal agencies;
- The public (including residents and landowners);
- Environmental advocacy organizations;
- Native American Tribes (Kiowa Nation and Fort Sill-Apache Tribe);
- Nongovernmental organizations (NGOs); and
- Other special interest groups (including local educational institutions and school districts).

Policy Committee and Technical Working Group

The development of the Fort Sill JLUS was guided by two committees made up of city, county, state and federal agencies, Fort Sill personnel, resource agencies, and other stakeholders. The two committees were the Policy Committee (PC) and the Technical Working Group (TWG).

JLUS Policy Committee (PC): The PC consisted of elected officials from participating jurisdictions, Fort Sill leadership, and representatives from other interested and affected agencies. The PC was responsible for the direction of the JLUS, preparation and approval of the study design, approval of policy recommendations, and approval of draft and final JLUS documents.

Technical Working Group (TWG): The TWG membership included area planners, military base planners, business and development community representatives, and other subject matter experts as needed to assist in the development and evaluation of implementation strategies and tools. The TWG was responsible for identifying and studying technical issues, providing feedback on report development, and assisting in the development and evaluation of implementation strategies and tools. Items discussed by the TWG were brought before the PC for consideration and action.

The PC and TWG served as liaisons to their respective stakeholder groups. PC and TWG members were charged with conveying committee activities and information to their organizations and constituencies and relaying their organization's comments and suggestions to both committees for consideration. PC members were encouraged to set up meetings with their organizations and / or constituencies to facilitate this input. The list of participants and their responsibilities for the JLUS sponsors, the PC, and the TWG are identified in Tables 1-1, 1-2, and 1-3, respectively.

Table 1-1. JLUS Sponsor Responsibilities and Participants

Responsibilities	Participants
■ Coordination ■ Accountability ■ Grant management ■ Financial contribution	■ Office of Economic Adjustment ■ Association of South Central Oklahoma Governments (ASCOG)

Table 1-2. JLUS Policy Committee Responsibilities and Participants

Responsibilities	Participants
■ Policy direction ■ Study oversight ■ Monitoring ■ Report adoption	■ Comanche County ■ Kiowa County ■ City of Apache ■ City of Cache ■ City of Elgin ■ City of Frederick ■ City of Lawton ■ Town of Indiahoma ■ Town of Medicine Park ■ Town of Sterling ■ Fort Sill ■ Kiowa Nation ■ Fort Sill-Apache Tribe

Table 1-3. JLUS Technical Working Group Responsibilities and Participants

Responsibilities	Participants
■ Identify issues ■ Provide expertise to address technical issues ■ Evaluate and recommend implementation actions to the PC ■ Provide draft and final report recommendations to the PC	■ Oklahoma Department of Transportation ■ Oklahoma Military Strategic Planning Commission ■ Comanche County ■ Kiowa County ■ City of Apache ■ City of Cache ■ City of Elgin ■ City of Frederick ■ City of Lawton ■ Town of Indiahoma ■ Town of Medicine Park ■ Town of Sterling ■ Lawton-Fort Sill Regional Airport ■ Fort Sill ■ Kiowa Nation ■ Fort Sill-Apache Tribe

Committee meetings were held throughout the process to ensure the JLUS identified and appropriately addressed local issues. The meetings conducted are highlighted as follows.

Project Kick-Off / TWG and PC Meeting #1 (January 5, 2017). This meeting served as the initial kick-off for the committees and provided an overview of Fort Sill's mission. The JLUS process and participants were introduced and information on the 25 compatibility factors evaluated in this JLUS was presented along with the first public brochure.

TWG and PC Meeting #2 (September 18, 2017). The second meeting conducted with the TWG included a review of potential data gaps, review of issues identified to date, and presentation of draft findings. Any additional issues were added and summarized along with general notes on issues, goals, and concerns identified to date.

TWG and PC Meeting #3 (February 5 and 6, 2018). The third PC meeting included a presentation of the project status, an explanation and discussion of the military operational footprints, and a brief discussion on the identified compatibility issues, which required action and acceptance by the PC. The presentation also covered a brief overview of the public meeting and next steps. The third TWG meeting was held on the morning g of PC meeting #2 which was held in the afternoon. The third TWG meeting included a presentation of the project status, an explanation on the military compatibility areas, and an open discussion about the draft recommendations. The purpose of this meeting was to garner input from the TWG on potential strategies.

TWG and PC Meeting #4 (September 18, 2018). The fourth TWG meeting was held to present the Draft JLUS and recommendations. The JLUS Team developed the Draft JLUS based on committee comments and revisions. The JLUS Team provided information regarding the public comment period and solicited input from TWG members. The fourth PC meeting included a presentation of the project status, an explanation on the military compatibility areas, which required action and acceptance by the PC. The PC also received information about next steps in the project.

TWG and PC Meeting #5 (December 19, 2018). The fifth meeting was held to present the Final JLUS Report. The JLUS Team prepared the final report to include all comments and revisions as outlined in the previous tasks and as deemed appropriate to incorporate by the PC. The presentation of the Final JLUS Report discussed the overall findings, major changes and revisions to the report that were incorporated based on comments received from the committee members and the public.

Public Workshops

In addition to the PC and TWG meetings, a series of public workshops were held throughout the development of the JLUS. These workshops provided an opportunity for the exchange of information with the greater community, assisted in identifying the issues to be addressed in the JLUS, and provided input on the strategies proposed. Each workshop included a traditional presentation and a facilitated exercise providing a "hands on," interactive opportunity for the public to participate in the development of the study. The public workshops that were conducted are highlighted as follows:

Public Workshop #1 (September 18, 2017). This initial public workshop provided an explanation of the purpose of a JLUS, an overview of the military operations at Fort Sill (Including military training areas), an introduction to project participants, and the JLUS approach and goals. A user-friendly JLUS Overview Fact Sheet was distributed at this workshop. The workshop opened with a formal presentation to the public regarding the overview of compatibility factors and the public involvement plan and was followed by an interactive working session where attendees were invited to share their input on potential compatibility issues. The workshop concluded with an opportunity for questions and answers.

Public Workshop #2 (February 5 and June 14, 2018). The second public workshop provided a chance to review and comment on the compatibility issues that have been identified for evaluation as part of the JLUS and provide input on the importance of the issues identified. Attendees were provided a set of sticker dots to "vote" on how important each compatibility issue was to them. They were also able to add issues that they felt should be addressed in the JLUS that were not previously captured.

Public Workshop #3 (September 18, 2018). The third public workshop was held to present the Public Draft JLUS and recommendations to attendees. Attendees were encouraged to provide feedback either during the meeting via comment cards or submission of comments via the project website and designated ASCOG JLUS Project Manager.

Public Outreach Materials

JLUS Overview Fact Sheet. At the beginning of the JLUS project, a fact sheet was developed describing the JLUS program, objectives, methods for the public to provide input into the process, an overview of the 25 compatibility factors that would be analyzed throughout the project, and the proposed Fort Sill JLUS Study Area. This fact sheet was made available at the public workshops for review by interested members of the public, as well as posted on the website for download.

Strategy Tools Brochure. The Strategy Tools Brochure was prepared for the second public workshop. JLUS strategies constitute a variety of actions that local governments, military installations, agencies, and other stakeholders can take to promote compatible land use planning. This brochure provides an overview of the strategy types that could be applied to address compatibility issues around Fort Sill.

Website. A project website (www.ftsilljlus.com) was developed and maintained to provide stakeholders, the public, and media representatives with access to project information. This website was maintained for the entire duration of the project to ensure information was easily accessible. Information on the website included program points of contact, schedules, documents, maps, public meeting information, and downloadable comment forms.

1.4 JLUS Study Area

The Fort Sill Regional JLUS Study Area, as depicted on Figure 1-1, is designed to address all lands near Fort Sill, where community uses and activities may impact current or future military operations or where such uses and activities may be impacted by operations. Fort Sill is located in Southwest Oklahoma and is situated within the City of Lawton city limits in Comanche County. Fort Sill is located in the northern portion of the city.

1.5 JLUS Implementation

It is important to note that once the JLUS process is completed, the final document is not an adopted plan, but rather a set of strategies to be used by local jurisdictions, agencies, and organizations in the Fort Sill JLUS Study Area to guide their future planning efforts. Acceptance of the study by stakeholders (e.g. committees, jurisdictions, and the public) will confirm their collective support for identified implementation efforts. For instance, local jurisdictions may use the strategies in this JLUS to guide future subdivision regulation, growth policy, and zoning amendments, and to assist in the review of development proposals in the JLUS Study Area. Fort Sill leadership and planners can use the JLUS to guide their interaction with local jurisdictions on future projects, and to manage internal planning processes with a compatibility-based approach.

1.6 JLUS Organization

The following is a brief overview of the organization of the Fort Sill JLUS, including the contents of the Executive Summary brochure, the main JLUS Report, and each of the chapters of the Background Report.

JLUS Executive Summary Brochure

An Executive Summary Brochure was prepared in conjunction with the Final JLUS Report. This high-level graphical brochure provides a brief overview of the JLUS project and process and highlights the major compatibility issues and recommended strategies to address them. It also includes Fort Sill operational footprint maps and their descriptions.

JLUS Report

The JLUS Report is a graphic portfolio of the key issues and strategies identified through the Fort Sill JLUS process. The report includes a user-friendly reference of the JLUS that is accessible and easy-to-use for all stakeholders. This report provides a brief discussion on the purpose and objectives of a JLUS, describes the overall benefit of a JLUS, and provides an overview of the various JLUS partners that assisted in developing the Fort Sill JLUS. Finally, this document outlines the relevant compatibility issues identified, accompanied by recommended key strategies developed through the Fort Sill JLUS process to address each issue. The JLUS Report is the action plan for addressing compatibility and provides recommended strategies for each participant.

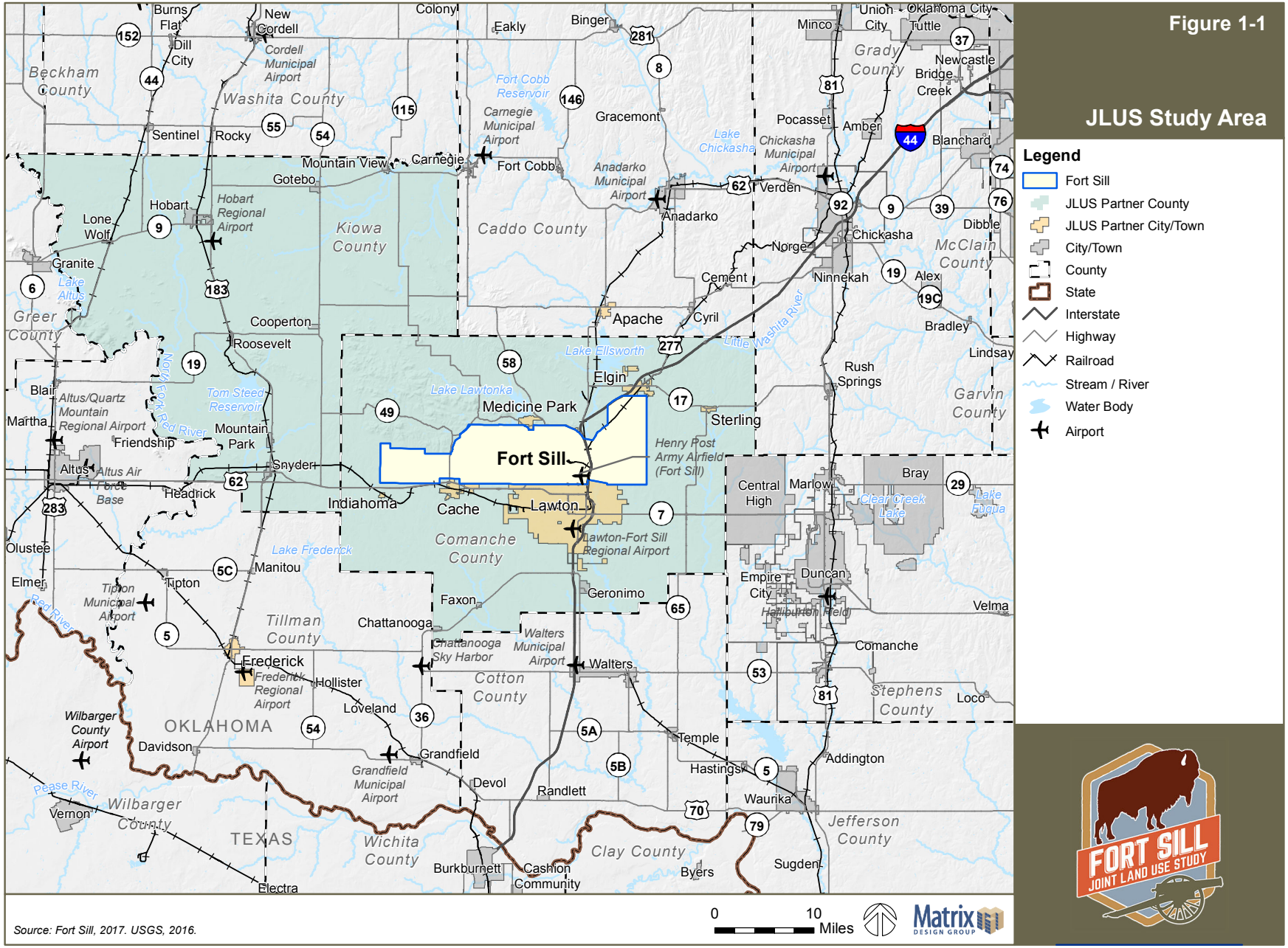


Figure 1-1
JLUS Study Area
Legend
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Airport
Fort Sill
Lawton
Medicine Park
Elgin
Sterling
Apache
Cache
Indiahoma
Geronimo
Faxon
Chattanooga
Frederick
Walters
Temple
Hastings
Waurika
Addington
Duncan
Comanche
Velma
Loco
Marlow
Bray
Central High
Empire City
Rush Springs
Lindsay
Chickasha
Verden
Anadarko
Cement
Cyril
Ninnekah
Alex
Bradley
Norge
Pocasset
Amber
Blanchard
Newcastle
Bridge Creek
Minco
Union City
Oklahoma City
Tuttle
Binger
Eakly
Colony
Gracemont
Carnegie
Fort Cobb
Mountain View
Gotebo
Hobart
Lone Wolf
Granite
Sentinel
Rocky
Dill City
Burns Flat
New Cordell
Cooperton
Roosevelt
Blair
Martha
Friendship
Mountain Park
Altus
Snyder
Headrick
Olustee
Elmer
Tipton
Manitou
Davidson
Vernon
Electra
Burkburnett
Cashion Community
Byers
Sugden
Jefferson County
Clay County
Wichita County
Wilbarger County
Tillman County
Cotton County
Comanche County
Stephens County
Caddo County
Kiowa County
Greer County
Beckham County
Washita County
Grady County
McClain County
Garvin County
OKLAHOMA
TEXAS
Cordell Municipal Airport
Hobart Regional Airport
Altus/Quartz Mountain Regional Airport
Altus Air Force Base
Frederick Regional Airport
Tipton Municipal Airport
Wilbarger County Airport
Grandfield Municipal Airport
Chattanooga Sky Harbor
Walters Municipal Airport
Carnegie Municipal Airport
Anadarko Municipal Airport
Chickasha Municipal Airport
Henry Post Army Airfield (Fort Sill)
Lawton-Fort Sill Regional Airport
Halliburton Field
Fort Cobb Reservoir
Lake Chickasha
Lake Altus
Tom Steed Reservoir
Lake Lawtonka
Lake Ellsworth
Lake Frederick
Clear Creek Lake
Lake Ft. Supply
Little Washita River
North Fork Red River
Red River
Pease River
0
10
Miles
Source: Fort Sill, 2017. USGS, 2016.
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Background Report

The JLUS Background Report is a detailed document that includes information about the communities within the Study Area, the military, the current tools available to both the communities and military, and a compatibility assessment for all identified compatibility issues. This report is fairly voluminous and provides supporting and supplementary information to the JLUS Report. It is intended to serve as a reference tool for the JLUS Report.

Chapter 1: Introduction. Chapter 1 provides an introduction and overview of the Fort Sill JLUS. This chapter describes the national strategic and local economic importance of Fort Sill, the working relationships among the installation and local communities, the background and intent of the JLUS, the JLUS Study Area, the objectives used to guide development of the JLUS, the stakeholders involved in developing the JLUS, public outreach methods, the implementation premise, and the organization of the document.

Chapter 2: Community Profile. This chapter introduces the communities that are within the JLUS Study Area and gives an overview of their history and current statistics, including population, housing characteristics, economic outlook, trends of growth and development. The chapter also provides an overview of the transportation system within the JLUS Study Area.

Chapter 3: Military Profile. This chapter describes the military presence within the JLUS Study Area. An overview of Fort Sill is provided, as well as the military operations that take place both there and the larger military footprints outside the installations boundaries. A brief history and discussion of Fort Sill include information on the units and schools that operate on the installation. It is important to identify the military operating areas and current and possible future missions that take place in the JLUS Study Area to understand how the military operations could potentially impact, or be impacted by, the surrounding communities. For this reason, Chapter 3 includes a discussion and maps describing the military footprints of Fort Sill.

Chapter 4: Existing Compatibility Tools. This chapter provides an overview of relevant plans, programs, and studies that are tools to address compatibility issues in the JLUS Study Area. The applicable tools are reviewed in order to set a baseline for the evaluation of the effectiveness of each plan or program relative to addressing the compatibility issues that are identified and described in Chapter 5.

Chapter 5: Compatibility Assessment. Compatibility, in relation to military readiness, can be defined as the balance or compromise between both community and military needs and interests. In this chapter, the JLUS presents the compatibility issues identified for the Fort Sill JLUS Study Area. These issues were identified based on input from the PC and TWG, members of the public, existing plans and technical reports, and evaluation by the project team. This chapter categorizes the issues into the following 25 compatibility factors.

- Air Quality
- Anti-Terrorism / Force Protection
- Biological Resources
- Coordination / Communication
- Cultural Resources
- Dust / Smoke / Steam
- Energy Development
- Frequency Spectrum Capacity
- Frequency Spectrum Impedance / Interference
- Housing Availability
- Infrastructure Extensions
- Land / Air / Sea Spaces
- Land Use
- Legislative Initiatives
- Light and Glare
- Marine Environment
- Noise
- Public Services
- Public Trespassing
- Roadway Capacity
- Safety Zones
- Scarce Natural Resources
- Vertical Obstructions
- Vibration
- Water Quality / Quantity

COMMUNITY PROFILES

2

Inside Chapter 2...

Wichita Canyon near Lawton, OK

This chapter provides information about the surrounding communities that participated in the Fort Sill Joint Land Use Study (JLUS). Capturing and describing certain demographic characteristics of these communities provides a baseline context from which informed decisions can be made when assessing compatibility strategies. The goal is to provide information that enables stakeholders to understand population and development trends that have the potential to affect Fort Sill's future. This information is intended to be considered with other factors to help decision makers generate coherent, informed planning policies and decisions about future development and economic growth of the communities they represent before compatibility issues arise.

Information presented in this chapter includes population growth, housing, economic development, and transportation within the region to better understand the impacts on Fort Sill. This chapter is also intended to inform Fort Sill about the types of activities occurring "outside the fence" when considering future missions and operations.

2.1 Regional Overview

The Fort Sill JLUS Study Area is a region comprised of many communities. These communities are Comanche and Kiowa Counties; the Cities of Apache, Cache, Elgin, Frederick, and Lawton; and the Towns of Indiahoma, Medicine Park, and Sterling. The Apache Nation and the Fort Sill-Apache Tribe were also JLUS Partners.

The JLUS Study Area is located in southwest Oklahoma, near the Wichita Mountains Wildlife Refuge. This region is well known for its scenic places and connection to nature due to the vast open spaces and federally protected land. Outside of the Wichita Mountains, the terrain is generally flat grassland with some rolling hills.

The regional climate generally experiences hot and humid summers and moderately cold, windy winters. The average temperature ranges from 41 to 85 degrees Fahrenheit, and the average annual precipitation is approximately 32 inches—very little of which consists of snow. This region of Oklahoma is well known for tornados, which are most common during the spring. Comanche County typically experiences at least one tornado per year.

View from Wichita Mountains looking south over Elmer Thomas Lake
Photo Credit: Mapio.net

Jurisdictions

Comanche County

Comanche County Courthouse
Photo credit: York Electronic Systems, Inc.

Year Incorporated:
1901

2016 Estimated Population:
122,136

Projected 2030 Population:
132,094

Major Industries:
Agriculture; Livestock Production; Government (Military); Oil, Gas, and Minerals

Comanche County is located in southcentral Oklahoma within the Red Bed Plains and Wichita Mountains region. The County covers approximately 1,084 square miles, and is bordered by: Caddo and Kiowa Counties to the north, Grady and Stephens Counties to the east; Cotton and Tillman Counties to the south; and Kiowa County to the west. The boundaries of Fort Sill reside completely within Comanche County. Comanche County is characterized by plains with rich soils provided by natural waterways. The Wichita Mountains, located in southwest Oklahoma, span 31 miles across Comanche, Jackson, Kiowa, and Greer Counties.

The county is named after the Comanche tribe and what was once the Kiowa-Comanche-Apache Reservation following the Louisiana Purchase in 1803. Camp Wichita (later named Fort Sill) was founded in the area in 1869. Comanche County was not established until 1901 when the area became available for non-Native American settlement. Since the county's establishment, agriculture and government services (including Fort Sill) have been the primary economic base for the area. Today, these industries share the space with other businesses including management, business, science, arts, sales and office services, and construction and production.

The county seat is the City of Lawton and the most populous municipality. Comanche County has an estimated population of 122,136 people as of the 2016 American Community Survey (ACS). The following is a list of jurisdictions are located within Comanche County.

The following are a list of communities in Comanche County. Communities that were Partners for the Fort Sill JLUS are denoted with an asterisk (*).

- City of Cache*
- City of Elgin*
- City of Lawton*
- Town of Chattanooga
- Town of Faxon
- Town of Fletcher
- Town of Geronimo
- Town of Indiahoma*
- Town of Medicine Park*
- Town of Meers
- Town of Pumpkin Center
- Town of Sterling*
- Bethel, unincorporated community

Comanche County is governed by a board of three commissioners elected by the people of each district. The county is divided into three districts of equal population. The Board of Commissioners is responsible for the administration and management of the county, and they are responsible for enforcing laws passed by the State of Oklahoma Legislature.

City of Cache

City of Cache City Hall
Photo Credit: City of Cache

Year Incorporated:
1909

2016 Estimated Population:
2,853

Major Industries:
Agriculture; Livestock Production; Oil, Gas, and Minerals

The City of Cache is located in southwest Comanche County and is situated along US Highway 62 approximately 17 miles west of the City of Lawton. The city occupies approximately 3.5 square miles just south of Fort Sill.

The city was officially incorporated in 1909. The railways and nearby Wichita Mountains provided ample opportunities for mining; however, concern over legal position due to non-incorporation resulted in the slow growth. Gravel / sand, coal, feed, cattle, and fuel oil comprised the industries for the city. With the attractions and resources, the city maintained a slow but steady growth through the 1970s. After the 1970s, the city boomed and by the turn of the century, the City had a population of 2,371 people. According to the 2016 ACS, the City had an estimated population of 2,853 people.

The City is governed by a mayor-council structure municipal government and the council is elected at-large by qualified voters within the city limits of Cache. The City is divided into four wards with each ward electing a representative to serve a four-year term. The mayor presides over the city council and serves as Chief Executive Officer performing the associated duties including establishing and setting a budget and appointing heads of departments.

City of Elgin

City of Elgin City Hall
Photo Credit: Trip Suggest

Year Incorporated:
1902

Major Industries:
Agriculture; Military; Manufacturing

2016 Estimated Population:
3,008

The City of Elgin is located in northeastern Comanche County and is situated southeast of Lake Ellsworth near the intersection of US Highways 17 and 277 and the H.E. Bailey Turnpike. The city covers about 3.7 square miles northeast of Fort Sill.

The city was incorporated in 1902 with the development of the U.S. Post Office. The city continued to grow due to railway construction of the Oklahoma City and Western Railroads from Chickasha to Lawton between 1901 and 1903. Growth and development continued through the 20th Century with agriculture being the primary economic industry. After the

turn of the century, Elgin experienced growth from Fort Sill as a result of a Department of Defense manufacturing plant locating in Elgin. As of the 2016 ACS, the City of Elgin had an estimated population of 3,008 people.

The City of Elgin uses an aldermanic form of municipal government with an elected mayor and councilmembers. There are four wards and the councilmembers are elected by residents to serve a four-year term. The mayor serves as the Chief Executive Officer and establishes and sets the budget for the city.

City of Lawton

Lawton City Hall
Photo credit: Chengwen Teng, http://www.panoramio.com/photo/109979321

Year Incorporated:
1901

2016 Estimated Population:
94,653

Major Industries:
Agriculture; Government (Military); Other Government; Oil, Gas, and Minerals

The City of Lawton is located in south-central Comanche County and serves as the county seat. Lawton is situated along several highways including Interstate 44, U.S. Highway 62, and State Highway 7. Lawton is approximately 87 miles southwest of Oklahoma City and is the largest community in southwestern Oklahoma.

The city was incorporated in 1901 and reaped the benefit of the military and defense industry with its proximity to Fort Sill which the U.S. Army has continuously operated since 1869. In addition, agriculture combined with industry prospered due to the construction of several railroads, within and around the city, supported the growing city economically. Within two years of founding, the city had three ice plants, two grain elevators and two cotton gins, and numerous other industries. By 1936, the City was supported by 18 industries that operated various companies including the Fairmont Creamery, the Dolese Brothers Rock Quarry, the Southwestern Light and Power Company, and the Chickasha Oil Company. Today, educational and health care services, retail trade, government services and military-related industry, arts and entertainment and hospitality services, and manufacturing characterize the city's economic base. As of the 2016 ACS, the City had a population of 94,653 people.

The City of Lawton uses council-manager system form of government with nine councilmembers including a mayor, and a city manager. The city is divided into seven wards with a councilmember elected by popular vote to represent each ward for a four-year term.

Town of Indiahoma

Town of Indiahoma Post Office
Photo credit: by http://www.flickriver.com/places/United+States/Oklahoma/Indiahoma/

Year Incorporated:
1903

Major Industries:
Agriculture; Local Government; Real Estate

2016 Estimated Population:
334

The Town of Indiahoma is located in southwestern Comanche County and is situated south of US Highway 62 along Indiahoma Road. Indiahoma is approximately 24 miles west of the City of Lawton and covers 0.3 square miles.

The City was incorporated in 1903 and was supported by the cotton manufacturing industry in the early 1900s. However, as Fort Sill grew and expanded, Indiahoma diminished. As result of the cotton industry shrinking, the Town declined. Today, the Town is characterized by local government offices, local eateries, a school, and other small local businesses. According to the 2016 ACS, the Town had a population of 334 people.

The Town of Indiahoma uses a mayor-manager form of municipal government. The mayor serves as Chief Executive Officer and establishes and sets budget along with providing oversight and administration duties for the town.

Town of Medicine Park

Town of Medicine Park
Photo credit: Facebook/MedicineParkOK

Year Incorporated:
1908

Major Industries:
Tourism; Local Government

2016 Estimated Population:
438

The Town of Medicine Park is located in north Comanche County and is situated along Interstate 44 and State Highway 49, just north of Fort Sill, and south of Lake Lawtonka. Medicine Park is approximately 14 miles northwest of the City of Lawton and covers about 2.1 square miles.

The Town was incorporated in 1908 and was envisioned by John William Elmer Thomas as a resort community utilizing the medicinal properties of the Medicine Creek. Thus, Medicine Park Summer Resort and Health Spa was founded. Today, the Town is characterized by resort-style businesses, including a two-story hotel, general stores, post office, and some eateries. There is a park area where concerts and other such events are held. The Town is frequented by over 200,000 visitors annually. According to the 2016 ACS, the Town had a population of 438 people.

The Town of Medicine Park uses a mayor-clerk form of municipal government. The mayor serves as Chief Executive Officer and establishes and sets budget along with providing oversight and administration duties for the town.

City of Apache

Apache Municipal Building
Photo Credit: LASR Community

Year Incorporated:
1902

Major Industry:
Agriculture

2016 Estimated Population:
1,441

The City of Apache is located about 24 miles north of the City of Lawton along Interstate 44 just north of Lake Ellsworth. The City covers about 2.0 square miles in southern Caddo County.

The City was incorporated in 1902 after the Kiowa-Comanche-Apache Reservation #1 was opened by the Land Lottery. The Land Lottery Director recommended setting aside the town site for the City of Apache then. Within the first hours of the land run, Apache was settled quickly with five lumber yards, six saloons, and a tent was constructed that would serve as a market for groceries. Then, and still today, the City has been an agriculture center producing wheat and cattle. This industry provides the necessary economic activity for a growing city in south-central Oklahoma. The city is also the home of the Fort Sill-Apache tribal headquarters. According to the ACS 2016, the City had an estimated population of 1,441 people.

The City of Apache uses a city manager-councilmember form of municipal government.

City of Frederick

Frederick, OK City Hall
Photo credit: Pinterest, courthouselover

Year Incorporated:
1902

Major Industries:
Agriculture Production

2016 Estimated Population:
3,665

The City of Frederick is located 44 miles southwest of Fort Sill and covers about 4.9 square miles in the central portion of Tillman County. The City of Frederick is also the Tillman County Seat.

In 1902, two town sites of Hazel and Gosnell merged to form the City of Frederick. With the coming of the Blackwell, Enid, and Southern Railroad, the two towns adopted the name Frederick (named after the son of a conductor on the first passenger train into town). During this time, the area experienced the boom and bust periods that followed the discovery in oil in northern Texas. Frederick also experienced the boom and bust that came with the construction of railroads including the Blackwell, Enid and Southern Railroad, Wichita Falls and Northwestern Railway which was later sold to the Missouri-Kansas-Texas Railroad (also known as the Katy Railroad).

Currently, the City is known as an agriculture city producing several commodities including wheat, cotton, and cattle. Nicknamed the "Friendly City" Frederick enjoys the business that the agriculture industry provides complemented by local businesses including the Frederick Regional Airport and local eateries. As of the 2016 ACS, the City of Frederick had an estimated population of 3,665 people.

The City of Frederick operates a city manager/council form of municipal government with an elected mayor and councilmembers. There are five wards from which the councilmembers represent and one councilmember is an at-large position.

Town of Sterling

Pennington Grocery Co. in Sterling, Oklahoma
Photo credit: Danielle Blaylock Photography

Year Incorporated:
1901

Major Industries:
Agriculture; Oil and Gas

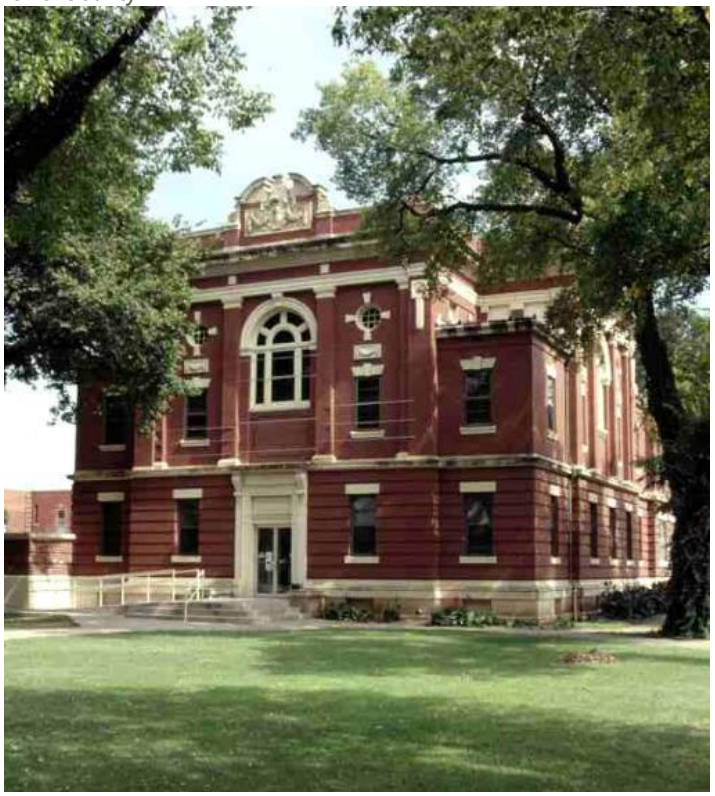
2016 Estimated Population:
784

The Town of Sterling is located in northeastern Comanche County and is situated at the intersection of State Highways 17 and 65, north of State Highway 7. Sterling is approximately 24 miles northeast of the City of Lawton and covers 0.8 square miles.

The Town was incorporated in 1901 and was supported by agriculture as it is still today. In the early 1900s through the 1930s, the Town diversified expanding to attract businesses that supported the agriculture industry. There were several commercial businesses including restaurants, grocery stores, meat-packing business, and a small medical clinic. Today, the Sterling is characterized by the same activity—commercial and agriculture businesses. According to the 2016 ACS, the Town had a population of 784 people.

The Town of Sterling uses a mayor-manager form of municipal government. The mayor serves as Chief Executive Officer and establishes and sets budget along with providing oversight and administration duties for the town.

Kiowa County



Kiowa County Courthouse
Photo credit: State Historic Preservation Office

Year Incorporated:
1901

Major Industries:
Agriculture Production; Manufacturing

2016 Estimated Population:
9,077

Kiowa County is located in southwestern Oklahoma characterized by flatlands and the Wichita Mountains covering a portion of the County's southern border. The County covers approximately 1,031 square miles, and is bordered by Washita County to north; Caddo and Comanche Counties to the east; Tillman County to the south; and Greer and Jackson Counties to the west.

Kiowa County was established in 1901 when the area became available for non-Native American settlement. Since its establishment, agriculture and transportation developments including railways were the primary economic base for the County. Currently, the County's economic base has expanded to include industry and manufacturing Complimenting agriculture which is still ingrained in the fabric of the County's economy.

The County Seat is the City of Hobart which is Kiowa County's most populous municipality with an estimated population of 3,666 people as of the 2016 ACS. The County as a whole had a 2016 population estimate of 9,077 people.

Kiowa County is governed by a Board of three commissioners elected by the people of each district. The county is divided into three districts mirroring an equal distribution of the population. The Board of Commissioners is responsible for the administration and management of the county, and they are responsible for enforcing laws passed by the State of Oklahoma Legislature.

Fort Sill-Apache Tribe

Fort Sill-Apache Tribe of Oklahoma Flag
Photo credit: http://www.crwflags.com/fotw/flags/xa-chrak.html

The Fort Sill-Apache Tribe is located 24 miles north of the City of Lawton and Fort Sill along Interstate 44 at the intersection of U.S. Highway 62 / 281 and State Highway 19. The Fort Sill-Apache Tribe owns numerous acres of land in the county. The Apache Nation is a combined Native American Nation that owns about 6,622 square miles of land in total in Oklahoma. This number is derived from a compilation of tribal lands within this region including the Kiowa-Comanche-Apache-Fort Sill Apache / Caddo-Wichita-Delaware Tribes with the Kiowa-Comanche-Apache-Fort Sill Apache Tribes.

The Fort Sill-Apache Tribal Government is a federally-recognized Tribe and is associated with the U.S. Department of the Interior, US Bureau of Indian Affairs. The Fort Sill-Apache Tribal Government operates through a General Council and a Business Committee. The General Council acts through elections cast by absentee ballots. The General Council approves the tribal operations budget and elects the Business Committee members.

The Business Committee is composed of six members:

- Chairman
- Vice Chairman
- Secretary-Treasurer
- Three (3) Business Committeemen

The Business Committee members are elected to two-year terms that are concurrent with the General Council elections. The Business Committee provides the administration and oversight of the Tribal government. The Committee oversees the Tribal membership application process, Tribal rolls, prepares and manages the Tribal budget, and appoints members to manage the various aspects of the Tribe's operations (i.e. departments, e.g. housing authority, education, and public works).

The General Council and Business Committee functions under tribal sovereignty where land use decisions must be coordinated through consultations between governments (e.g. state and federal governments and the tribal governments).

The Fort Sill-Apache Tribe of Oklahoma provides public services to its residents similar to those that local governments provide for their residents. Services include, but are not limited to, education, public works, senior care services, and general Native American assistance services.

2.2 Study Area Growth Trends

The following section provides a profile of the JLUS Study Area's trends concerning population change, housing stock, and economic development. This information establishes a regional context for historical and projected growth and development in the JLUS Study Area while providing a broad understanding of growth potential for compatibility analysis-based planning.

Population

Population data was obtained from the 2000 and 2010 US Census counts and 2015 ACS. Population comparisons show the growth or decline in people in a geographical area. Population ultimately supports employment and housing opportunities. The following information provides a comparison of the changes in population in the Fort Sill JLUS Study Area between 2000, 2010, and 2015.

The population figures represent the permanent population in the Study Area, but do not consider the temporary population surges associated with the tourism industry and migration from seasonal employment or transient workers within the area.

Table 2-1 shows the 2000 and 2010 US Census population totals, and 2015 estimated ACS population totals. The table also compares each jurisdiction's population change from 2000-2015.

Table 2-1. Population Change 2000-2015 for the Fort Sill JLUS Study Area

Jurisdiction	2000	2010	2015 Estimated Population	Number Change 2000 – 2015	Percent Change 2000 – 2015
State of Oklahoma	3,450,654	3,751,351	3,849,733	399,079	11.6%
Comanche County	**114,996**	**124,098**	**125,531**	**10,535**	**9.2%**
Kiowa County	**10,227**	**9,446**	**9,302**	**-925**	**-9.04%**
City of Cache	2,371	2,796	2,919	548	23.1%
City of Elgin	1,210	2,156	2,702	1,492	123.3%
City of Lawton	92,757	96,867	97,589	4,832	5.2%
Town of Indiahoma	374	344	346	-28	-7.5%
Town of Medicine Park	373	382	233	-140	-37.5%
Town of Sterling	762	820	850	88	11.5%
City of Apache	1,616	1,444	1,282	-334	-20.7%
City of Frederick	4,637	3,910	3,804	-833	-18.0%

Source: US Census, Quick Facts 2000; American Community Survey 2010, 2011-2015

Comanche County experienced significant growth from 2000 to 2010 but has slowed with steady growth between 2010 and 2015. In all, Comanche County has kept pace with the State of Oklahoma in growth as identified by the percent change between 2000 and 2015. This is, in large part, due to Fort Sill's growth, expanding its military and civilian workforce by 53 percent from 2014 to 2016 per the Fiscal Year (FY) 2016-2017 Fort Sill Economic Perspective. The City of Elgin has experienced the most significant growth between 2000 and 2015, due to its proximity to Fort Sill and the effects of increased construction and housing to support personnel working at the installation as well as the construction of a defense-related manufacturing plant in the city. The City of Cache also experienced growth related to migration to the city from other surrounding communities, the proximity to the installation, and the availability of quality new housing options. Kiowa County experienced a decline in growth at almost the same rate as the increase in growth as Comanche County's growth trend. This is likely due to out-migration from Kiowa County to Comanche County.

Future Population Projections

Identifying where clusters of population are currently is also important in planning for future growth and development. Figure 2-1 illustrates the population density throughout the JLUS Study Area in 2000, and Figure 2-2 illustrates the population density in 2010. These figures show the change in population density over the decade, which can be indicators of growth in communities due to new opportunities for jobs and new housing construction.

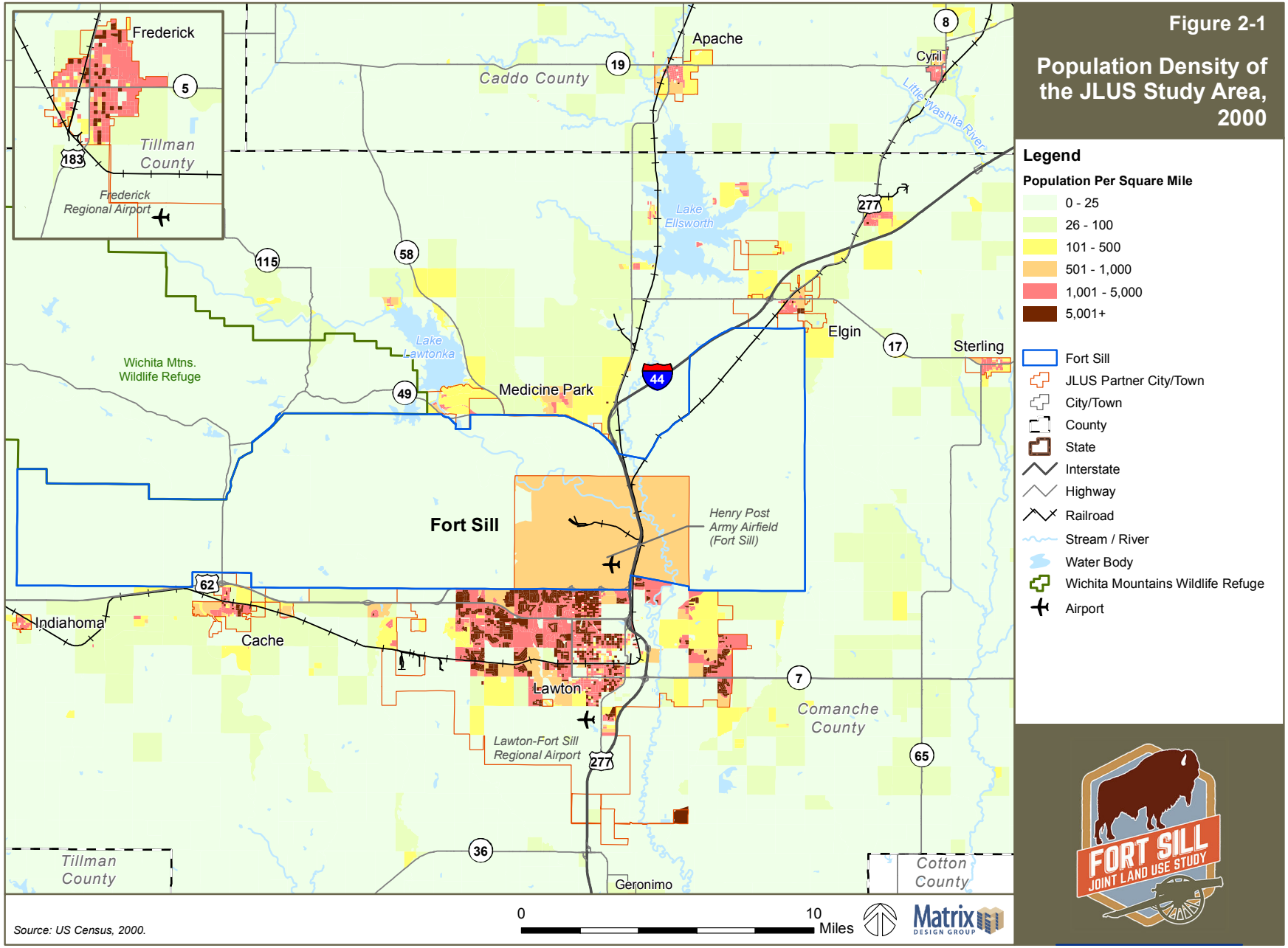


Figure 2-1
Population Density of the JLUS Study Area, 2000
Legend
Population Per Square Mile
0 - 25
26 - 100
101 - 500
501 - 1,000
1,001 - 5,000
5,001+
Fort Sill
JLUS Partner City/Town
City/Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Wichita Mountains Wildlife Refuge
Airport
Frederick
Tillman County
Frederick Regional Airport
Caddo County
Apache
Cyril
Little Washita River
Lake Ellsworth
Elgin
Sterling
Wichita Mtns. Wildlife Refuge
Lake Lawtonka
Medicine Park
Fort Sill
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Comanche County
Lawton-Fort Sill Regional Airport
Tillman County
Geronimo
Cotton County
Source: US Census, 2000.
0
10
Miles
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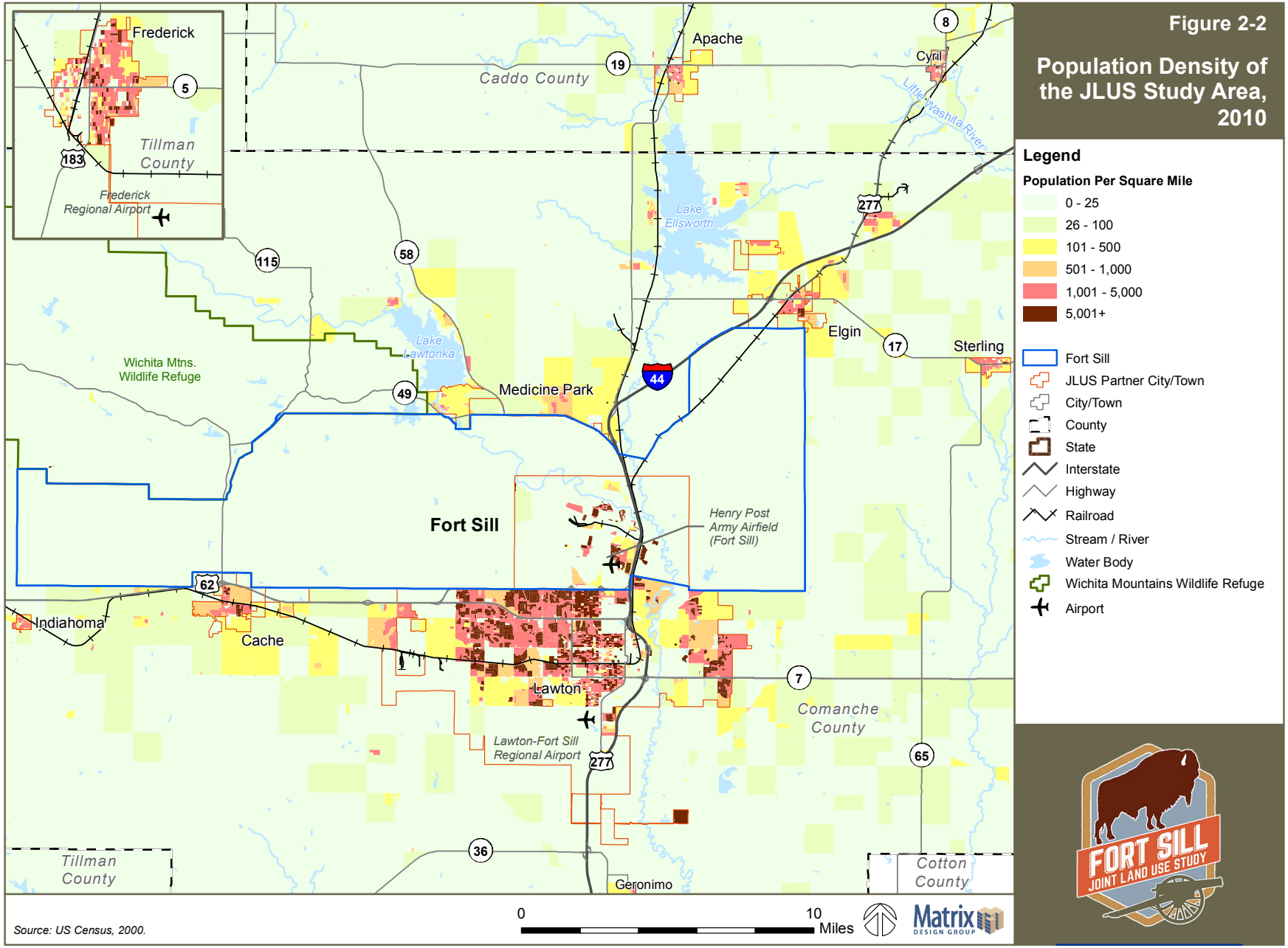
FORT SILL JOINT LAND USE STUDY


Frederick
Tillman County
Frederick Regional Airport
Caddo County
Apache
Cyril
Little Washita River
Lake Ellsworth
Elgin
Sterling
Wichita Mtns. Wildlife Refuge
Lake Lawtonka
Medicine Park
Fort Sill
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Comanche County
Lawton-Fort Sill Regional Airport
Tillman County
Geronimo
Cotton County
Source: US Census, 2000.
0
10
Miles
Figure 2-2
Population Density of the JLUS Study Area, 2010
Legend
Population Per Square Mile
0 - 25
26 - 100
101 - 500
501 - 1,000
1,001 - 5,000
5,001+
Fort Sill
JLUS Partner City/Town
City/Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Wichita Mountains Wildlife Refuge
Airport
FORT SILL JOINT LAND USE STUDY

The Oklahoma Department of Commerce developed a report for projected population growth in the state counties through 2075, however for planning purposes this study uses the 2030 year for projections, which are shown in Table 2-2. The population projections are based off of the most current US Census Bureau population information and centers around a widely used population projection method called the Cohort-Component method. This method is based on the premise that population can be split into age-sex cohorts and changes in the size of each cohort can be categorized into three components: births, deaths, and migration (those leaving or coming to the community). The component method projects the size for each of the components for a given period of time and then the population is calculated at the end of the period to give the projected population size. It should be noted that Comanche County's and the City of Lawton's population projections include the Fort Sill population following the 1990's annexation.

Comanche County is projected to continue increasing into the foreseeable future at a steady rate; however, the State's growth is twice as much as Comanche County during this time period. Other counties, although not part of the JLUS Study Area, are included in this projection and discussion to show growth in the region over the next 15 years. The majority of the counties experiencing a decline in growth in the next 15 years are in the western portion of the state indicating growth is moving north-central and northeast towards the Oklahoma City and Tulsa Metropolitan Statistical Areas.

These projected populations are estimated to help cities and counties to develop land use priorities to reduce impacts of future growth challenges.

Table 2-2. 2030 Population Projection and Change for the Region's Counties

Jurisdiction	2010	2030 (Estimated)	Number Change (Estimated)	Percent Change (Estimated)
State of Oklahoma	3,751,351	4,302,501	551,150	12.8%
Caddo County	29,600	30,500	900	3.0%
♦Comanche County	124,098	132,094	7,996	6.1%
Cotton County	6,193	5,737	-456	-7.9%
Grady County	52,431	61,286	8,885	14.4%
Jackson County	26,446	24,865	-1,581	-6.4%
♦Kiowa County	9,446	8,612	-834	-9.7%
Stephens County	45,048	48,234	3,186	6.6%
Tillman County	7,992	6,916	-1,076	-15.6%

♦ *Denotes JLUS Partner involved in the development of the Fort Sill JLUS.*
Source: Oklahoma Department of Commerce, 2012. 2012 Demographic State of the State Report

Housing Trends

Housing trends are an important indicator of economic vitality because they show population growth or decline relative to new residential construction and can also indicate future types of residential and commercial development. Table 2-3 shows the median housing values for 2010 and 2015 for each JLUS jurisdiction.

Table 2-3. Median Housing Value for the JLUS Jurisdictions in 2010 and 2015

Jurisdiction	2010	2015	Number Change 2010 – 2015	Percent Change 2010 – 2015
State of Oklahoma	$104,300	$117,900	$13,600	11.5%
Comanche County	**$99,900**	**$115,800**	**$15,900**	**13.7%**
Kiowa County	**$50,100**	**$60,300**	**$10,200**	**20.4%**
City of Cache	$88,400	$115,100	$26,700	23.2%
City of Elgin	$99,800	$153,400	$53,600	53.7%
City of Lawton	$95,900	$106,100	$10,200	9.6%
Town of Indiahoma	$47,900	$60,000	$12,100	20.2%
Town of Medicine Park	$101,800	$151,800	$50,000	32.9%
Town of Sterling	$78,900	$71,900	-$7,000	-8.9%
City of Apache	$62,100	$77,300	$15,200	24.5%
City of Frederick	$34,400	$49,200	$14,800	43.0%

Source: US Census Fact Finder, 2010 and 2015, Housing Value Characteristics

Housing values have increased in the majority of jurisdictions between 2010 and 2015 except the Town of Sterling. While the median housing value across the state is greater than all the jurisdictions in the JLUS Study Area with the exception of the Town of Medicine Park, the JLUS jurisdictions have experienced a significant rate of increase in housing values between 2010 and 2015. With exception of Lawton and Sterling, each community in the JLUS Study Area has experienced a percentage increase in home values by a rate greater than that of Oklahoma State as a whole between 2010 and 2015.

The Cities of Elgin and Frederick experienced the greatest increases in median home values during this time period with more than four times as much as the state's median housing value rate. This increase in housing value is likely due to the property values increasing in the cities as the City of Elgin is home to a DOD-related manufacturing plant and the City of Frederick is growing due to very reasonable home values. The Town of Medicine Park increased by almost three times the state's rate, which is likely due to the town being known for its weekend resort community providing numerous activities and events throughout the year to support over 200,000 visitors annually. The City of Lawton had a rate of growth in median home values less than the rate of the State of Oklahoma. The Town of Sterling had a declining rate of median home values during the period from 2010 to 2015.

Overall, Comanche County had a steady increase in the median home value rate of 13.7 percent, which was above the rate of the state by roughly two percentage points. Kiowa County has experienced a median housing value increase of over 20%, even though the County's population has been decreasing. Thus, median housing values in the JLUS Study Area are steadily increasing at a faster rate than the State of Oklahoma as a whole, which could be due to the recent development and tourism that is ongoing and will likely continue into the near future.

House in Medicine Park, Oklahoma

Table 2-4 shows the median monthly housing costs for each jurisdiction in the JLUS Study Area between 2010 and 2015. Similar to the median housing value for each community, median monthly costs also steadily increased between 2010 and 2015. The Town of Indiahoma had the lowest median rate increase. The Town of Medicine Park had the highest increase in monthly housing costs with nearly three times as much as the State's monthly housing cost. This increase is likely due to the Town's growing tourism industry. The City of Elgin also had experienced an increased median monthly housing cost rate comparable to the Town of Medicine Park, likely due to the proximity to Fort Sill and the expanding DOD-related industry in the city. Comanche County and the City of Lawton each had a comparable increase in median monthly housing costs, indicating the growth in monthly housing costs for the county and the county seat is similar and the demand is about the same for rental properties within the City of Lawton and Comanche County.

Table 2-4. Median Monthly Housing Costs, 2010 and 2015

Jurisdiction	2010	2015	Number Change 2010 – 2015	Percent Change 2010 – 2015
State of Oklahoma	$633	$727	$94	12.9%
Comanche County	**$660**	**$784**	**$124**	**15.8%**
Kiowa County	**$741**	**$843**	**$102**	**13.8%**
City of Cache	$483	$624	$141	22.6%
City of Elgin	$1,049	$1,373	$324	30.9%
City of Lawton	$669	$787	$118	15.0%
Town of Indiahoma	$508	$543	$35	6.4%
Town of Medicine Park	$632	$967	$335	34.6%
Town of Sterling	$776	$878	$102	13.1%
City of Apache	$750	$806	$56	7.5%
City of Frederick	$775	$850	$75	9.7%

Source: US Census Fact Finder, 2010 and 2015, Financial Characteristics of Housing

The median monthly housing rates compared to Fort Sill's Basic Allowance for Housing (BAH) rates are currently sufficient for military personnel with a rank of E-5 or higher without dependents. Military personnel with a rank of E-4 or lower with dependents would have challenges finding affordable, quality housing with the current BAH rates. While these military personnel most likely live on-post, there is still a slight disparity for monthly median housing costs for the personnel without dependents in the lower ranks. Table 2-5 shows Fort Sill's BAH rates as of the year 2015 based military personnel rank (grade) and whether or not they have dependents.

Table 2-5. Fort Sill 2015 BAH Rates

Grade	Rank	With Dependents	Without Dependents
E1	Private E-1 (PV1)	$984.00	$753.00
E2	Private E-2 (PV2)	$984.00	$753.00
E3	Private First Class (PFC)	$984.00	$753.00
E4	Corporal (CPL) / Specialist (SPC)	$984.00	$753.00
E5	Sergeant (SGT)	$1,113.00	$834.00
E6	Staff Sergeant (SSG)	$1,266.00	$948.00
E7	Sergeant First Class (SFC)	$1,380.00	$1,035.00
E8	Master Sergeant (MSG) / First Sergeant (1SG)	$1,506.00	$1,146.00
E9	Sergeant Major (SGM) / Command Sergeant Major (CSM)	$1,608.00	$1,206.00
W1	Warrant Officer (W01)	$1,269.00	$951.00
W2	Chief Warrant Officer (CW2)	$1,431.00	$1,143.00
W3	Chief Warrant Officer (CW3)	$1,587.00	$1209.00
W4	Chief Warrant Officer (CW4)	$1,617.00	$1,293.00
W5	Chief Warrant Officer (CW5)	$1,653.00	$1,410.00
O1E	Second Lieutenant	$1,407.00	$1,113.00
O2E	First Lieutenant	$1,563.00	$1,179.00
O3E	Captain	$1,623.00	$1,266.00
O1	Second Lieutenant (2LT)	$1,131.00	$855.00
O2	First Lieutenant (1LT)	$1,263.00	$1,068.00
O3	Captain (CPT)	$1,581.00	$1,212.00
O4	Major (MAJ)	$1,665.00	$1,395.00
O5	Lieutenant Colonel (LTC)	$1,722.00	$1,467.00
O6	Colonel (COL)	$1,740.00	$1,587.00
O7	Brigadier General (BG)	$1,758.00	$1,620.00

Source: 2015 Oklahoma BAH Rates for the Fort Sill/Lawton Military Housing Area

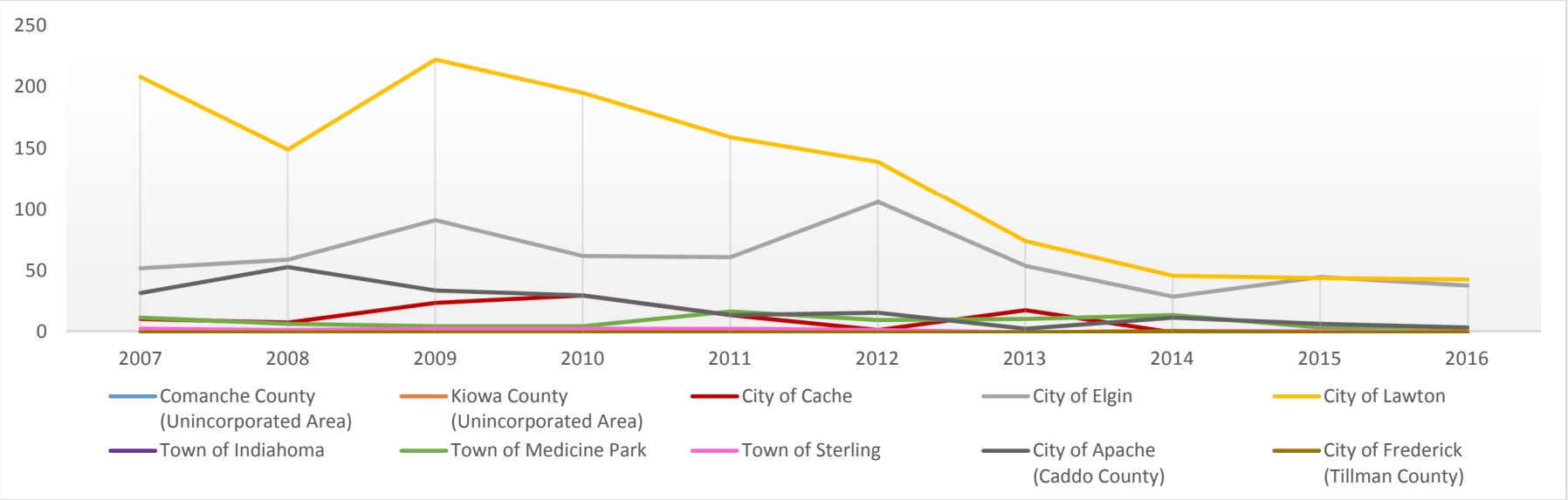
Building Permits

An analysis of the number of building permits issued can be a good indicator of the growth of a community. Records since 2007 show how the construction of housing in the JLUS Study Area responded to growth and the economic recession during the last decade. The US Census State of the Cities Data Systems Building Permits Database, 2007 – 2016 provided the data for the following building permit evaluation.

Figure 2-3 shows the single-family residential unit building permits issued by the JLUS jurisdictions between 2007 and 2016. Based on the data, it seems this region was not as severely impacted by the 2008 recession as many other areas in the US. The most single-family activity occurred in the cities of Elgin and Lawton, which has remained a fairly consistent trend over the past 10 years. The City of Lawton experienced an increase from 2008 to 2009 and then a slight, steady decline, but there were no indicators of a dramatic drop-off in residential construction during the recession years. The City of Elgin also had a peak between 2008 and 2009 and remained fairly steady until another peak in 2012. Both Elgin and Lawton have experienced a steady decline from 2012 to 2014 but maintained a sustainable level of activity relative to issuing single-family residential permits since 2014.

Figure 2-3 also shows there was little to no activity relative to single-family residential for the unincorporated area of Comanche County indicating there are not a lot of subdivisions or residential estates occurring outside of the city and town limits. There was some activity in the City of Cache and Town of Medicine Park, but activity has since tapered off and come down to a sustainable level where the community will be able to provide quality public services.

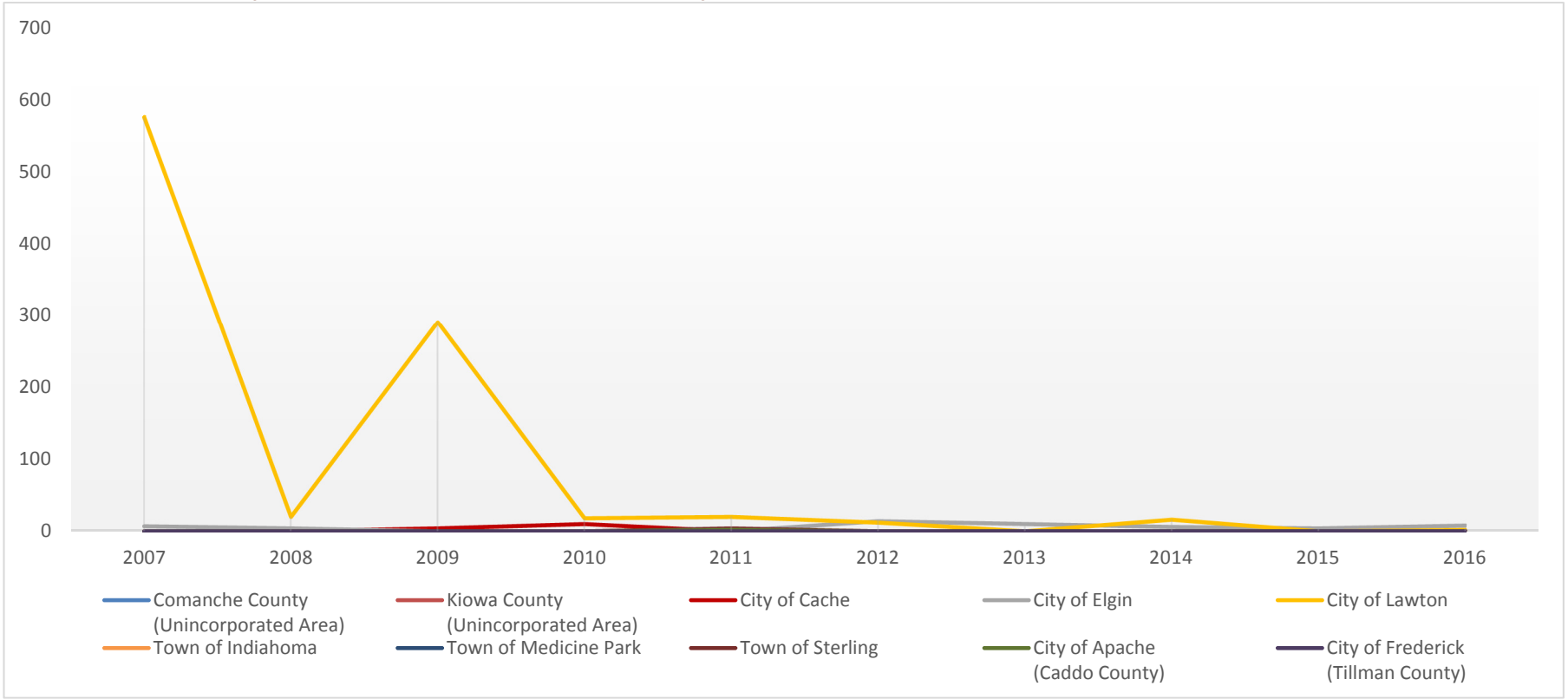
Figure 2-3. Single-family residential permits issued in the JLUS Study Area, 2007-2016



Source: State of the Cities Data Systems, Building Permits Database, 2007 – 2016

Unlike single-family residential permits, the issuance of multi-family residential permits were impacted by the recession, which is apparent in Figure 2-4. While there was no activity in several of the JLUS Study Area jurisdictions from 2007 to 2016, there was some multi-family residential activity in the City of Lawton before the recession. Since the recession, the multi-family residential construction has not restored to its pre-recession activity levels. There was minimal activity in the City of Cache, but the other jurisdictions in the JLUS Study Area had either no or very minimal demand and activity for multi-family residential construction.

Figure 2-4. Multi-family Residential Permits Issued in the JLUS Study Area, 2007-2016



Source: State of the Cities Data Systems, Building Permits Database, 2007 – 2016

2.3 Economic Overview

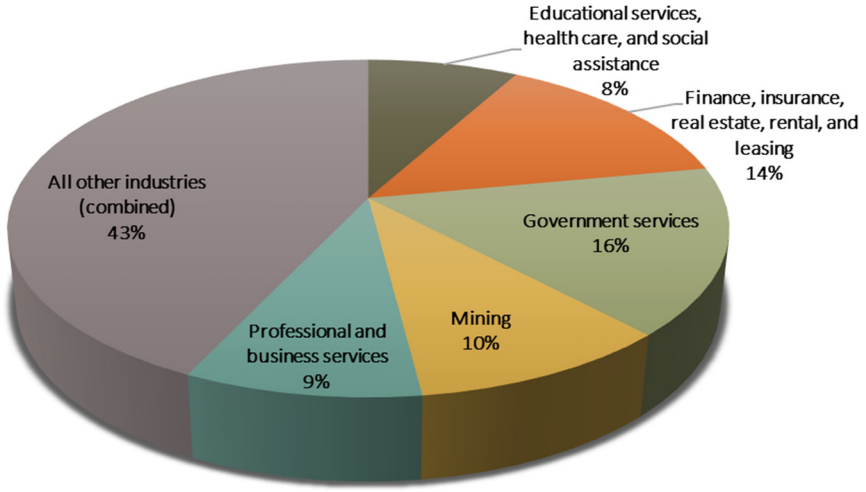
The primary economic activity throughout the JLUS Study Area is centered on the agriculture and government services (military) industries dating back to the late 19th and early 20th Centuries. Efforts to diversify the Lawton-For Sill region's economy with new sectors have brought new growth to the region in manufacturing and commercial businesses.

The economy in the Fort Sill JLUS Study Area has remained relatively consistent, largely due to Fort Sill's presence and the jobs and stability it provides for the surrounding area. In 2015, Fort Sill was one of only three Army installations across the United States to receive an increase in personnel. This has been the impetus for the continued collaboration, investment, and growth in the region. Lawton is the commercial hub in the region with the majority of the economic activity occurring in the Lawton-Fort Sill area. However, the City of Elgin's rapid population growth over the past decade has generated increased economic activity and commercial development within the city.

Oklahoma

According to the 2016 US Department of Commerce, Bureau of Economic Analysis, the top five industries by gross domestic product (GDP) (the total amount of goods and services produced in the state during a year) are illustrated in Figure 2-5. The top industry is government services at 16 percent, while the lowest industry is educational services, health care, and social assistance at 8 percent. All of these industries account for $182.9 billion in current-dollar GDP, which means all the industries combined in the State of Oklahoma produce over $180 billion in current-dollars GDP.

Figure 2-5. Top Five Industries by Gross Domestic Product in the State of Oklahoma, 2016



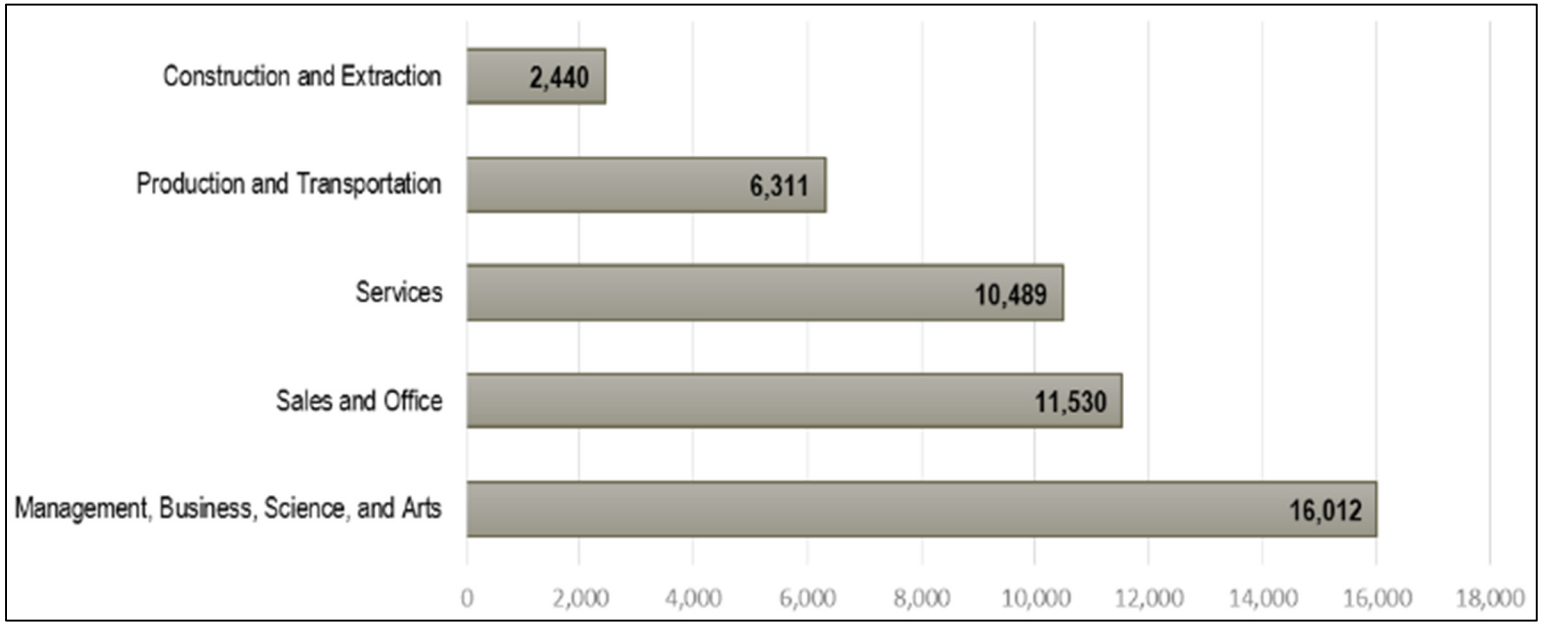
Comanche County

According to the US Census Bureau American Community Survey 5-year Estimates, 2011-2015, the top five industries that compose the Comanche County economy are illustrated in Figure 2-6. The top five industries in Comanche County are the Management, Business, Science, and Arts sector.

These industries include careers in the following areas:

- Architecture and engineering
- Community and social services
- Business and financial operations
- Management, education and training
- Legal services
- Computer and mathematical
- Health practitioners and technicians

Figure 2-6. Top Five Industries in Comanche County, Oklahoma by Number of Employees, 2015



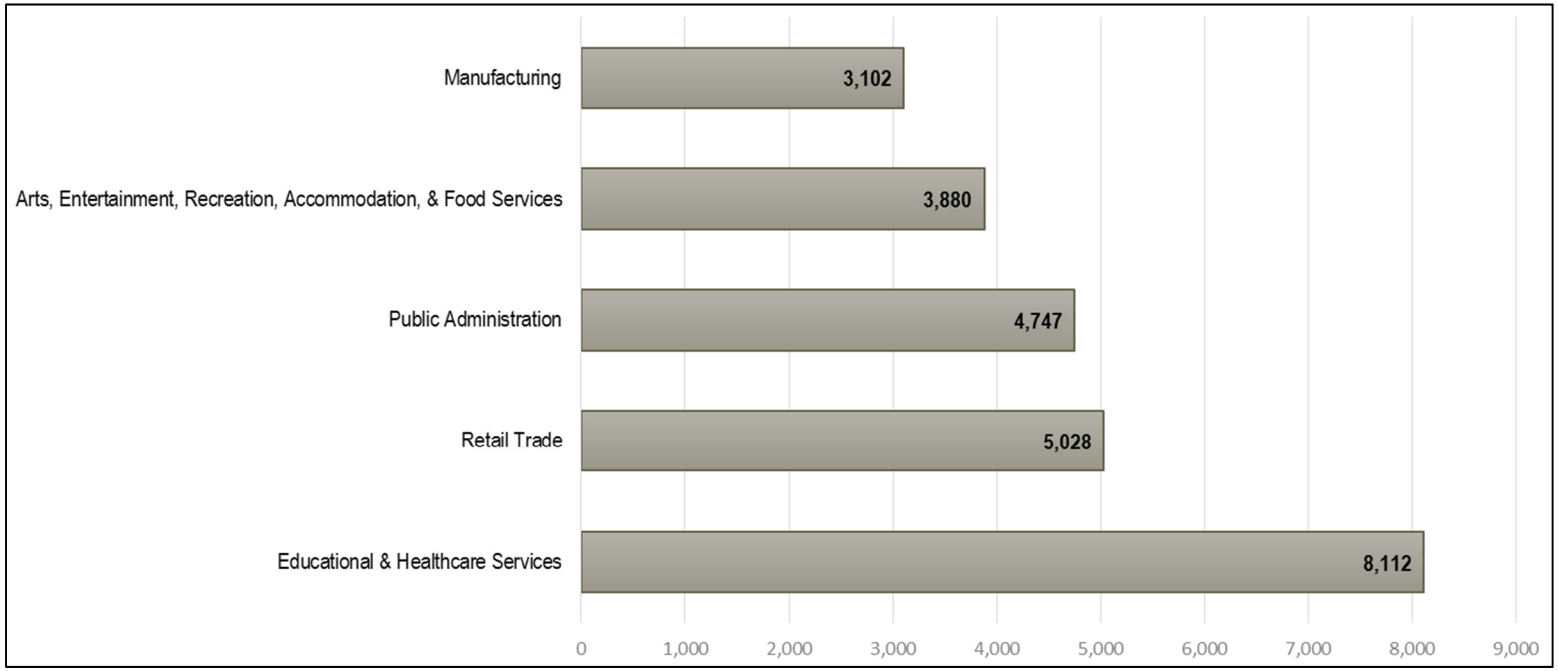
Source: US Census Bureau American Community Survey 5-year Estimates, 2011-2015

City of Lawton

According to the US Census Bureau American Community Survey 5-year Estimates, 2011-2015, the top five industries that compose the City of Lawton economy are illustrated in Figure 2-7. The top industry in Lawton is the Educational and Healthcare sector. While these are the top five industries there are several more that compose the economy in the City of Lawton, they are with their respective numbers of employees:

- Professional, Scientific, Management, & Waste Management Services 3,010
- Construction 2,040
- Other Services (non-public administration) 2,023
- Finance, Insurance, Real Estate 2,012
- Transportation & Warehousing 1,375
- Information Technology 699
- Agriculture, Forestry, Fishing, Hunting, & Mining 494
- Wholesale Trade 482

Figure 2-7. Top Five Industries in the City of Lawton by Number of Employees, 2015



Source: US Census Bureau American Community Survey 5-year Estimates, 2011-2015

2.4 Current Development Overview within the Study Area

Land uses throughout the JLUS Study Area range from open space and agriculture in unincorporated Comanche County, to the residential and population center in the City of Lawton as well as other growing jurisdictions. This section discusses the setting in the immediate vicinity of Fort Sill.

Fort Sill

North

The Wichita Mountains National Wildlife Refuge and the North Mountain Wilderness Area is adjacent to Fort Sill to the north. These natural and wildlife areas span the entire northwestern border of the installation ending at the Town of Medicine Park and Lake Lawtonka. This refuge provides a natural buffer and limits development in the northern area of the installation.

The weekend resort-community of the Town of Medicine Park is located adjacent to Fort Sill east of Lake Lawtonka. The Town of Medicine Park is mostly built out, and it makes its revenue providing numerous activities and events on the weekend.

The only other development activity on-going to the north of the installation is in the City of Elgin. The city is located in the northeastern area outside the installation. The City of Elgin currently has single-family residential units and developments occurring near the installation fence line, which can result in encroachment for both the military and city. The residential unit development complements the demand that is occurring in the commercial and manufacturing land uses. Recently, the City was selected as the location for a defense-related manufacturing plant, which can result in increases in population and rooftops.

Wichita Mountain Refuge Buffalo

East

The Town of Sterling is located about 24 miles to the northeast of Fort Sill, and there is no development activity occurring in the town. Other than the northeast area, there is no development occurring to the east of the installation.

South

The Cities of Lawton and Cache and the Town of Indiahoma are located to the south of the installation. The City of Lawton has the majority of the development activity occurring to the south.

There are several improvements being made in and around the city of Lawton. Currently, there are infrastructure improvements occurring around Cache Road that will allow for increased growth. There is a potential industrial park development proposed south of Southeast Bishop Road. There is also growth potential in the southern portion of the city near the southern city limits. In addition, there is industrial development potential in the far western portion of the city near the city limits. Finally, there is rezoning occurring south of the installation along South Boundary Road. This rezoning is for low-density residential associated with Phase III of development.

In the City of Cache, there is a housing subdivision, Mountain View, occurring to the south of Fort Sill along West Oak Avenue and west of Crater Creek Road. There is also a subdivision being discussed located to the west of the city of Cache in Comanche County. This subdivision is expected to be planned for low-density, potentially 1 to 10 acre lots. Finally, there is some potential for industrial development in the southern portion of the city.

The Town of Indiahoma is located to the south of the installation. Currently, there is no development occurring in the town.

West

There is no development occurring west of the installation.

2.5 Transportation Network

Transportation planning for the Lawton area and Comanche County is performed by the Lawton Metropolitan Planning Organization (LMPO). The LMPO consists of a group of elected officials who make transportation decisions for the LMPO Planning Area, which is located in southwest Oklahoma adjacent to Interstate 44 approximately 80 miles south of Oklahoma City and approximately 44 miles north of Wichita Falls, Texas. The planning area is bound to the north by Rogers Lane/US Highway 62, to the east by 90th Street, to the south by Coombs Road and to the west by Deyo Mission Road. The LMPO has developed a Unified Planning Work Program, a Bicycle and Pedestrian Plan, a Transportation Improvement Program, and a Lawton Industrial Park Transit Feasibility Study to assist both access and mobility in the event the planned Lawton Industrial Park is developed. While this organization covers planning for the City of Lawton and parts of Comanche County, the other jurisdictions are not affiliated with the LMPO. The remaining JLUS jurisdictions within the JLUS Study Area work with the Oklahoma Department of Transportation to assist in transportation planning and assistance, as appropriate.

The transportation network for the Study Area is illustrated on Figure 2-8.

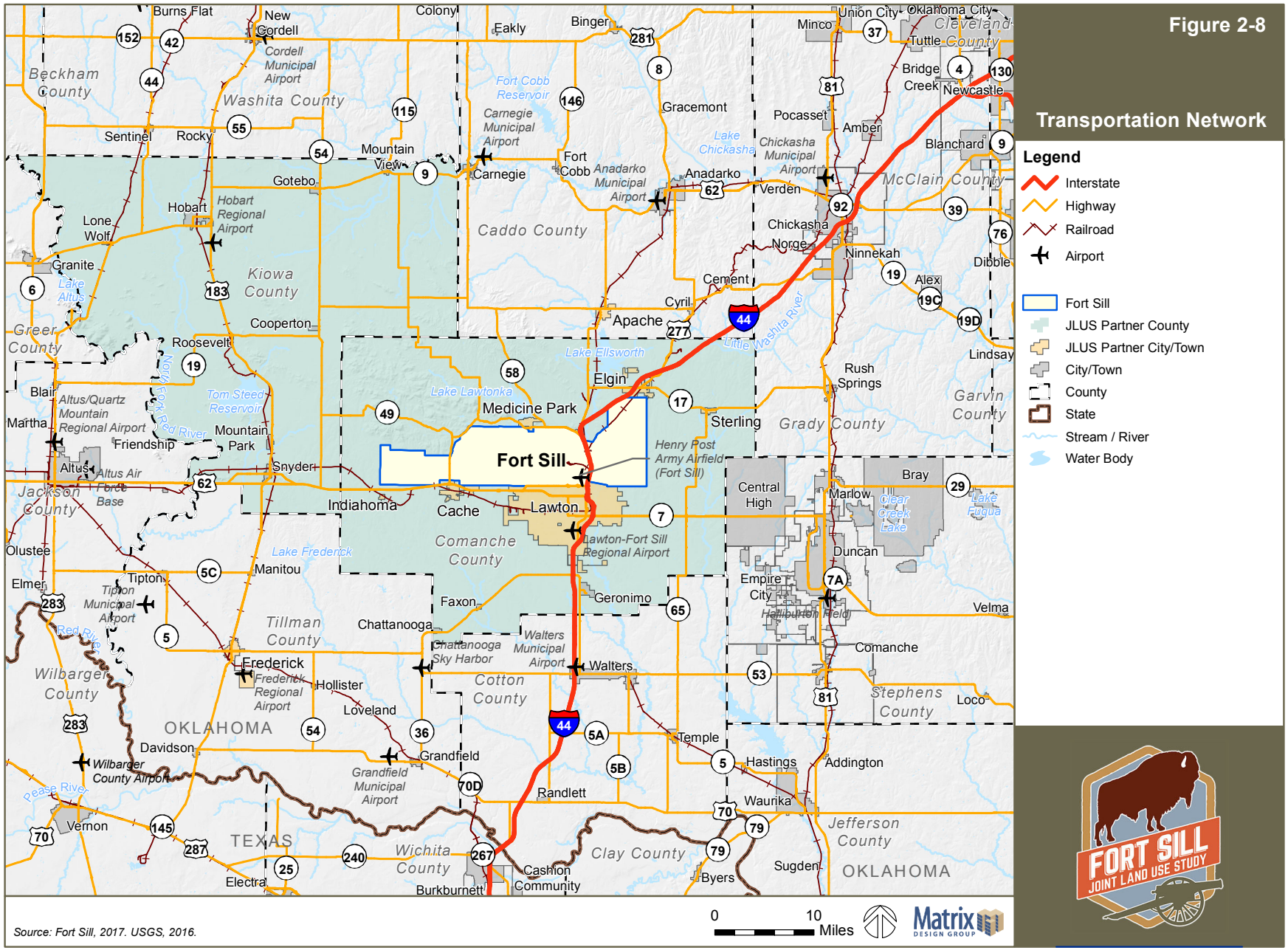


Figure 2-8
Transportation Network
Legend
Interstate
Highway
Railroad
Airport
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
State
Stream / River
Water Body
Fort Sill
Medicine Park
Elgin
Lawton
Cache
Indiahoma
Apache
Cyril
Cement
Sterling
Rush Springs
Chickasha
Norge
Verden
Anadarko
Gracemont
Carnegie
Hobart
Mountain View
Gotebo
Cooperton
Roosevelt
Snyder
Altus
Martha
Blair
Granite
Lone Wolf
Sentinel
Rocky
Burns Flat
New Cordell
Colony
Eakly
Binger
Minco
Union City
Oklahoma City
Cleveland
Tuttle
Bridge Creek
Newcastle
Pocasset
Amber
Blanchard
Ninnekah
Dibble
Alex
Lindsay
Garvin County
Grady County
McClain County
Caddo County
Kiowa County
Greer County
Jackson County
Beckham County
Washita County
Tillman County
Comanche County
Cotton County
Wilbarger County
Stephens County
Jefferson County
Clay County
Wichita County
Henry Post Army Airfield (Fort Sill)
Lawton-Fort Sill Regional Airport
Altus/Quartz Mountain Regional Airport
Altus Air Force Base
Hobart Regional Airport
Cordell Municipal Airport
Carnegie Municipal Airport
Anadarko Municipal Airport
Chickasha Municipal Airport
Tipton Municipal Airport
Frederick Regional Airport
Chattanooga Sky Harbor
Walters Municipal Airport
Grandfield Municipal Airport
Wilbarger County Airport
Halliburton Field
Lake Ellsworth
Lake Lawtonka
Lake Frederick
Lake Altus
Tom Steed Reservoir
Fort Cobb Reservoir
Lake Chickasha
Clear Creek Lake
Lake Fuqua
Little Washita River
North Fork Red River
Red River
Central High
Marlow
Duncan
Empire City
Bray
Velma
Comanche
Loco
Addington
Hastings
Temple
Waurika
Randlett
Faxon
Chattanooga
Geronimo
Walters
Frederick
Hollister
Loveland
Davidson
Vernon
Electra
Burkburnett
Cashion Community
Byers
Sugden
Lawton
Tipton
Manitou
Olustee
Elmer
Mountain Park
Friendship
OKLAHOMA
TEXAS
Source: Fort Sill, 2017. USGS, 2016.
0
10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Highways

There is one interstate highway, Interstate 44 (I-44), that runs through Comanche County and is a designated highway in the National Highway System (NHS). Because I-44 is part of the NHS, this means the Oklahoma Department of Transportation is responsible for the roadway's operation and maintenance. I-44 is the primary north–south transportation corridor in the JLUS Study Area. I-44 runs through Fort Sill to the east of the installation. I-44 connects Lawton to Oklahoma City approximately 87 miles to the north-northeast and onto the City of Tulsa for another 106 miles to the northeast.

US Highway 62 and State Highway 7 provide the major connection for east-west routes in the JLUS Study Area. US Highway 62 connects Lawton to the City of Altus and Altus Air Force Base approximately 56 miles west of the City of Lawton. While US Highway 62 runs west, State Highway 7 runs east and connects the City of Lawton to the City of Duncan approximately 34 miles east.

There are several State Highways in the JLUS Study Area that provide mobility through the county and connect the cities and the western portion of the State of Oklahoma. The State Highways that are located within the JLUS Study Area including the following:

- State Highways 5, 5A, 5B, and 5C
- State Highways 17, 49, 53, 58, 65, 79

All these routes provide Oklahomans access and mobility throughout the JLUS Study Area.

Public Transit

Lawton Area Transit System (LATS) is the fixed route bus transit and complementary paratransit services available to the Lawton-Fort Sill community. LATS buses provide service to Fort Sill, including the Post Exchange, Commissary, and Reynolds Army Community Hospital.

All routes run through the Downtown Transfer Center, located on the north side of the 400 Block of Southwest B Avenue. LATS serves most of the major shopping areas and movie theaters in town. Every Lawton Public Middle School and High School are on a LATS route. LATS buses operate Monday through Friday, from 6 am to 7 pm, and Saturday, from 9 am to 9 pm. A network of five fixed routes with 10 buses operating on a pulse/clockwise/counter-clockwise manner serving the community. LATS makes flag stops for passengers along the fixed routes. Reduced fares are available for: Medicare cardholders, disabled, elderly, and students ages 17 and under. However, there are no services provided or available on Sundays.

Lawton Area Transit System bus
Photo credit: Lawton Area Transit System

Rail

In the Lawton Metropolitan Area (LMA) there are approximately 13.75 miles of railway. Burlington Northern Railroad and Union Pacific Railroad are the companies responsible for the operation and maintenance of these tracks. The railways primarily serve the industrial area on Southwest Goodyear Boulevard and industrial uses east of the Central Business District.

The clear majority of passenger and freight movement occurs on roadways. The only freight movement by rail occurs on a daily basis at the Goodyear plant and at the Republic Paper site, which are both located at the intersection of SW Lee Boulevard and SW 97th Street. Passenger service is not available.

There are 26 street-railway crossings in the LMA; one grade separated, 10 protected by flashing light signals and gate arms, and 13 protected by warning signs.

Air

There are 3 regional airports in the JLUS Study Area. The Lawton-Fort Sill Regional Airport (LAW) is owned by the City of Lawton and leased to the Lawton Metropolitan Area Airport Authority (LMAAA). The operation, maintenance, and development activities are under the purview of the LMAAA. The airport is located approximately three nautical miles south of Fort Sill and provides commercial services encompassing all aspects of civilian aviation and military activity, as well as accommodating both private recreational and business general aviation activities. Currently, the airport is serviced by only five daily American Airlines flights that travel to Dallas-Fort Worth International Airport (DFW).

The LAW service area is limited to Comanche County. Of the total service population, which includes an estimated 2016 population of 122,136 people, it is estimated that the area in which business travelers are attracted make up the primary service area.

The LAW facilities include a single runway, a partial parallel taxiway, six connecting taxiways, appropriate airport lighting for the airfield and terminal, a passenger terminal, aircraft parking aprons, hangar facilities, fuel facilities, aircraft rescue and firefighting facility, calibration pad, plus a general aviation services and terminal.

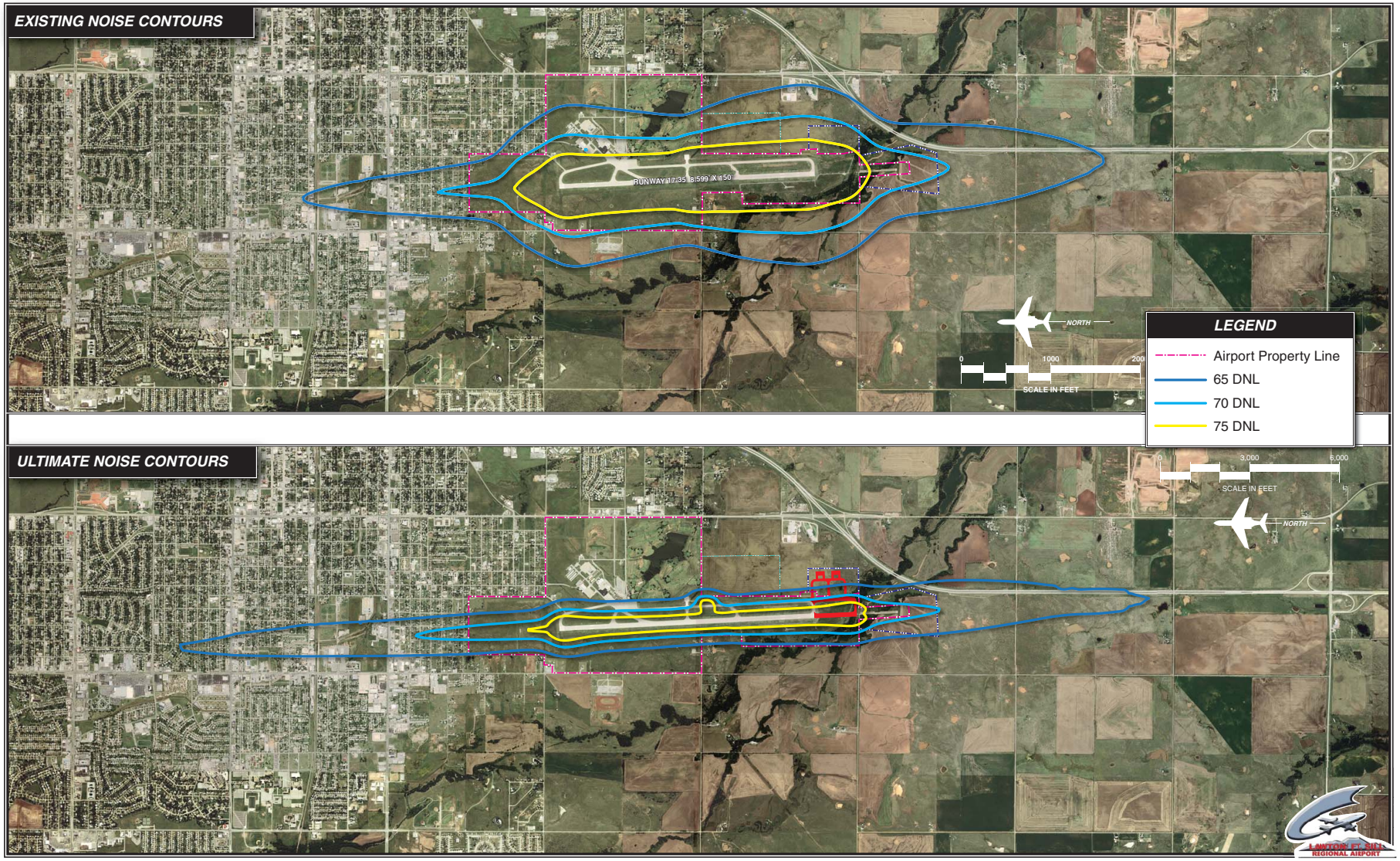
The LAW single runway, Runway 17/35; it is 8,599 feet long and 150 feet wide. Runway 17/35 is constructed of asphalt and has an improved surface to provide the capability for improved braking performance. The runway pavement has a single-wheel loading capacity of 45,000 pounds, a dual-wheel loading capacity of 179,000, and a double tandem-wheel loading capacity of 344,000 pounds.

The LAW Master Plan indicated that enplanements at the airport have fluctuated over the past several decades with significant decreases after the economic recessions of the 1980s and late 2000s. Although, enplanements rose steadily following those recessions, two events caused a major regression in number of enplanements in the early 2000s—the 9/11 2001 events and when Delta discontinued services out of LAW with their Embraer regional jet. It took two years for LAW to experience increases in month-to-month enplanements. According to the LAW Master Plan, LAW recorded 40,953 total enplanements in 2003, the lowest since 1976. According to Federal Aviation Administration passenger boarding data, LAW recorded 51,088 enplanements in 2016, which is approximately a 25% increase since 2003; however, this was a decrease from 51,859 total enplanements in 2015.

The noise contours produced from aircraft at LAW are mapped in the 2008 Airport Master Plan and depicted on Figure 2-9.

The other two regional airports in the area, Sheppard Air Force Base / Wichita Falls Municipal Airport (SPS) in Wichita Falls, Texas, and Will Rogers World Airport (OKC) in Oklahoma City, Oklahoma.

Figure 2-9. Lawton-Fort Sill Regional Airport Noise Contours



Source: Lawton-Fort Sill Regional Airport Master Plan 2008

There are no military aircraft based at LAW. However, it should be noted the US military is the largest user of the Lawton-Fort Sill Regional Airport. In the past 12 months of the development of the LAW Master Plan, the military use of the airport accounted for nearly 70 percent of total operations. Military aircraft use of the airport is associated with training operations from Sheppard Air Force Base.

Types of military aircraft that use the airport include small jet trainers, helicopters, and large transport aircraft such as the C-130 Hercules, C-17 Globemaster, and C-5 Galaxy. All these aircraft are included in the model used to derive projections and other data in the LAW Master Plan.

Fort Sill uses the airport for deployments of troops and equipment. This activity includes large military transport aircraft such as the C-17 Globemaster for equipment transport and civil transport aircraft as large as the MD-11 McDonald Douglas wide-body, jet airliner for troop transport. Helicopters from Fort Sill also utilize the airport.

The LMAAA recently received a grant from the Oklahoma Military Planning Commission for a 55-year lease on approximately 80 acres of land, along the airport's southeastern border, from the Oklahoma School Land Commission. On that site there is the potential planned development of a Military Air Mobility Complex. This complex would be capable of accommodating five large aircraft, a terminal facility to process troops, and a "hot pad" to load live ammunition. However as of today, this potential military development has not been implemented.

2.6 Natural and Wildlife Resources

The Lawton-Fort Sill region has a numerous natural and wildlife resources, including the Wichita Mountains Wildlife Refuge and the North Mountain Wilderness Area.

The Wichita Mountains Wildlife Refuge was established in 1901 and is located adjacent to Fort Sill to the north-northwest providing a natural buffer for over half the Fort Sill northern border. The refuge encompasses 59,020 acres of land to which is managed by the US Fish and Wildlife Service (USFWS). T

The refuge provides habitat for several large native grazing animals such as the American bison, Rocky Mountain elk, and the white-tailed deer. Texas longhorn cattle also share the refuge rangelands as a legacy species. More than 50 mammals, 240 bird, 64 reptile and amphibian, 36 fish, and 806 plant species thrive on this refuge. Recreationalists and visitors to the refuge can experience wildlife watching, hunting, fishing, special events, and much more quality recreational and educational opportunities and amenities.

Wichita Mountains Bison on the refuge

The North Mountain Wilderness Area is part of the Wichita Mountains Wildlife Refuge encompassing 22,400 acres of the refuge's 59,020 acres. This wilderness area is open public land and is also managed by the USFWS. This area is located in the rugged northwestern corner of the refuge and is named the Charons Garden Wilderness Unit. This wilderness area provides unique scenic views and qualities that attract many visitors annually.

Charons Garden Wilderness Area

MILITARY PROFILE 3

Inside Chapter 3...

This chapter provides an overview of Fort Sill and describes the installation's history, its setting in the Joint Land Use Study (JLUS) Study Area, the economic and strategic importance of Fort Sill, and provides a general description of the military operations conducted at Fort Sill.

Identifying and describing the various activities performed within the operating areas and in the surrounding airspace provides valuable insight into the importance of Fort Sill as a national strategic asset and as a part of the fabric of the surrounding communities. The purpose of providing this information is to inform the community about the installation and enable decision-makers to make informed decisions about future development and economic growth within communities and institutions near Fort Sill that could potentially impact the viability and future role of the installation.

Photo Credit: Fort Sill, Oklahoma

3.1 History of Fort Sill

Fort Sill

Fort Sill is the only active Army installation on the southern Great Plains that has been continuously active since the American-Indian Wars. Fort Sill has trained hundreds of thousands of soldiers and officers throughout its nearly 150 years of service and has provided personnel that has been involved in every war since the Philippine Insurrection of the 1880s. Fort Sill is the original home of tactical combat aviation and the Army's first airfield.

Early Days

The area where Fort Sill is situated today was first officially visited by the U.S. Army in 1834 when General Henry Leavenworth led the exploratory mission, as the First Dragoon Expedition of 1834, into the southern Great Plains. General Leavenworth led the mission until his death, after which Colonel Henry Dodge took over his command. This expedition was the first official interaction between the U.S. Army and the Southern Plains Indians.

In January 1868, Camp Wichita was founded by Major General Philip H. Sheridan. The first units at Camp Wichita included the 7th Cavalry, the 19th Kansas Volunteers, and the 10th Cavalry, which would become known as the famous "buffalo soldiers." In 1869, the 10th and parts of the 6th Infantry began building a more permanent installation. Camp Wichita was renamed Fort Sill. Major General Sheridan named the post in honor of his friend, Brigadier General Joshua W. Sill, who was killed during the Civil War.

In the early days, Fort Sill was an isolated outpost. Fort Sill's Infantry and Cavalry soldiers maintained vigilance over the area providing security for border settlements in Texas and Kansas.

Late 19th Century – Early 20th Century

By the end of the 19th through the beginning of the 20th Century, there were discussions of closing the Post. However, in 1905, regiments of field artillery units began replacing the Calvary units, which prevented the post from closure. In 1911, the School of Fire for the Field Artillery was founded at Fort Sill.

During World War I, more than 50,000 soldiers trained at Fort Sill. In 1917, the Army Air Service constructed Henry Post Army Airfield (HPAAF), named after Lieutenant Henry B. Post, as a home for Army Aviation. In 1919, the School of Fire became the world renowned United States Army Field Artillery School which continues to operate today.

School of Fire's first headquarters for Field Artillery (Fort Sill, Oklahoma, 1911)

1920s – 1930s

While the Post experienced growth in the early 1900's, several arson fires destroyed dozens of buildings in the 1920s. In the 1930s, the installation's buildings were restored, in 1934 the Fort Sill Artillery Museum was dedicated.

Battery A 142d Field Artillery, Fort Sill, Oklahoma, 1930s

1940s – 1950s

During World War II, the installation was expanded to accommodate the training of thousands of soldiers. The Post served as the home to the 45th Infantry Division. In 1945, the U.S. Army Aviation School was added, and Henry Post became the first fully functional Army Airfield in the Army. In 1946, the U.S. Army Artillery Center was established to test new equipment and instructions.

In the 1950s, Fort Sill transferred the Army Aviation School to Fort Rucker, Alabama. Fort Sill maintained its role training Army personnel supporting the Korean War. Fort Sill expanded its artillery mission during this time by acquiring the responsibility for Army missile and atomic bomb training.

1960s – Present

During the Vietnam War and current conflicts in the Middle East, Fort Sill continues to provide both basic combat and artillery training to Army personnel and other service organizations.

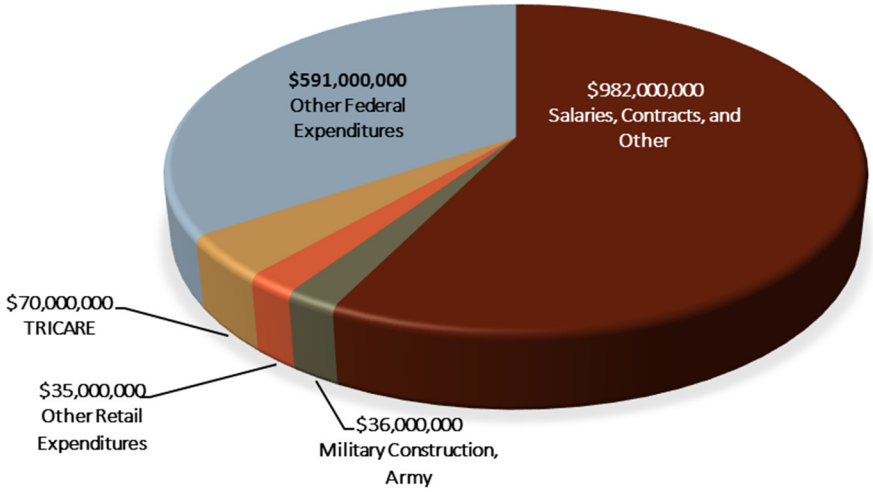
Fires Center of Excellence

The Fires Center of Excellence (FCoE), established in 2009, provides integrated fires (weapons) capabilities by developing and integrating soldiers from both national and international locations. The FCoE combines the Artillery Field School and the Air Defense Artillery School to create a center of excellence designed to confidently deliver a coordinated and ready force to execute joint missions and apply integrated fires skills in combat scenarios.

3.2 Fort Sill Economic Benefit

Fort Sill is the third largest single-site employer in the State of Oklahoma with over 13,528 personnel (active duty military, national guard/reserve, and civilian personnel). The Fort Sill economic region of influence includes the City of Lawton and extends into the greater Southwest Oklahoma region. Through the purchase of goods and services and payment of salaries, Fort Sill has an economic benefit on the local and regional economy of approximately $1.7 billion per year. Figure 3-1 shows the local and regional economic benefit for Fort Sill.

Figure 3-1. 2015 Fort Sill Economic Benefit



Source: Fort Sill 2015 Economic Perspective

3.3 Military Strategic Importance

Fort Sill is not only important to the region and state for its economic benefit, but it also provides unique capabilities and training areas for a range of national and international military services. Through the Fires Center of Excellence, Fort Sill educates and trains soldiers from all over the world in the employment of tactics, strategy, and ordnance use. The Field Artillery School is also responsible for developing U.S. Army doctrine, systems, organizations, and planning the role of field artillery in future battlefield scenarios. This capability enables Fort Sill to create and develop soldiers and officers with superior skills sets in support of the national defense strategy.

In addition to developing U.S. Army soldiers into superior, tactical and strategic weapons specialists, Fort Sill is responsible for basic combat training of Army recruits, which results in thousands of newly trained soldiers every year. Basic combat training is a 10-week training course where recruits are taught the values of serving in the U.S. Army and learning basic skills and team dynamics and leadership. Fort Sill's training center plays a pivotal role in the transformation of recruits into soldiers.

The military planning, training and application of the latest tactics, techniques, and procedures that take place on Fort Sill have far reaching implications for national security at home and abroad. Fort Sill has been a platform for preparing and projecting America's forces since 1869. Fort Sill's 75th Field Artillery and 31st Air Defense Artillery Brigades deploy worldwide to protect our Nation's and our partners' interests. (see Section 3.5 for more on current mission operations). For Fort Sill to produce ready combat soldiers it relies on the protected airspace above the installation to conduct its training operations. Fort Sill conducts heavy artillery training including Multiple Launch Rocket System (MLRS) training, which requires the use of restricted airspace designated for Fort Sill. In addition to the MLRS rocket training, Fort Sill provides aerial bombing training, which also integrates training for Altus Air Force Base (AFB) and Vance AFB in OK and Sheppard AFB and in Texas.

3.4 Installation Setting

Fort Sill is situated in the southwest portion of the State of Oklahoma, centrally located in Comanche County. Fort Sill is approximately 53 miles north of Sheppard AFB in Texas, 52 miles east of Altus AFB, OK and 95 miles southwest of the City of Oklahoma City and Tinker AFB as illustrated in the JLUS Study Area on Figure 1 in Chapter 1. Fort Sill shares part of its southern border with the City of Lawton as illustrated on Figure 3-2.

Geographic Areas on Fort Sill

There are five geographic areas that comprise the installation providing the necessary capabilities for training, exercises, and both support and operations that facilitate the mission at Fort Sill. These areas are:

- Cantonment Area
- Airfield
- East Range
- West Range
- Quanah Range

The **Cantonment Area** includes the installation's housing units, administrative buildings, and recreation use areas. The installation's cantonment area is illustrated in Figure 3-3.

The **East Range** is located east of Interstate 44 and includes light and heavy maneuver training areas and an artillery impact area. The East Range is primarily used to conduct individual weapons qualification, limited maneuver training and live fire artillery training.

The **West Range** is located east of State Highway 115 and west of Interstate 44, and is used for maneuver training, live fire artillery training, collective live fire, and individual and crew served weapons qualification. The West Range also includes an area for demolition training.

The Quanah Range is located west of State Highway 115 and is primarily used for heavy maneuvering and includes Falcon Range, which is used for United States Air Force training in air-to-ground maneuvering and engagement tactics. There are also maneuvering and live fire artillery exercises that occur at the Quanah Range.

Existing Land Uses

Within the five geographic areas, the installation has a number of related land uses as illustrated in Figure 3-4. The following section defines the key land use types found on the installation and what each land use is used for as well as the types of buildings or structures that may be associated with each land use.

As described earlier, the **Cantonment Area** is situated in the south-southeastern portion of the installation and shares its southern border with the City of Lawton. The Cantonment Area has 1,811 family housing units and provides areas suitable for living and recreating. Structures include housing units, administrative buildings, and recreation structures and areas.

The **Airfield** is located in the southeastern portion of the cantonment area and contains the Henry Post Army Airfield (HPAAF) and all related buildings and structures including aprons, taxiways, and air navigation aids that are needed for effective and safe use of the airfield.

Training Areas are located throughout the installation and primarily are the areas where training and live training exercises occur to facilitate mission preparedness.

Impact Areas are smaller areas centrally-located within the range areas. These areas are the locations targeted during training and where munitions impacts are designed to land.

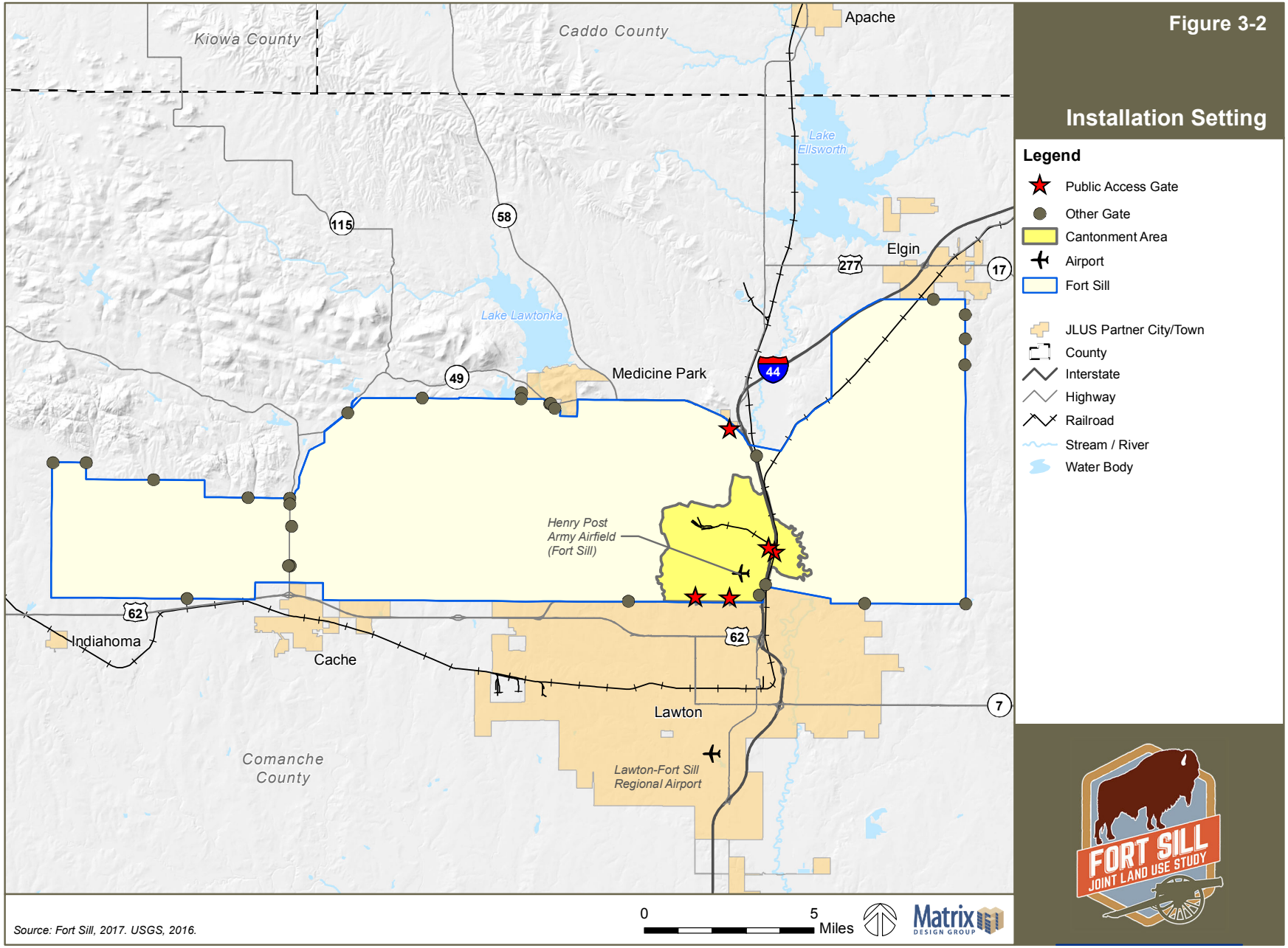


Figure 3-2
Installation Setting
Legend
Public Access Gate
Other Gate
Cantonment Area
Airport
Fort Sill
JLUS Partner City/Town
County
Interstate
Highway
Railroad
Stream / River
Water Body
Kiowa County
Caddo County
Apache
Lake Ellsworth
Elgin
Lake Lawtonka
Medicine Park
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Comanche County
Lawton-Fort Sill Regional Airport
115
58
49
44
277
17
62
7
Source: Fort Sill, 2017. USGS, 2016.
0
5
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

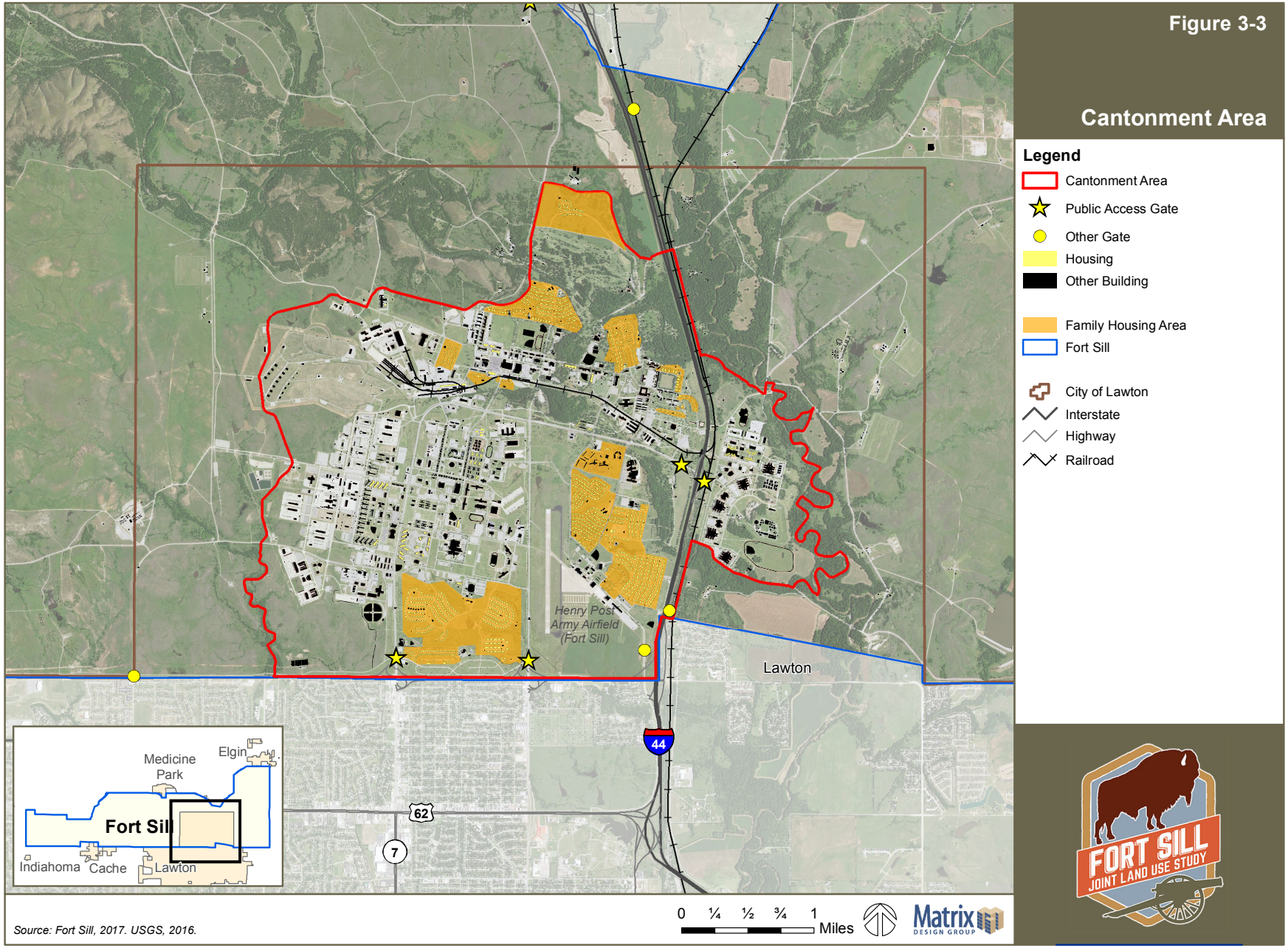
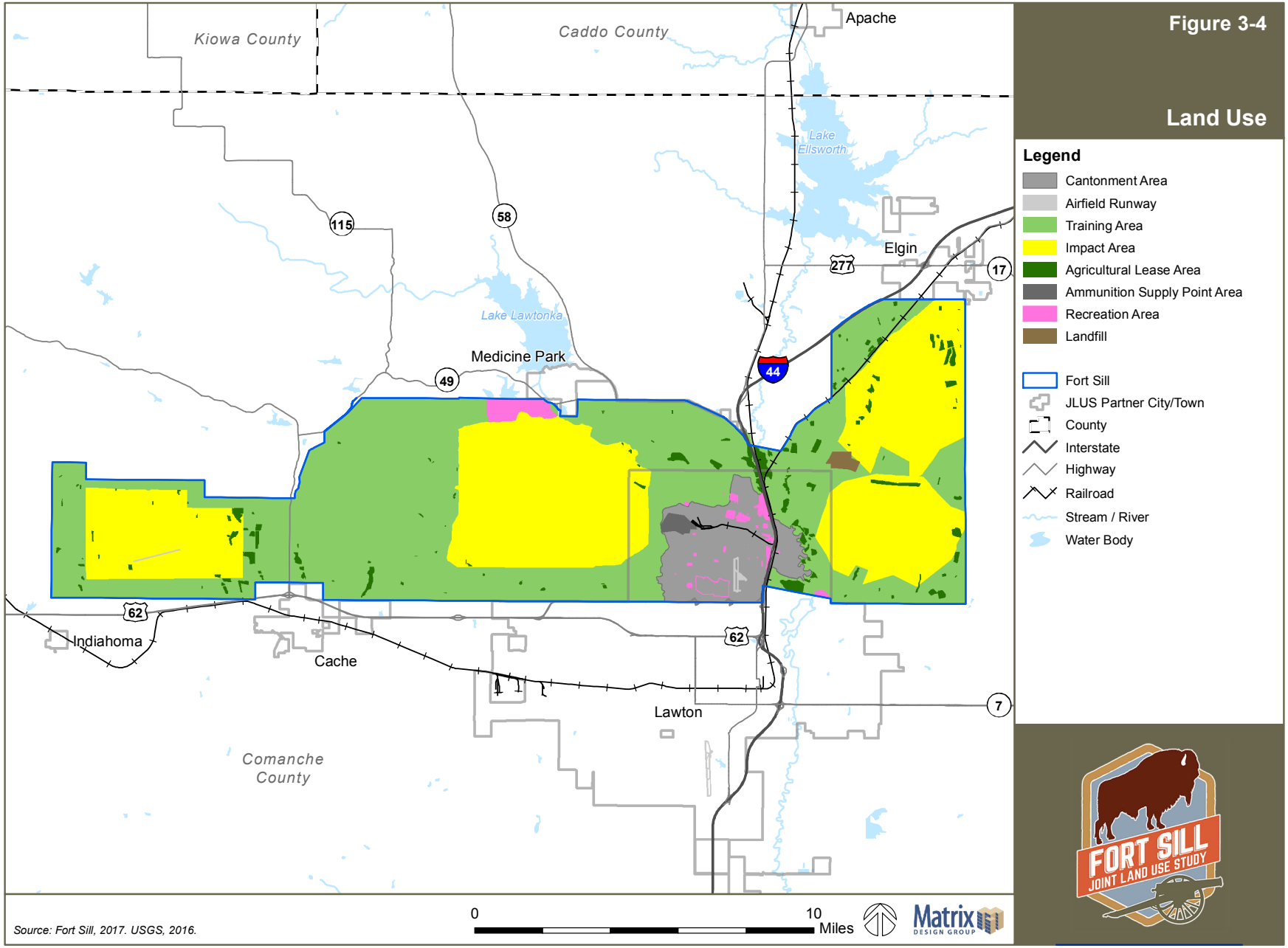


Figure 3-3
Cantonment Area
Legend
Cantonment Area
Public Access Gate
Other Gate
Housing
Other Building
Family Housing Area
Fort Sill
City of Lawton
Interstate
Highway
Railroad
Henry Post Army Airfield (Fort Sill)
Lawton
44
62
7
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: Fort Sill, 2017. USGS, 2016.
0 ¼ ½ ¾ 1 Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Figure 3-4

Land Use



Fort Sill also maintains a number **Agricultural Leases** located throughout the installation. These leases are used to allow farmers or ranchers the opportunity to cultivate crops, such as alfalfa, in areas not used for training, or to clear areas to be used for training by grazing down natural grasses.

The **Ammunition Storage Point** is situated in the far northwest area of the cantonment area. This is the area used for munition or ordnance storage.

Recreation Areas are the areas dotted throughout the cantonment area. These areas provide open space and recreation for Fort Sill's military and their dependents.

There is also a **Landfill** on Fort Sill, which is where the military disposes of solid waste. This landfill is located in the East Range area outside of the impact area and away from the airfield.

Army Compatible Use Buffer Areas

In addition to the land uses mentioned, Fort Sill has developed working partnerships with private landowners in the area to place certain parcels of land in an easement. The parcels are identified by Fort Sill as priority lands to protect the installation from encroachment. Then, the Army engages with a landowner to discuss their willingness to partner to preserve the existing conditions of the land by agreeing to an easement.

Funds from the Army's Compatible Use Buffer (ACUB) program are used to assist installations in working with willing private landowners to secure, protect, and preserve land that is important to the military mission. Fort Sill has protected several hundreds of acres with the ACUB program over the years.

Historic Resources

Being the oldest continuously active Army Post in the southern Great Plains, there are numerous historic sites on Fort Sill. The historic sites include some original structures and other early structures, its use as a prisoner-of-war camp for Apache Indians in the late 19th and 20th centuries, and its use as a troop training facility during both World Wars (WWI and WWII). Fort Sill also contains numerous historic sites associated with the long use of the area by Native Americans. There are thousands of artifacts that can be viewed at the Fort Sill Museum.

Ranges and Training Areas

The ranges and training areas at Fort Sill are located outside the cantonment area as illustrated on Figure 3-5. There are numerous small arms live-firing ranges, demolition and grenade ranges, aircraft bombing ranges, and special use training areas that provide various capabilities for Fort Sill to conduct and execute its mission. The following pages provides a brief summary of the types of ranges and a list of weapons used and operations conducted at each type of range.

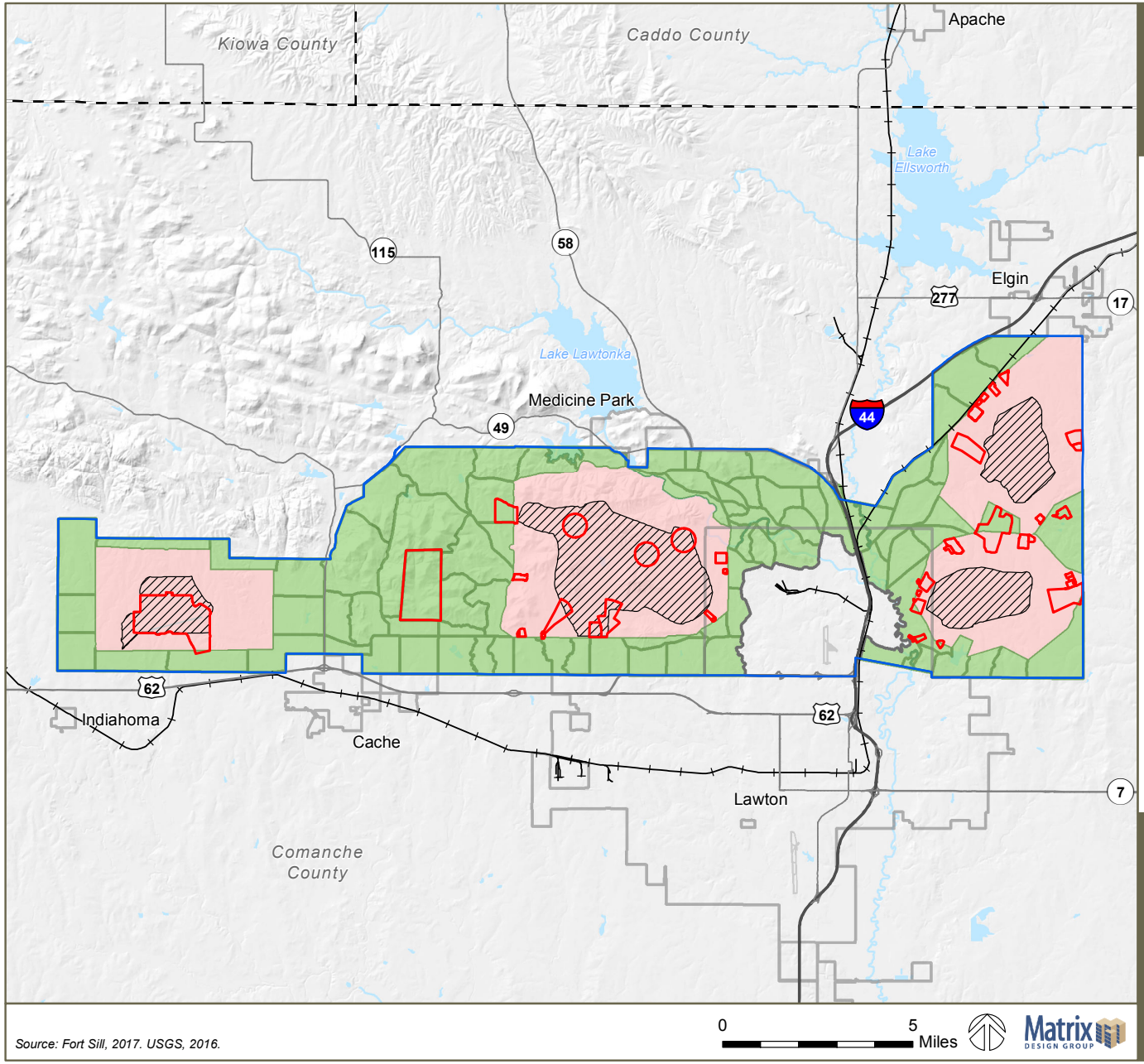
Fort Sill Artillery Training
Photo credit: Fort Sill, Oklahoma

Small Live-Fire Ranges

The small live-fire ranges enable soldiers to train and hone their skills in firing small arms such as handguns, rifles and machine guns. These ranges provide the necessary features to allow training from initial familiarization to qualification at different proficiency levels (such as proficient marksmanship or a sniper qualification).

Figure 3-5

Range and Training Areas



Legend

- Military Range
- Training Area
- Impact Area
- Dudded Impact Area
- Cantonment Area
- Fort Sill
- JLUS Partner City/Town
- County
- Interstate
- Highway
- Railroad
- Stream / River
- Water Body
- Airfield Runway

**Note: These areas mostly coincide with Dudded Impact Areas but a few additional areas are restricted for other reasons.*

3.5 Current Mission Operations

Fort Sill is responsible for the basic combat training of over 18,000 Army recruits annually. The basic combat training includes learning the core values of the Army and becoming proficient in rifle marksmanship, physical fitness, and other basic soldier skills.

In addition to basic combat training, there are thousands of soldiers, marines and foreign students that train annually at Fort Sill's schools, mission simulation centers, and firing ranges. Fort Sill trains soldiers from the rank of Private to Colonel in critical artillery skills. The 428th Field Artillery and 30th Air Defense Artillery Brigades prepare branch weapons specialists to fulfill the Army's missions around the world. Fort Sill's Marine Detachment trains hundreds of artillery officers and artillery crewmen annually.

Fort Sill's special use airspace provides Sheppard AFB the ability to fly 80,000 training sorties annually. Fort Sill's HPAAF enables Altus AFB to conduct Joint Precision Air Drop System (JPADS) operations, Assault Strip Landings, and Equipment Load training regularly using the C-17 Globemaster III and C-130 Hercules aircraft.

Fort Sill's HPAAF is used five days a week on average, primarily for daytime operations. Night operations (occurring between 10:00 pm and 7:00 am) are minimal. The majority of aviation operations that occur at HPAAF are from fixed-wing trainer aircraft including the T-38 Talon and the T-6 Texan. Other aircraft that operate at HPAAF are the C-130 Hercules, UC-35 Citation (Cessna), C-12 Huron, and Army helicopters. The majority of the helicopter training is conducted outside the Fort Sill boundary in the Slick Hills Helicopter Training Area (HTA). The Slick Hills HTA is located approximately six miles north-northwest of Fort Sill's northern boundary.

In addition to mission activities ongoing at the HPAAF, Fort Sill is also known for their Unmanned Aerial System (UAS) aircraft operations. The UAS mission, which includes launch and recovery of UASs, takes place at Frisco Ridge in the northern portion of the East Range (see Figure 3-9). The UASs conduct laser targeting and other operations from this location. More information on the UAS mission is provided in Section 3.7, Fort Sill Mission Footprints.

Units and Tenants

The following units and tenants provide both administrative and operational support systems to facilitate the ongoing operation and activities that Fort Sill requires to conduct its mission and train and produce soldiers and officers ready and prepared for any combat theater worldwide.

Field Artillery School

The mission of the Field Artillery School is to train Soldiers, officers, and Marines in tactics, techniques, and procedures for the use of fire support systems in combat in order to destroy the enemy's fire support systems. The school provides instruction and training from the basic level to mid-level leadership skills. The Field Artillery School supports high-tech gaming simulations for advanced training of staff throughout the military.

Field Artillery Proponent Office

The Field Artillery Proponent Office provides oversight of the management functions related to all Field Artillery career fields for officer and enlisted personnel. The Office also facilitates personnel requirements and actions in coordination with Human Resources Command, the FCoE at Fort Sill and all units and agencies impacted by personnel management decisions, actions, and functions.

434th Field Artillery Brigade

The 434th Field Artillery Brigade "Destroyers" conducts reception operations and Basic Combat Training at the FCoE by integrating and transforming Army recruits into Soldiers who are prepared to complete Initial Military Training.

428th Field Artillery Brigade

The 428th Field Artillery Brigade trains and educates Soldiers, Allies, and Marines in Field Artillery core competencies and values-based leadership in order to provide capable and confident leaders and artillery men and women to the operational force.

75th Field Artillery Brigade

The 75th Field Artillery Brigade provides maintenance on long-range weapons systems. The 75th also conducts long range communications and provides support for long-range artillery fires with four Multiple Launch Rocket System (MLRS) Fires Battalions, and one High Mobility Artillery Rocket System (HIMARS) Fires Battalion.

Air Defense Artillery School

The Air Defense Artillery School is responsible for both the operational and institutional functions of the U.S. Army weapons specialists. The School's mission is to provide operational support worldwide and develop the doctrine, training tactics, techniques, procedures and strategies to win on the battlefield.

30th Air Defense Artillery Brigade

The 30th Air Defense Artillery Brigade trains in joint and combined air missile defense tactics and strategies to promote a joint and integrated operational force.

31st Air Defense Artillery Brigade

The 31st Air Defense Artillery Brigade's objective is to be ready to deploy to any Theater of Operations in support of the 32nd Army Air and Missile Defense Command and conduct decisive air and missile defense operations.

Other Units

902nd Military Intelligence Group

The 902nd Military Intelligence Group conducts full spectrum counterintelligence operations for the Army enterprise to protect forces, information and technologies by detecting, identifying, neutralizing, and exploiting Foreign Intelligence Services, international terrorist organizations and insider threats to U.S. Military forces at Fort Sill and throughout North Texas and the state of Oklahoma.

Logistics Readiness Center

The mission of the Logistics Readiness Center is to coordinate and deliver the right equipment, on time, and in good condition for all forces at Fort Sill, units within Fort Sill and contracted organizations.

Marine Corps Artillery Detachment

The Marine Corps Artillery Detachment, Fort Sill develop a training continuum for the Artillery Occupational Field and the 2887 Military Occupational Specialty and serve as the focus for artillery training issues. The Detachment validates training and education requirements, assists in drafting doctrine, tactics, techniques and procedures, and programs of instruction. The Detachment also provides subject matter experts and instructors for entry-level and sustainment-level training), and mentorship to artillery Marines and the U.S. Army Field Artillery School. The Detachment also promotes advancement of artillery programs and instruction through direct coordination with operating forces and other levels of Marine Training and Education agencies.

Reynolds Army Health Clinic

The Reynolds Army Health Clinic (RAHC) provides outpatient care, advanced rehabilitative services. The RAHC is dedicated to promoting wellness through the education of prevention services and behaviors and high-quality, patient-focused care.

Marine Corps Detachment at Fort Sill, Oklahoma

3.6 Future Mission Operations

While no new missions have been identified for Fort Sill at the time of this document, this JLUS study will provide information that can be used to protect available assets in order to maintain future growth potential.

3.7 Fort Sill Mission Footprint

Mission activities conducted on and around Fort Sill can generate potential impacts on, or receive potential impacts from, surrounding communities. Examples of potential mission impacts on surrounding communities include noise and vibration from weapons training, demolition and noise from fixed and rotary wing aircraft. Conversely, the military mission is susceptible to hazards and other incompatibilities created by certain types of civilian development or activities, such as physical obstructions to airspace or location of noise sensitive uses in high noise areas. Understanding the intersecting or overlapping spatial patterns of these compatibility zones, related to the Fort Sill "mission footprint", is essential for informing and promoting compatible land use decisions, and developing the recommended compatibility strategies presented in Chapter 6 of the JLUS Report.

There are several elements that make up and define the Fort Sill mission footprint that extend outside the boundaries of Fort Sill. These elements play a key role in the installation's viability for sustaining current and future mission operations. These elements are listed below and described in more detail on the following pages.

- Small Arms Range Noise Contours
- Medium to Large Range Noise Contours
- Aircraft Bombing Range Noise Contours
- Surface Danger Zones
- Explosive Safety Quantity Distance Arcs
- Aircraft Clear Zones and Accident Potential Zones
- Aircraft Operations Training Noise Zones
- Imaginary Surfaces (including Approach and Departure Zones)
- Helicopter Primary Corridors
- Airspace Control
- Wildlife Aircraft Strike Hazard (WASH) Relevancy Area

Noise

Noise Contours for Small Arms

To develop the noise contours for the various ranges and weapons used at Fort Sill, data on existing range usage must be collected and added to a noise model. The Small Arms Range Noise Assessment Model (SARNAM) is used to calculate various components of weapons firing for ordnance that is .50 caliber and smaller, and is based in part on ordnance type, number of rounds fired, time of day the weapons are fired and the location of both the firing areas and the targets. Added to this is available information is sound propagation and the effects of noise mitigation sources and safety measures, such as berms and ricochet barriers. The SARNAM also accounts for weather conditions and wind direction to determine final results. The small arms noise is addressed using peak level measurements. Peak level measurements are used to estimate the risk of receiving a noise complaint since noise complaints usually occur and are attributable to a specific event. There is more information about noise modeling and results in the Section 5.17, Noise.

A decibel (dB) is a measurement of the intensity of sound. A conversation between two people has a 60 dB level, while a rocket launch platform can be upwards of 180 dB at the firing point.

SARNAM creates noise contours for two noise zones. Noise Zone II (NZ II) and Noise Zone III (NZ III) are modeled for the small arms ranges and are shown on Figure 3-6. NZ III is the noise contour calculated at greater than 104 peak decibels (dBP) and is closest to the source of the noise firing point. NZ III is contained within the Fort Sill boundary. NZ II shows areas that are projected to have noise levels between 87 dBP and 104 dBP, and it extends off-installation at the West Range and East Range. At the West Range, the NZ II extends to the north of the installation into the Town of Medicine Park. There is a slight extension of NZ II to the south in the city of Lawton and in unincorporated Comanche County. At the East Range, NZ II extends off installation slightly to the northwest and west of the installation. These noise zones are shown on Figure 3-6.

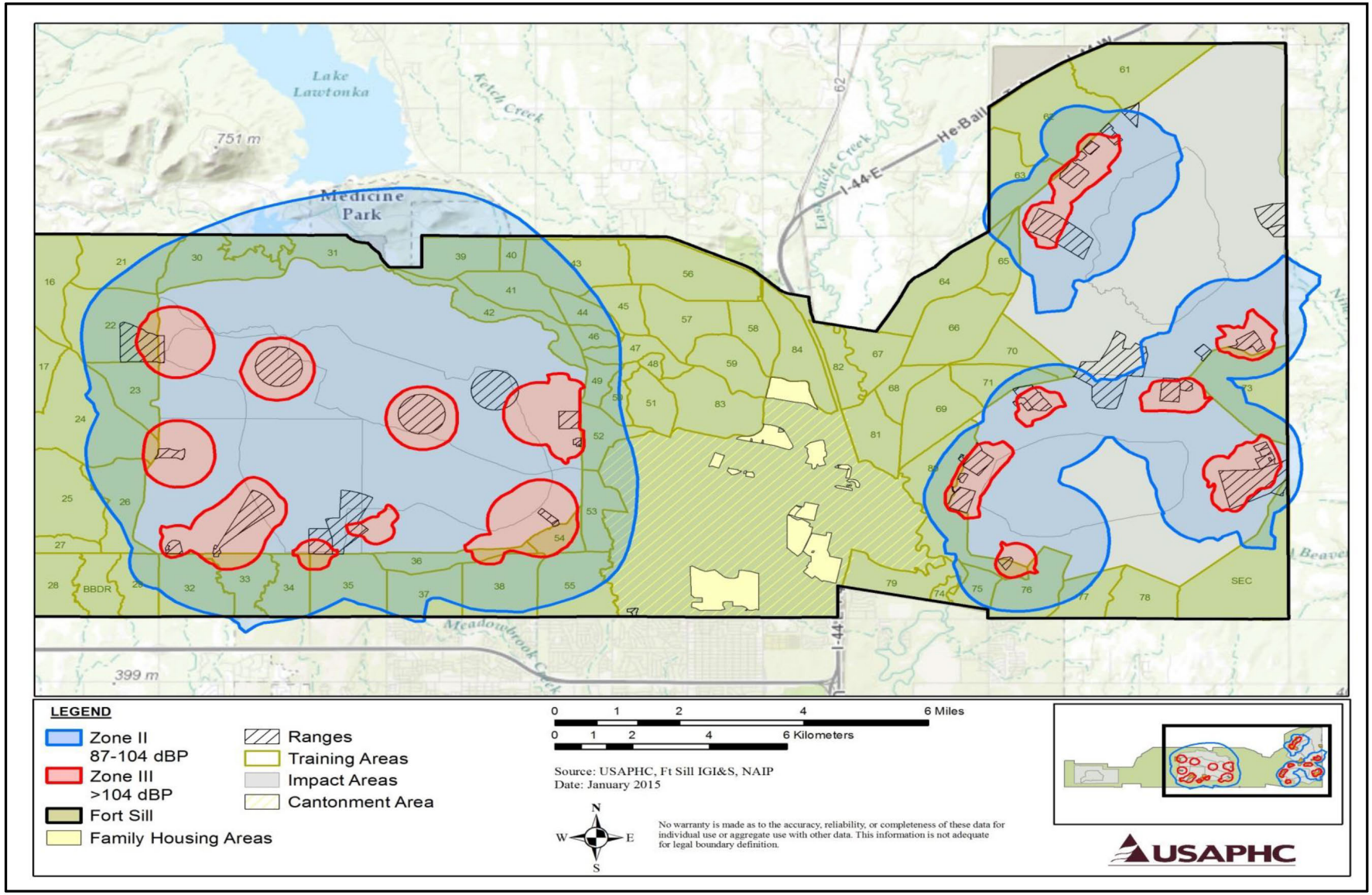
Noise Contours for Medium to Large Arms and Explosives

The BNOISE2 modeling program is used to calculate noise produced by medium to large arms—20 millimeters and greater—as well as high-explosive charges. The noise generated by these activities can carry over a greater distance and produce small levels of vibration and are more noticeable to the public. As opposed to the peak level (single event) noise measurements used for small arms, this type of noise is measured using a C-weighted Day-Night average noise level (CDNL). CDNL represents an average sound exposure over the modeled time period. During the nighttime period (10:00 pm to 7:00 am), averages are artificially increased by 10 dB. This weighting addresses the added intrusiveness and the greater disturbance potential of nighttime noise events. The assessment period for the medium to large arms for Fort Sill was 250 days. For more information about noise, please refer to Section 5.17, Noise.

The BNOISE2 model generates contours for three NZs (NZIII, NZII, NZI) with NZ III being the closest to the source identifying the highest noise levels. NZ III has a calculated noise level of 70 dB CDNL or greater. For the medium to large range noise contours, the majority of NZ III is contained within the Fort Sill boundary except for a small portion that extends off-installation in the south for approximately 300 meters (~ 0.2 miles) in the city of Lawton.

NZ II contours are calculated to show areas exposed to noise levels between 62 and 70 dB CDNL. NZ II extends off-installation to the north for approximately 3.2 miles over a portion of the Town of Medicine Park and, the south for approximately 3.1 miles over a portion of the City of Lawton, and to the east for less than 2 miles.

Figure 3-6. Small Arms Range Noise



Source: Fort Sill Installation Compatible Use Zone Study 2015

NZ I contours are calculated to show areas exposed to noise levels less than or equal to 62 dB CDNL. For planning purposes, a subcategory, called the Land Use Planning Zone (LUPZ), was defined for noise levels from 57 and 62 dB CDNL. This is considered to be the lowest levels at which sounds can be discerned and could impact noise sensitive land uses. The LUPZ noise contour extends off-installation significantly in all directions—approximately 9.8 miles to the north, 9.2 miles to the south, which covers the City of Lawton, and to the east approximately 6.9 miles. The LUPZ also covers the cities of Cache to the south and Elgin to the north-northeast. The Wichita Mountains, specifically the Mount Scott area (off-installation), provides mitigation of the noise that is propagated from training operations to the northwest.

These noise zones are illustrated on Figure 3-7.

Noise Contours for Aircraft Range Operations

Noise associated with aircraft use of the Close Air Support ranges located in the West Range and Quanah Range are modeled using peak level measurement and a risk of noise complaints level of noise. A peak decibel is used to measure the highest sound at an instantaneous moment.

Using peak decibel level measurements for aircraft bombing activities and according to Army Regulation 200-1, the peak level model generates moderate risk and high-risk noise complaint areas. A high risk of noise complaint area is where the noise limits range from 130 dBP to 140 dBP. A moderate risk of noise complaints area is where noise limits range from 115 dBP to 130 dBP. For Fort Sill, the noise model assumed unfavorable and neutral weather conditions. Unfavorable weather conditions refer to when the peak sound level is exceeded, factoring in and considering weather variations, 15 percent of the time. This means the loudest sound generated by these aircraft bombing activities would likely occur and be experienced by nearby land uses 15 percent of the time. Neutral weather conditions means the peak level for sound would be expected 50 percent of the time. It should be noted if these activities take place under favorable weather conditions, then the noise levels would be lower. For the purposes of this report, the unfavorable weather conditions were used in this discussion as it is illustrative of the most significant impact to land uses outside the installation. For more information about noise, please refer to Section 5.17, Noise.

The high complaint risk area is potentially exposed to sound levels greater than 130 dBP, with areas matching this noise level occurring at two ranges on the installation—Quanah and West. The high complaint risk area extends slightly beyond the installation's north and south boundary emanating from Quanah Range.

The moderate complaint risk area (with a noise level between 115-130 dBP) extends beyond the installation boundary approximately 8.7 miles to the north, nearly 9.2 miles to the west, and 11.2 miles to the south. While the moderate complaint risk area has an extensive footprint outside the installation, as shown on Figure 3-8, the impact of the noise generated by aircraft range operations is minimal due to the relative infrequency of operations, and relative to ambient conditions, the daily artillery training has a more sustained awareness in the area.

While infrequent, it is important to note that there are noise sensitive land uses impacted when aircraft range operations occur. The moderate complaint risk area covers portions over the towns of Indiahoma and Medicine Park, the City of Cache, the Wichita Mountains Wildlife Refuge, and parts of the City of Lawton.

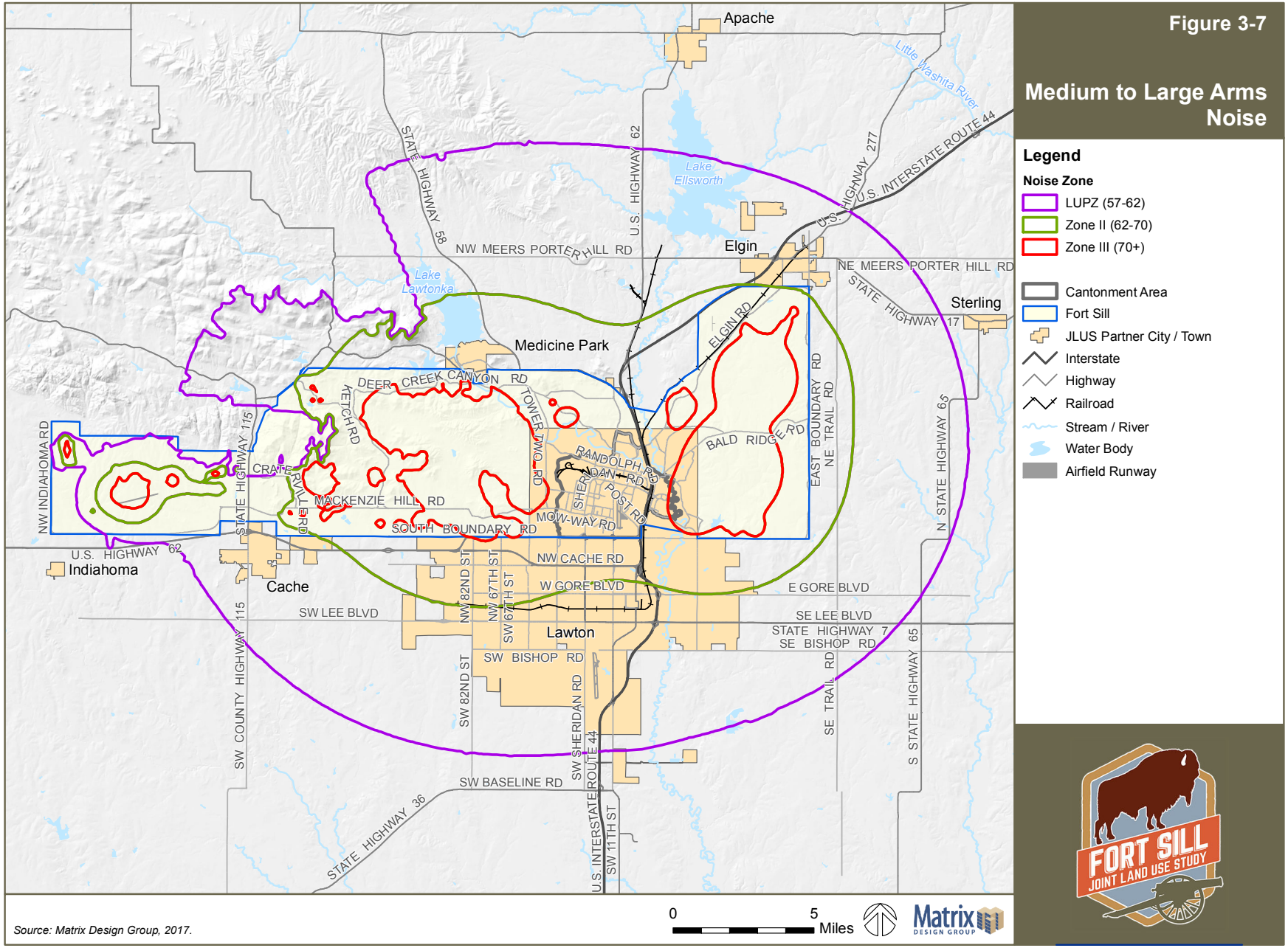
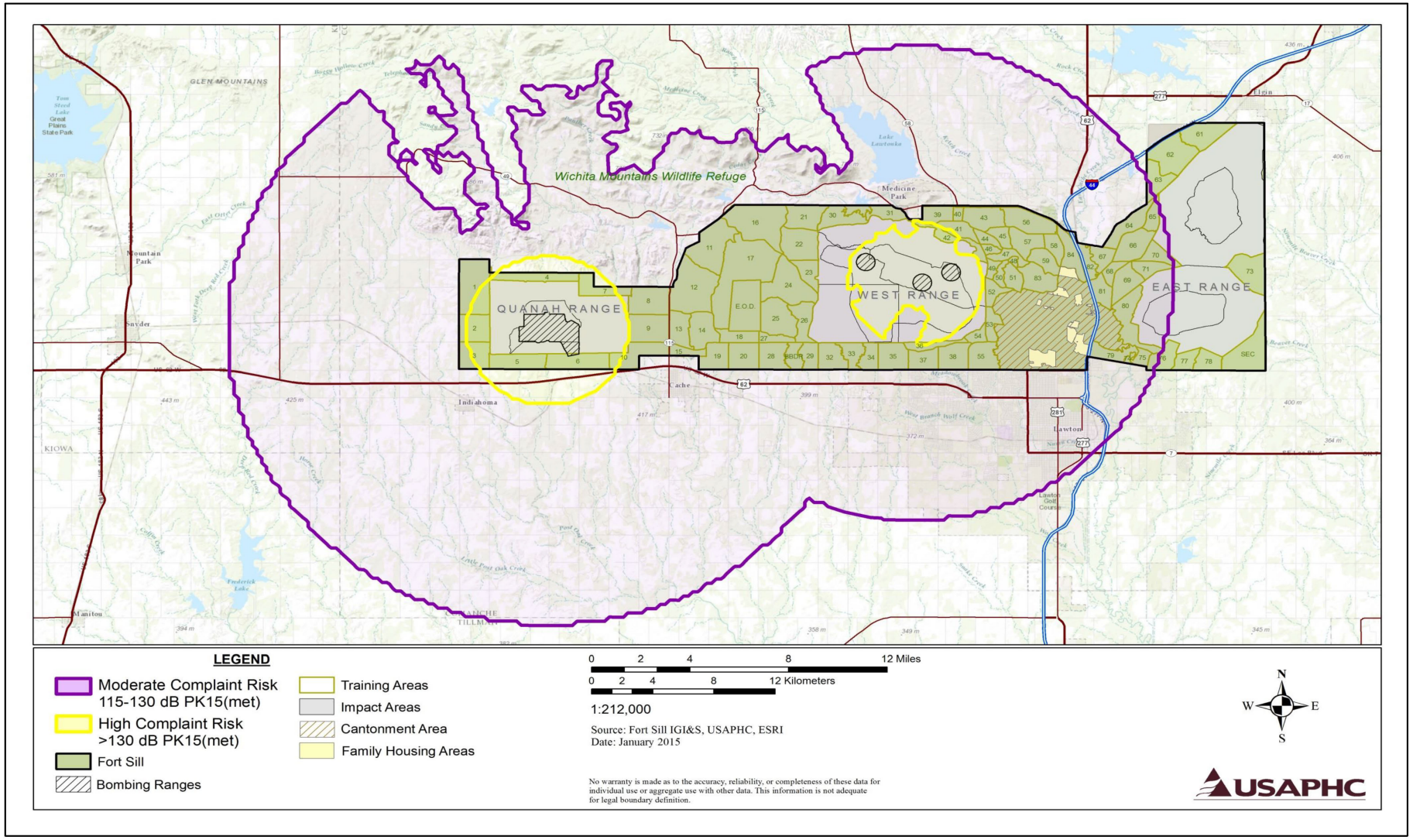


Figure 3-7
Medium to Large Arms Noise
Legend
Noise Zone
LUPZ (57-62)
Zone II (62-70)
Zone III (70+)
Cantonment Area
Fort Sill
JLUS Partner City / Town
Interstate
Highway
Railroad
Stream / River
Water Body
Airfield Runway
Apache
Elgin
Sterling
Medicine Park
Indiahoma
Cache
Lawton
Lake Ellsworth
Lake Lawtonka
Little Washita River
NW MEERS PORTER HILL RD
NE MEERS PORTER HILL RD
DEER CREEK CANYON RD
MACKENZIE HILL RD
SOUTH BOUNDARY RD
NW CACHE RD
W GORE BLVD
E GORE BLVD
SW LEE BLVD
SE LEE BLVD
SW BISHOP RD
SE BISHOP RD
SW BASELINE RD
BALD RIDGE RD
ELGIN RD
RANDOLPH RD
SHERIDAN RD
POST RD
MOW-WAY RD
KETCH RD
TOWER RD
CRATE RIVETT RD
NW INDIAHOMA RD
EAST BOUNDARY RD
NE TRAIL RD
SE TRAIL RD
NW 82ND ST
NW 67TH ST
SW 67TH ST
SW 82ND ST
SW SHERIDAN RD
SW 11TH ST
U.S. HIGHWAY 62
U.S. HIGHWAY 277
U.S. INTERSTATE ROUTE 44
STATE HIGHWAY 58
STATE HIGHWAY 17
STATE HIGHWAY 115
SW COUNTY HIGHWAY 115
STATE HIGHWAY 36
STATE HIGHWAY 7
N STATE HIGHWAY 65
S STATE HIGHWAY 65
U.S. INTERSTATE ROUTE 44
0
5
Miles
Source: Matrix Design Group, 2017.
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Figure 3-8. Aerial Bombing Noise



Source: Fort Sill Installation Compatible Use Zone Study 2015

Safety

Explosive Safety Quantity Distance Arc

The Explosive Safety Quantity Distance (ESQD) Arc defines the area that would be affected by an accidental explosion at an ammunition storage area. According to Fort Sill, there are not ESQD arcs that extend outside the installations perimeter boundary.

Surface Danger Zones

A surface danger zone (SDZ) is an area around a weapons' firing range from which the access of all military personnel and civilians is restricted due to the inherent dangers associated with the firing of live munitions. An SDZ can include the surface (and subsurface) of land and water, as well as the overhead air space that accommodate launched projectiles. An SDZ includes the weapons firing position, target impact area, and a secondary buffer area, which is an additional distance where errant projectile/munitions fragments may land without risking harm to life or property. All of Fort Sill's SDZs are completely contained within the installation's boundaries.

Aircraft Accident Potential Zones

There are no fixed wing aircraft stationed on Fort Sill, but as previously mentioned, Sheppard AFB, TX uses the airfield to fly over 80,000 training operations per year. In addition, Altus AFB, OK uses the airfield to train on the C-17 Globemaster III and C-130 Hercules aircraft. The fixed wing aircraft that frequently use HPAAF include the following:

- Army helicopters
- C-12 Huron
- C-17 Globemaster III
- C-130 Hercules
- T-6 Texan
- T-37 Cessna
- T-38 Talon
- UC- Citation (Cessna)

Rotary aircraft are used by pilots to perform aviation training activities from the HPAAF, with most of the helicopter training activities conducted at the Slick Hills Helicopter Training Area, which is six miles north-northwest of the installation.

The HPAAF is an Army airfield that has one concrete runway measuring 5,001 feet long by 200 feet wide in a north-south orientation. The aircraft safety zones for the HPAAF are designated based on the runway classification "A". As an Army Class A runway, the HPAAF has a Clear Zone (CZ), Accident Potential Zone I (APZ I), and an APZ II as illustrated on Figure 3-9.

The **Clear Zone (CZ)** begins at the end of each runway and measures 1,000 feet wide by 3,000 feet long. This is an area where the risk associated with aircraft mishaps are greater, thus the area should be clear and free from obstruction of any type.

The **Accident Potential Zone I (APZ I)** begins immediately after the CZ at both ends of the runway and is measured as a rectangular shape extending out from the CZ another 2,500 feet long and 1,000 feet wide. This area is associated with some risk of accident potential; however, there are some land uses that are recommended as compatible for this area.

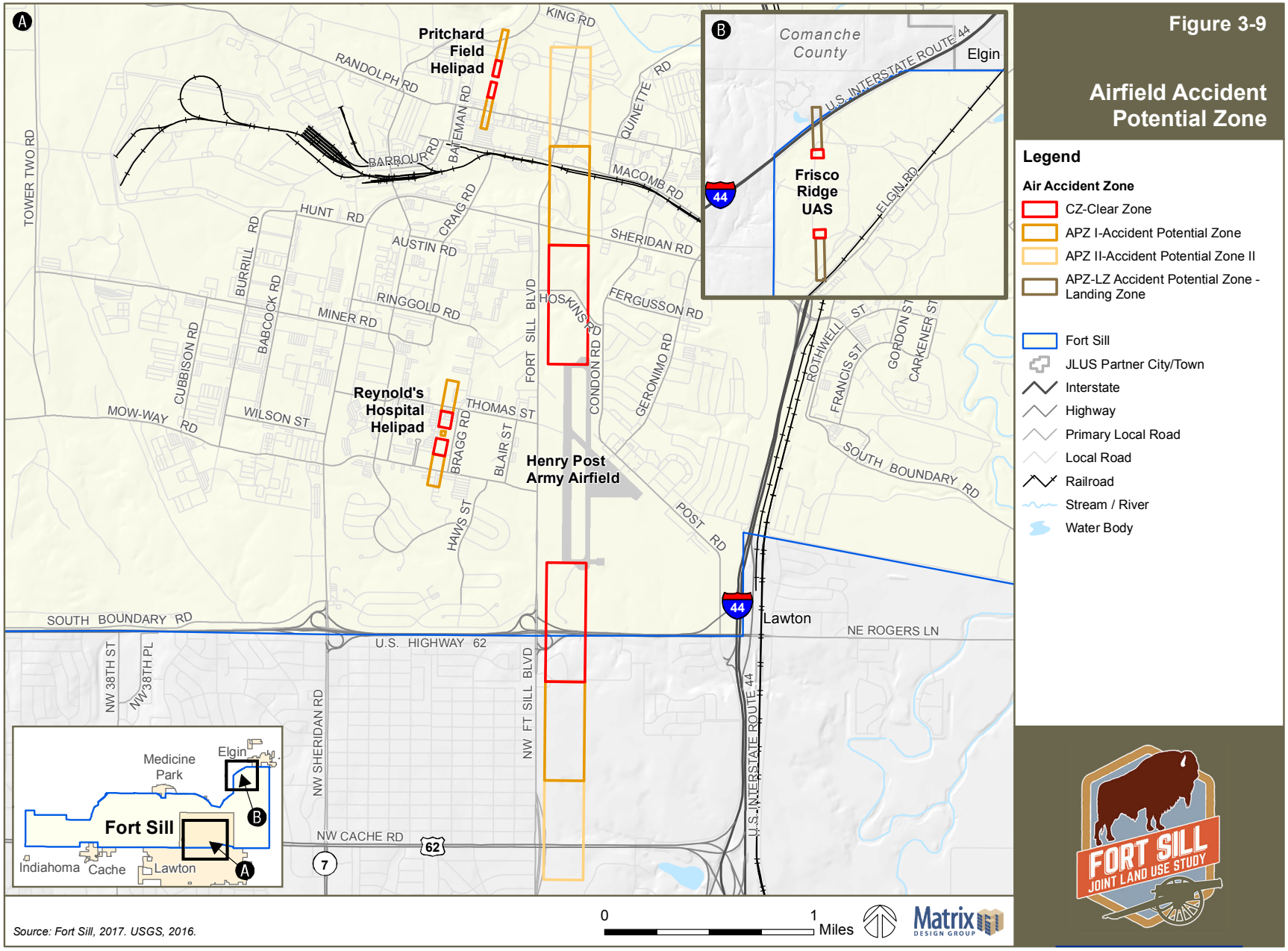
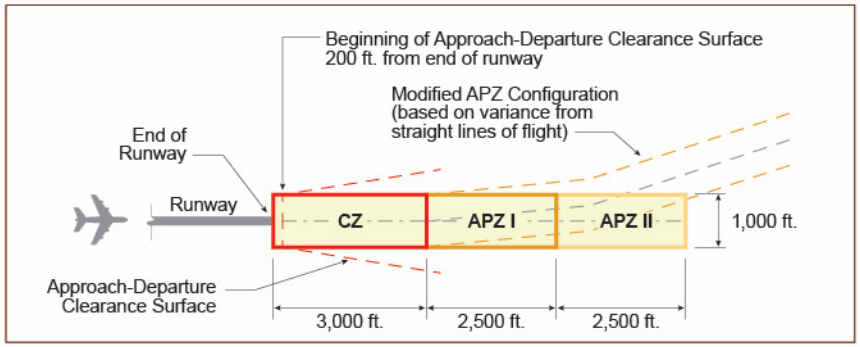


Figure 3-9
Airfield Accident Potential Zone
Legend
Air Accident Zone
CZ-Clear Zone
APZ I-Accident Potential Zone
APZ II-Accident Potential Zone II
APZ-LZ Accident Potential Zone - Landing Zone
Fort Sill
JLUS Partner City/Town
Interstate
Highway
Primary Local Road
Local Road
Railroad
Stream / River
Water Body
Pritchard Field Helipad
Reynold's Hospital Helipad
Henry Post Army Airfield
Frisco Ridge UAS
Comanche County
Elgin
Lawton
Medicine Park
Fort Sill
Indiahoma
Cache
KING RD
RANDOLPH RD
BARBOUR RD
BATEMAN RD
QUINETTE RD
MACOMB RD
SHERIDAN RD
HUNT RD
AUSTIN RD
CRAIG RD
TOWER TWO RD
BURRILL RD
BABCOCK RD
CUBBISON RD
MINER RD
RINGGOLD RD
FERGUSSON RD
HOSKINS RD
FORT SILL BLVD
CONDON RD
GERONIMO RD
ROTHWELL ST
FRANCIS ST
GORDON ST
CARKENER ST
MOW-WAY RD
WILSON ST
THOMAS ST
BRAGG RD
BLAIR ST
HAWS ST
POST RD
SOUTH BOUNDARY RD
U.S. HIGHWAY 62
NE ROGERS LN
NW 38TH ST
NW 38TH PL
NW SHERIDAN RD
NW FT SILL BLVD
NW CACHE RD
U.S. INTERSTATE ROUTE 44
ELGIN RD
Source: Fort Sill, 2017. USGS, 2016.
0
1
Miles
Matrix DESIGN GROUP

The **Accident Potential Zone II (APZ II)** is measured as a rectangular shape extending out from APZ I for another 2,500 feet with a width the same as the CZ and APZ I of 1,000 feet wide. This area has less of a risk associated with aircraft mishaps, and thus certain land uses are less restricted for this area.



Army Class A Runway Aircraft Accident Potential Zones

In addition to HPAAF, there are several sod runways used for staging areas and helicopter landing zones and a paved strip located at Frisco Ridge, which is in the northern part of the East Range (see Figure 3-9), used for Unmanned Aerial Systems (UAS) training operations. The sod runways are located west of HPAAF with their associated APZs completely contained within Fort Sill's boundaries. The Frisco Ridge paved air strip is approximately 2,900 feet in length and is located in the northwest corner of the East Range. A portion of its APZ-landing zone extends off installation. The air strip's safety zones are also illustrated in Figure 3-9.

The **Clear Zone** for the Frisco Ridge air strip extends 500 feet beyond both ends of the paved air strip at a width of 500 feet. The Frisco Ridge CZs are completely within the installation's boundaries.

The **Accident Potential Zone-Landing Zone (APZ-LZ)** begins immediately after the CZ and is measured as rectangular shape with a width of 500 feet extending out from the CZ on each end of the air strip for a length of 2,500 feet. It is this northern extension that the APZ-LZ extends outside the installation.

The sod or unpaved runways are located west of HPAAF and have CZs and APZs. These are also shown in Figure 3-9. The unpaved runway located to the north of Macomb Road has CZs that measure 150 feet wide by 400 feet long on both ends of the runway. The unpaved runway in the south closest to the southern installation boundary has CZs that are 300 feet wide and 400 feet long on both ends of the runway.

The northernmost unpaved runway has APZs that extend from the CZs to a length of 800 feet long and maintains the same width of the CZ, 150 feet at both ends of runway. For the southernmost unpaved runway, the APZs measure 300 feet wide by 800 feet long at both ends of the runway.

Both unpaved runways and their associated safety zones are completely located within the installation's boundaries.

Airfield Noise

Aircraft Training Noise Contours

The aircraft training noise contours for HPAAF are based on a Department of Defense (DoD) NOISEMAP model. Data collected to generate the NOISEMAP model includes an average of aircraft operations over a given period of time (commonly a year), type of aircraft, frequency of aircraft operations, type of operations, engine run-ups and testing operations, weather conditions, and land features, (i.e. accounting for terrain that can provide barriers to sound).

The noise contours modeled for HPAAF were calculated for an average annual condition, meaning the operations are averaged across all 365 days in a year. For model development, HPAAF personnel provided data for a six-month period from July 2014 to December 2014, and the numbers were extrapolated out to provide a 12-month data set.

Based on the data provided, the NOISEMAP calculations identified three noise zones. A LUPZ was designated for areas that were modeled to have a 60-65 dB A-weighted day-night level (ADNL) noise exposure. NZ II was designated to show areas that were modeled to have a 65-75 dB ADNL, and NZ III was designated as areas with noise levels greater than 75 dB ADNL. These noise zones are illustrated on Figure 3-10.

The LUPZ noise area extends off-installation to the south approximately 3,032 feet into the City of Lawton. The NZ II area extends off-installation into the City of Lawton for approximately 1,696 feet. The NZ III area is contained within the airfield property, well within the Fort Sill boundary.

Airfield Primary Approach and Departure Flight Corridors

There are four primary flight corridors that aircraft use to perform their operations at HPAAF as illustrated on Figure 3-11. The corridors are designed to avoid major urban development areas to the most practicable extent. Starting from west going east around the airfield, the four primary flight corridors are as follows.

- **Goodyear Corridor** is a corridor that runs west-east extending outside the installation boundaries until it intersects with U.S. Highway 62, and then runs west along U.S. Highway 62.
- **Snow Ridge Corridor** is a route that runs north-south extending from the cantonment area on-installation towards the northern boundary.
- **Lake George Corridor** is a route that runs east-west extending east on-installation.
- **Flower Mound Corridor** is an arrival route only that runs northwest-southeast extending from the installation boundary where it meets Interstate 44.

Airspace Control

Fort Sill is located under restricted airspace. Restricted Airspace is a type of special use airspace designated by the Federal Aviation Administration (FAA). Restricted Airspace is an important asset to the Department of Defense because allowed uses include weapons systems training and testing purposes. These areas are necessary for ground weapons and artillery firing, aerial gunnery, and dropping inert and practice bombs. Restricted Airspace designation serves to separate training and testing from the public and general aviation users. These areas are identified by the letter “R” followed by a number designation on FAA Sectional Charts, Enroute Charts, and Terminal Area Charts. The floor and ceiling altitudes, operating hours, and controlling agency can be found in the sectional chart legend.

Restricted airspaces in the Fort Sill JLUS Study Area that are illustrated on Figure 3-12. All the restricted airspaces have a portion that is not contained within the installation boundary. These areas are important to consider when evaluating potential compatibility impacts associated with the mission on land uses outside the installation.

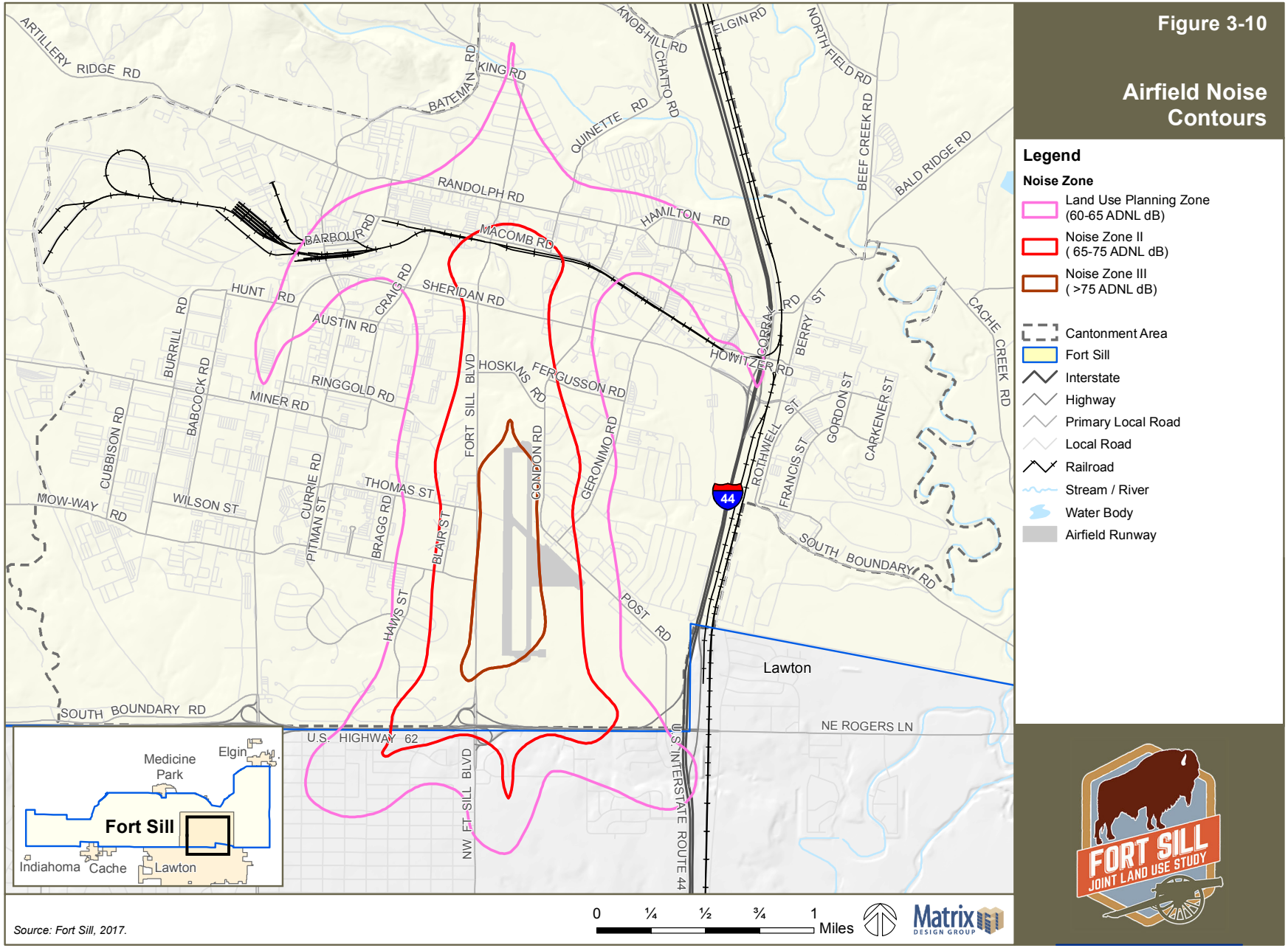


Figure 3-10
Airfield Noise Contours
Legend
Noise Zone
Land Use Planning Zone (60-65 ADNL dB)
Noise Zone II (65-75 ADNL dB)
Noise Zone III (>75 ADNL dB)
Cantonment Area
Fort Sill
Interstate
Highway
Primary Local Road
Local Road
Railroad
Stream / River
Water Body
Airfield Runway
ARTILLERY RIDGE RD
BATEMAN RD
KING RD
KNOB HILL RD
CHATTO RD
ELGIN RD
NORTH FIELD RD
QUINETTE RD
BEEF CREEK RD
BALD RIDGE RD
RANDOLPH RD
HAMILTON RD
BARBOUR RD
MACOMB RD
HUNT RD
CRAIG RD
SHERIDAN RD
AUSTIN RD
BURRILL RD
BABCOCK RD
CUBBISON RD
RINGGOLD RD
MINER RD
HOSKINS RD
FERGUSSON RD
HOWITZER RD
CORRAL RD
BERRY ST
CACHE CREEK RD
FORT SILL BLVD
GERONIMO RD
GORDON RD
ROTHWELL ST
FRANCIS ST
GORDON ST
CARKENER ST
MOW-WAY RD
WILSON ST
CURRIE RD
PITMAN ST
BRAGG RD
BLAIR ST
THOMAS ST
HAWS ST
POST RD
SOUTH BOUNDARY RD
U.S. HIGHWAY 62
NW FT SILL BLVD
U.S. INTERSTATE ROUTE 44
NE ROGERS LN
Lawton
44
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: Fort Sill, 2017.
0 ¼ ½ ¾ 1 Miles
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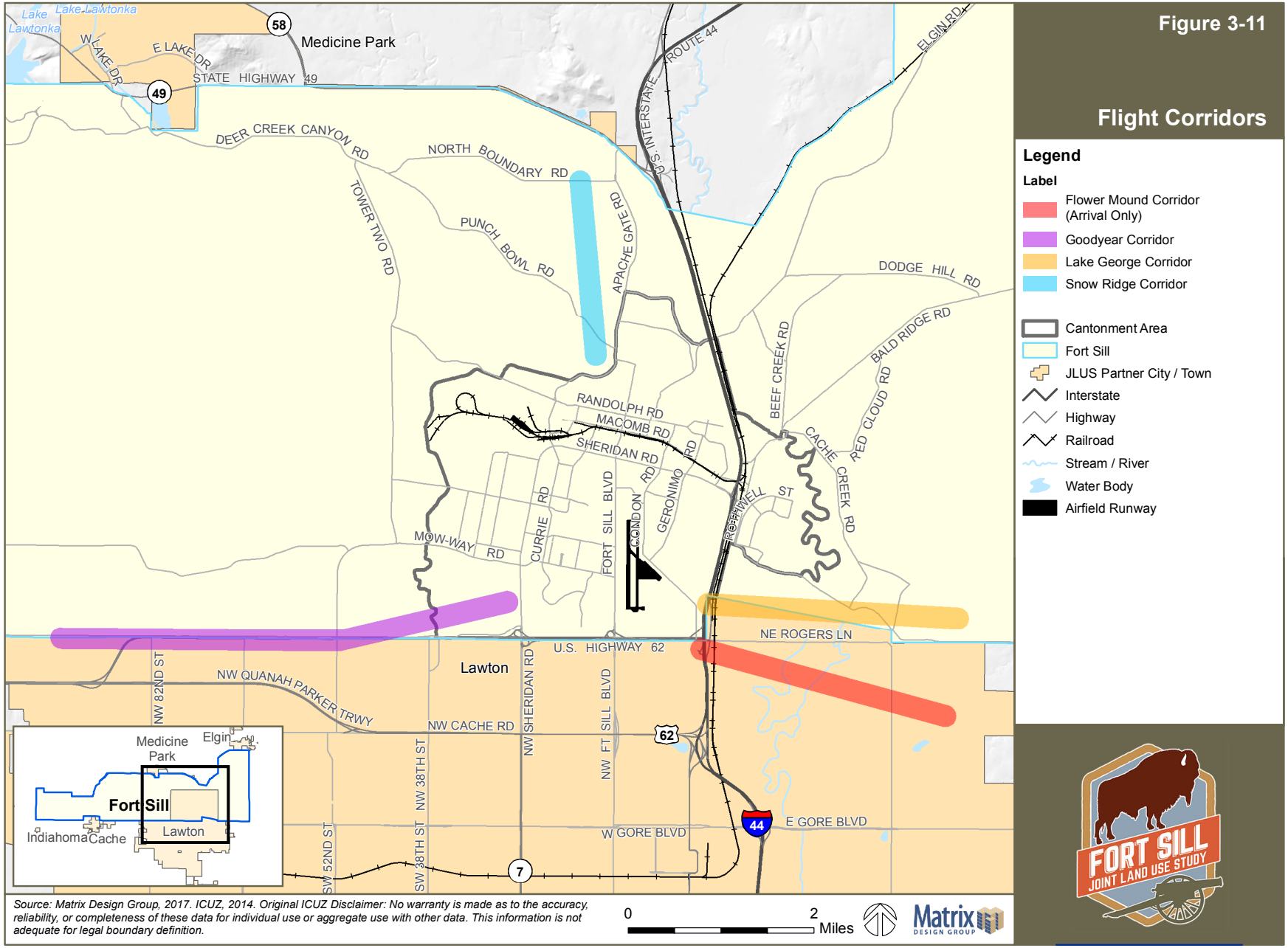
Figure 3-11
Flight Corridors
Legend
Label
Flower Mound Corridor (Arrival Only)
Goodyear Corridor
Lake George Corridor
Snow Ridge Corridor
Cantonment Area
Fort Sill
JLUS Partner City / Town
Interstate
Highway
Railroad
Stream / River
Water Body
Airfield Runway
Medicine Park
Lawton
Fort Sill
Elgin
Indiahoma
Cache
STATE HIGHWAY 49
DEER CREEK CANYON RD
NORTH BOUNDARY RD
TOWER TWO RD
PUNCH BOWL RD
APACHE GATE RD
U.S. INTERSTATE ROUTE 44
ELGIN RD
DODGE HILL RD
BALD RIDGE RD
BEEF CREEK RD
RED CLOUD RD
CACHE CREEK RD
RANDOLPH RD
MACOMB RD
SHERIDAN RD
GERONIMO RD
CURRIE RD
FORT SILL BLVD
LONDON RD
MOW-WAY RD
PROFFITT WELL ST
NE ROGERS LN
U.S. HIGHWAY 62
NW QUANAH PARKER TRWY
NW 82ND ST
NW CACHE RD
NW SHERIDAN RD
NW FT SILL BLVD
NW 38TH ST
SW 52ND ST
SW 38TH ST
W GORE BLVD
E GORE BLVD
Source: Matrix Design Group, 2017. ICUZ, 2014. Original ICUZ Disclaimer: No warranty is made as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This information is not adequate for legal boundary definition.
0
2
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

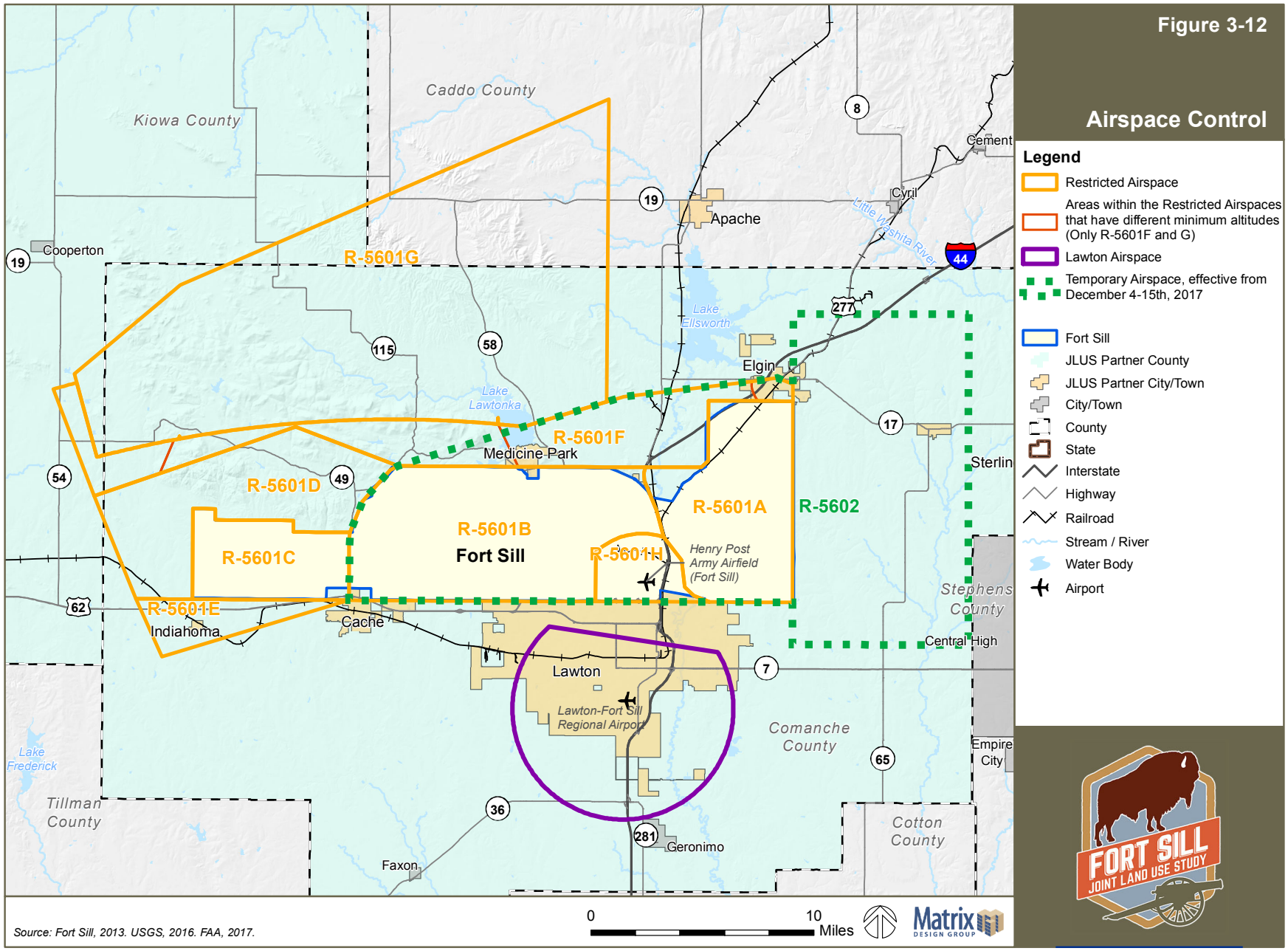
Figure 3-12
Airspace Control
Legend
Restricted Airspace
Areas within the Restricted Airspaces that have different minimum altitudes (Only R-5601F and G)
Lawton Airspace
Temporary Airspace, effective from December 4-15th, 2017
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Airport
Kiowa County
Caddo County
Stephens County
Comanche County
Tillman County
Cotton County
Cooperton
Apache
Cement
Cyril
Elgin
Sterlin
Medicine Park
Cache
Indianoma
Lawton
Geronimo
Faxon
Central High
Empire City
Lake Ellsworth
Lake Lawtonka
Lake Frederick
Little Washita River
Henry Post Army Airfield (Fort Sill)
Lawton-Fort Sill Regional Airport
R-5601G
R-5601F
R-5601D
R-5601C
R-5601B
Fort Sill
R-5601H
R-5601A
R-5602
R-5601E
Source: Fort Sill, 2013. USGS, 2016. FAA, 2017.
0
10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Table 3-1 provides the vertical limits, the hours of operation, and general location of the restricted airspaces in the JLUS Study Area.

Table 3-1. Restricted Airspace in the JLUS Study Area

Restricted Airspace	Vertical Limits	Hours / Days of Operation	Location
R-5601A	Surface to Flight Level 400	Continuous	Covers the East Range east of Henry Post Army Airfield
R-5601B	Surface to Flight Level 400	Continuous	Covers the area between Falcon Range in the West and the East Range
R-5601C	Surface to Flight Level 400	Continuous	Covers the Falcon Range in the West Area of Fort Sill
R-5601D	500 feet above ground level to Flight Level 400	Sunrise to 10:00 pm Monday – Friday	Covers the area North and West of R-5601C over the Wichita Mountains Wildlife Refuge
R-5601E	500 feet above ground level to 6,000	Sunrise to 10:00 pm Monday – Friday	Covers an area south-southwest of Falcon Range. The Town of Indiahoma is located under a portion of this airspace.
R-5601F	500 feet above ground level to Flight Level 400	Sunrise to 10:00 pm Monday – Friday	Covers a portion spanning the entire northern boundary of Fort Sill and extending north into unincorporated portions of Comanche County and other jurisdictions.
R-5601G	500 feet above ground level to 8,000 feet mean sea level	One hour before / one hour after sunset, Monday – Friday, Notice to Airmen	Covers the portion beginning at the boundary of R-5601F up through the remaining part of Comanche County into the southwest corner of Caddo County.
R-5601H	Surface to 40,000 feet mean sea level	Continuous	Covers the Henry Post Army Airfield and cantonment areas

Source: Fort Sill Installation Compatible Use Zone Study, 2015; Draft Environmental Assessment for the Creation of Restricted Area (RA) R-5601G and R-5601H, Fort Sill, 2013

Vertical Obstructions

Part 77 Compliance

The Federal Aviation Act was enacted in 1958 to provide methods for overseeing and regulating civilian and military use of airspace over the US. With this act came the creation of the Federal Aviation Administration (FAA). The act and supporting organization enable the Secretary of Transportation to make long range plans that formulate policy for the orderly development and use of navigable airspace. The intent is to serve the needs of both civilian aeronautics and national defense, but it does not specifically address the needs of military agencies. The FAA was created for a variety of

purposes including the management of airspace over the U.S. In the 1963 the U.S. Court of Claims ruling in Aaron v. United States declared that flights 500 feet or more Above Ground Level (AGL) do not represent a compensable taking because they (flights) enjoy a free right-of-passage without liability to the owners below. This 500-foot rule, promulgated by the FAA, states that every citizen of the United States has "a public right of freedom of transit in air commerce through the navigable air space of the United States."

Another important outcome of the Federal Aviation Act is Code of Federal Regulation (CFR) Title 14 Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace, commonly referred to as Part 77 Compliance. Part 77 Compliance provides the basis for evaluation of vertical obstruction compatibility. This regulation provides information to evaluate the potential for a vertical obstruction based on the elevation of an airfield, the height and resulting elevation of a new structure or facility, and the location of the structure or facility relative to the airfield in question. This regulation determines compatibility based on the height of proposed structures, or natural features, relative to their distance from the ends of a runway. Using a distance formula from this regulation, local jurisdictions can easily assess the height restrictions near their airfields. Additional information on Part 77 Compliance is located on the FAA Internet site at http://www.faa.gov/.

As of January 29, 2013, the main focus of Part 77 Compliance Subpart 77.17 titled Obstruction Standards, is to establish standards to determine obstructions within navigable airspace, typically within a certain distance from an airport or airfield. It defines an obstruction to air navigation as an object that is of greater height than any of several measures. A key reference used for compatibility planning is the following:

> *A height that is 200 feet AGL or above the established airport elevation, whichever is higher, and within three nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length is considered a vertical obstruction. This height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport up to a maximum of 499 feet.*

Figure 3-13 provides an illustration of the FAA Part 77 measure of vertical obstruction around Fort Sill's HPAA and the Lawton-Fort Sill Regional Airport. Note that this is in addition to, not a replacement of, imaginary surfaces discussed later in this section.

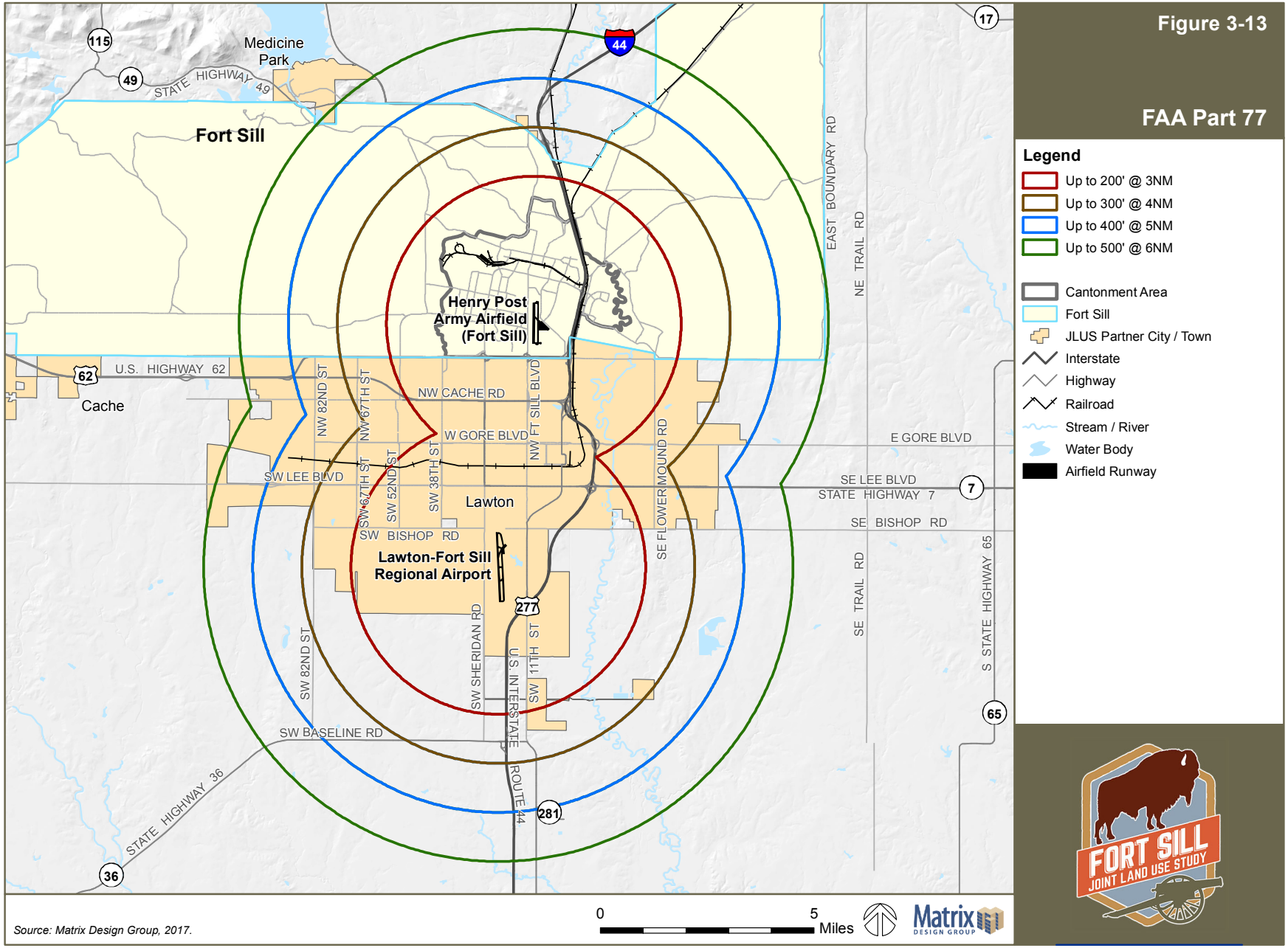
Figure 3-13
FAA Part 77
Legend
Up to 200' @ 3NM
Up to 300' @ 4NM
Up to 400' @ 5NM
Up to 500' @ 6NM
Cantonment Area
Fort Sill
JLUS Partner City / Town
Interstate
Highway
Railroad
Stream / River
Water Body
Airfield Runway
Medicine Park
Fort Sill
Henry Post Army Airfield (Fort Sill)
Lawton
Lawton-Fort Sill Regional Airport
Cache
STATE HIGHWAY 49
U.S. HIGHWAY 62
NW CACHE RD
W GORE BLVD
E GORE BLVD
SW LEE BLVD
SE LEE BLVD
STATE HIGHWAY 7
SW BISHOP RD
SE BISHOP RD
SW BASELINE RD
STATE HIGHWAY 36
NW 82ND ST
NW 67TH ST
NW FT SILL BLVD
SW 67TH ST
SW 52ND ST
SW 38TH ST
SE FLOWER MOUND RD
EAST BOUNDARY RD
NE TRAIL RD
SE TRAIL RD
S STATE HIGHWAY 65
SW SHERIDAN RD
SW 82ND ST
SW 11TH ST
U.S. INTERSTATE ROUTE 44
Source: Matrix Design Group, 2017.
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Miles
Matrix DESIGN GROUP
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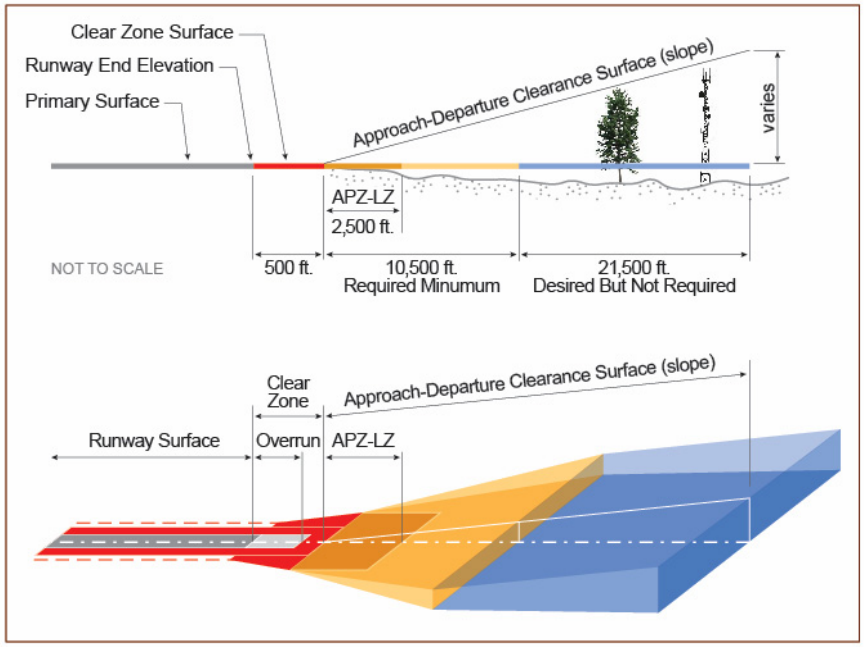
Henry Post Army Airfield and Other Runway Imaginary Surfaces

Federal Aviation Regulation, Part 77 Compliance specifies a series of Imaginary Surfaces surrounding military and civilian airports that define allowable vertical obstruction heights. The imaginary surfaces of an active runway are used to define the required airspace that must remain free of any vertical obstructions in the vicinity of aviation operations to ensure safe flight operations. Figure 3-14 shows diagram of the slope of the surfaces that help guide military and community planners in land use planning around an airfield. Structures on the ground should not exceed these heights to protect the navigable airspace associated with the airfield, the safety of pilots and people, and the land uses on the ground. This is especially important in the clear zone and the approach-departure surfaces.

Figure 3-14. Imaginary Surfaces Diagram Relevant for Henry Post Army Airfield



Source: Unified Facilities Criteria: Airfield and Heliport Planning and Design (UFC 3 260 01), November 2008

Figure 3-15 shows the general geometry of imaginary surfaces for planning purposes for Fort Sill's HPAAF and the Frisco Ridge airstrip and sod runways. There are two Imaginary Surfaces associated with HPAAF, they are:

Primary Surface. The primary surface is an imaginary surface symmetrically centered on the landing zone. The elevation of the primary surface is the same as the elevation of the runway or the extended runway centerline.

Approach-Departure Clearance Surface (End of Primary Surface). The approach-departure clearance surface is an inclined plane or combined inclined plane symmetrically centered about the runway or extended runway centerline. The first segment of this surface begins at the ends and edges of the primary surface and the elevation of the center of the runway's end. This surface flares outward and upward from these points to a minimum length of 10,500 feet. The desired length is 32,000 feet. The width of the first part of this segment is 500 feet and flares outward to a width between 10,500 to 32,000 feet. This slope has requirement that no structures should exceed a slope of 40 feet horizontal to one vertical foot.

There are two imaginary surfaces for the Frisco Ridge airstrip, which are the Exclusion Area and the Approach Zone.

Exclusion Area. The exclusion area is an unoccupied area covering 700 feet of the runway and area around the runway. The exclusion area is centered on the runway and extends the length of the runway and the clear zones at the end of each runway.

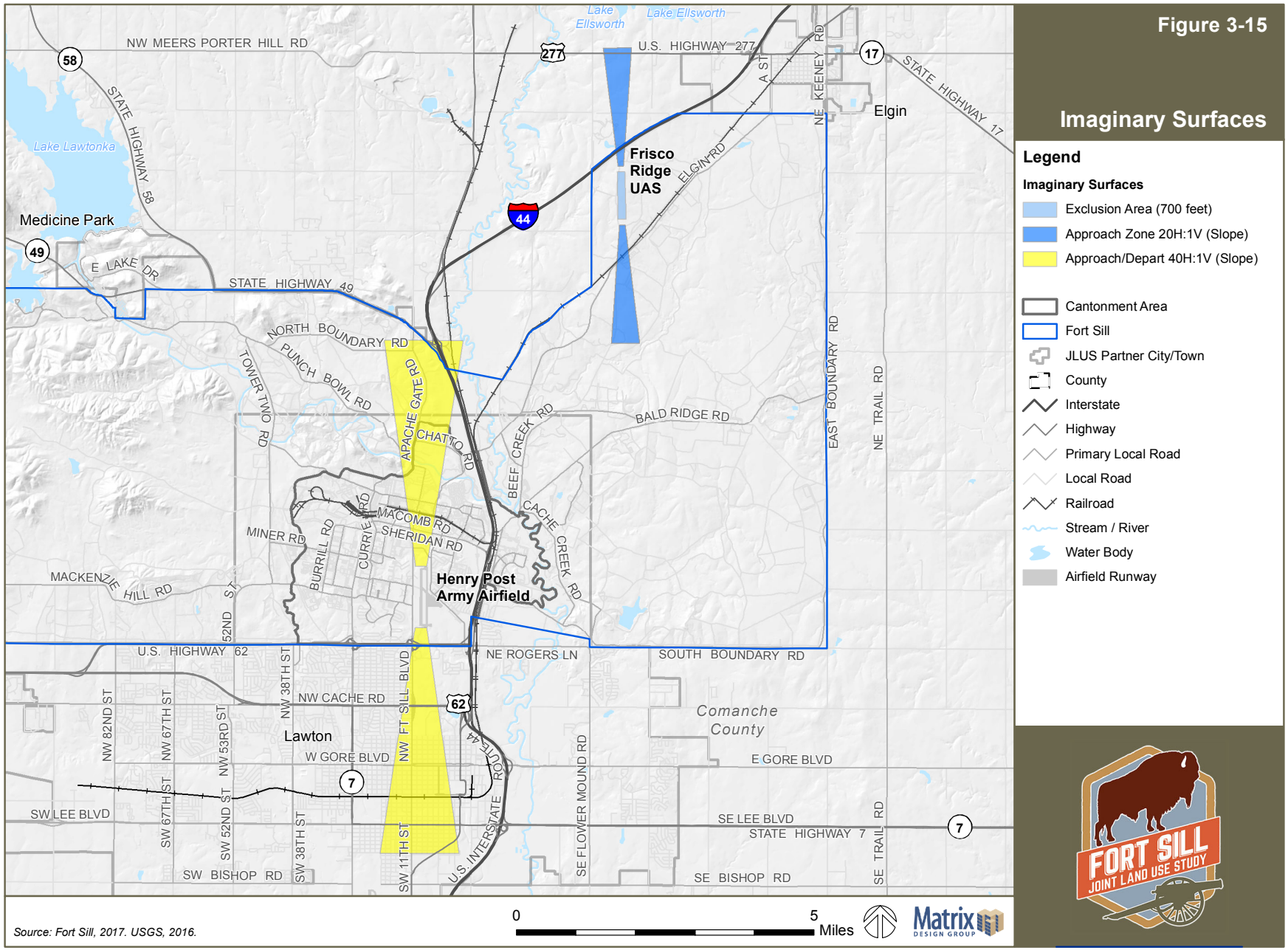


Figure 3-15
Imaginary Surfaces
Legend
Imaginary Surfaces
Exclusion Area (700 feet)
Approach Zone 20H:1V (Slope)
Approach/Depart 40H:1V (Slope)
Cantonment Area
Fort Sill
JLUS Partner City/Town
County
Interstate
Highway
Primary Local Road
Local Road
Railroad
Stream / River
Water Body
Airfield Runway
Frisco Ridge UAS
Henry Post Army Airfield
Medicine Park
Lawton
Elgin
Comanche County
Lake Lawtonka
Lake Ellsworth
NW MEERS PORTER HILL RD
U.S. HIGHWAY 277
STATE HIGHWAY 58
STATE HIGHWAY 49
E LAKE DR
NORTH BOUNDARY RD
PUNCH BOWL RD
TOWER TWO RD
APACHE GATE RD
CHATTO RD
BEEF CREEK RD
BALD RIDGE RD
EAST BOUNDARY RD
NE TRAIL RD
NE KEENEY RD
A ST
ELGIN RD
STATE HIGHWAY 17
MACOMB RD
SHERIDAN RD
MINER RD
BURRILL RD
CURRIE RD
CACHE CREEK RD
MACKENZIE HILL RD
52ND ST
U.S. HIGHWAY 62
NE ROGERS LN
SOUTH BOUNDARY RD
NW CACHE RD
NW 38TH ST
NW FT SILL BLVD
NW 82ND ST
NW 67TH ST
NW 53RD ST
W GORE BLVD
E GORE BLVD
SW LEE BLVD
SW 67TH ST
SW 52ND ST
SW 38TH ST
SW 11TH ST
SW BISHOP RD
U.S. INTERSTATE 44
SE FLOWER MOUND RD
SE LEE BLVD
STATE HIGHWAY 7
SE TRAIL RD
SE BISHOP RD
Source: Fort Sill, 2017. USGS, 2016.
0
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Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Approach Zone. The approach zone for the Frisco Ridge airstrip has a slope of 20 horizontal feet to every one vertical foot. This surface extends from the runway edges and ends. It should be noted that the Frisco Ridge approach zone extends off installation to the north.

There are three imaginary surfaces for the sod or unpaved runways. The imaginary surfaces consist of an approach-departure zone, and two transitional surfaces.

Approach-Departure Clearance Surface (Edges [or Sides] of Primary Surface). The approach-departure clearance surface for the edges or sides of the primary surface has a slope of eight feet horizontally for every one foot vertically.

Transitional Surface. The transitional surface is an imaginary plane that connects the primary surface to the approach-departure clearance surface and the horizontal surface, or a prescribed horizontal distance beyond the horizontal surface. This surface extends upward and outward at a two-foot horizontal to one vertical foot slope.

Wildlife Aircraft Strike Hazard (WASH) Relevancy Area

Bird or animal strikes since 1980 have approached approximately 20,000 events that have resulted in two deaths, 25 aircraft destroyed and over $300 million in damage for the DOD. According to the United States Avian Hazard Advisory System, there have been 23 bird strikes reported for HPAAF since 2006. More recently, there were two strikes in 2016, one strike each in 2015 and 2014, and six strikes in 2013.

Certain types of land features and uses attract birds and wildlife, such as farmland, golf courses, landfills, open water areas, standing water, and natural woodland areas. The location of Fort Sill's HPAAF is within the Central Flyway for migratory birds and is in a suburban area that has numerous bodies of water off-post including the Lawtonka Lake, nearby golf courses with water features, and farmland, all which increase the risk for WASH incidents.

Fort Sill Regulation 385-15 is the WASH program that has been established to reduce the impact of birds on aircraft operations. Figure 3-16 shows a five-mile radius around the HPAAF air operations area. Based on FAA statistical analysis, this is the primary area of concern for WASH incidents to occur, and the primary focus of compatibility planning for this issue.

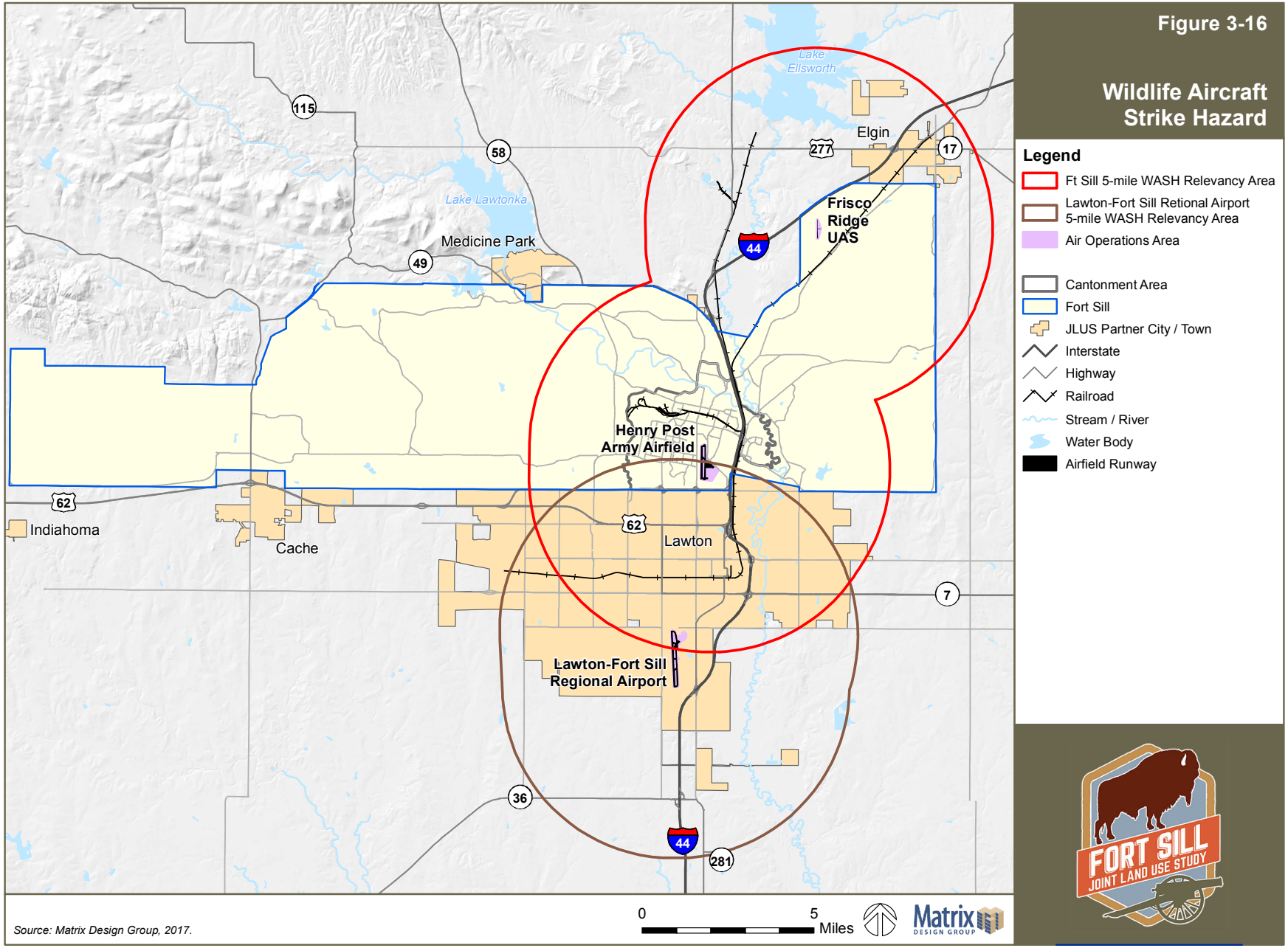


Figure 3-16
Wildlife Aircraft Strike Hazard
Legend
Ft Sill 5-mile WASH Relevancy Area
Lawton-Fort Sill Retional Airport 5-mile WASH Relevancy Area
Air Operations Area
Cantonment Area
Fort Sill
JLUS Partner City / Town
Interstate
Highway
Railroad
Stream / River
Water Body
Airfield Runway
Lake Ellsworth
Elgin
Lake Lawtonka
Medicine Park
Frisco Ridge UAS
Henry Post Army Airfield
Indiahoma
Cache
Lawton
Lawton-Fort Sill Regional Airport
115
58
277
17
49
44
62
7
36
281
Source: Matrix Design Group, 2017.
0
5
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Inside Chapter 4...

This chapter provides an overview of planning and compatibility tools currently used, applied, or available in evaluating and addressing compatibility issues in the Fort Sill JLUS Study Area. Relative to compatibility planning, there are a number of existing plans and programs that are either designed to address compatibility directly or that indirectly address compatibility issues through the topics they cover.

This summary provides an overview of key plans and programs that impact compatibility planning organized by level of government. There are three types of planning tools evaluated relative to their applicability: permanent, semi-permanent, and conditional. Permanent planning tools include acquisition programs, either fee simple purchase of property or the purchase of development rights. Semi-permanent tools include regulations such as zoning or adopted legislation. Examples of conditional tools would include memorandums of understanding, intergovernmental agreements, and other policy documents such as comprehensive plans that can be periodically modified. This review is meant to provide an overview of applicable planning tools and determine how each may apply to compatibility as presented under the compatibility factors discussed in Chapter 5, Compatibility Assessment.

4.1 Federal Plans and Programs

Federal tools authorize federal, state, and local entities to implement regulatory measures and policies to protect the multiple resources that are involved in land use and military compatibility planning. The intent of these regulatory measures and policies includes the protection of the quality of life and general welfare of the public and preservation of military training areas for military use. These tools assist land use decision makers and planners of all levels of government to make informed decisions that enable compatible land use development between military installations and the communities that exist around them.

Federal programs and policies were evaluated in the Fort Sill JLUS to assist in determining where areas of improvement could enable better land use planning at the local level.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act (AIRFA) establishes the rights of Native Americans to access sacred sites or sites of religious importance. It defines a religious site as any place or area including, but not limited to, any geophysical or geographical area or feature. Examples of sacred or religious sites characteristic include sites:

- Sacred to Native American religions;
- Where Native American practitioners are required by their religion to gather, harvest, or maintain natural substances or natural products for use during ceremonies, rituals, or for spiritual purposes; and/or which is used by Native American religious practitioners for ceremonies, rituals, or other spiritual practices.

A religious site may or may not contain physical remains, objects, or other elements that could identify it as an archaeological site. The AIRFA defines objects as specific items of use for religious practices that have spiritual or ritualistic importance. They may include sacred objects, non-sacred objects, and objects of cultural patrimony.

The AIRFA is important to the Fort Sill JLUS Study Area because of the Native American History and presence in the area. There are Native American religious sites located within Fort Sill's boundary and within the Study Area. Fort Sill proactively manages and protects the sites on the installation. Future mission expansion at Fort Sill could encroach on Native American sacred sites.

Geronimo's grave is located at Fort Sill

Ammunition and Explosives Safety Standards 385-64

The Department of the Army Pamphlet 385-64 details the Army's safety criteria and standards for operations involving ammunition and explosives. The pamphlet includes mandatory procedures and guidance as well as preferred methods of accomplishing those procedures. Pertinent information in the pamphlet includes, but is not limited to, explosives safety training standards, explosives safety management programs, safety inspection procedures, and guidance for the creation of installation ammunition and explosive location maps. Fort Sill personnel utilize these standards when preparing for training to ensure safety management is a top priority.

Fort Sill Artillery Ammunition.
Photo Credit: Sgt. Bradley Cooney

Army Compatible Use Buffer Program

Title 10, Section 2684a of the United States Code authorizes the DOD to partner with non-federal governments and private organizations to establish buffer zones around critical active military assets. Within the Department of the Army, this is called the Army Compatible Use Buffer (ACUB) program. Through the ACUB program Army installations can work with organization partners, such as land trusts, to acquire land or development rights to establish buffer zones that can help protect habitats, sensitive areas, and military training areas without acquiring any new land for Army ownership. The partner organization is the entity that acquires and manages the land or land rights.

Army Regulation 200-1, Environmental Protection and Enhancement

This regulation implements federal, state, and local environmental laws and DOD policies for preserving, conserving, and restoring the environment. This regulation should be used in conjunction with 32 Code of Federal Regulation Part 651, which provides Army policy on NEPA requirements and supplemental program guidance.

This regulation defines Army Environmental Management System (EMS) framework and the five interconnected EMS areas of policy which are policy, planning and implementation, program management and operation, checking and corrective action, and management review. This is pertinent to military installations that have environmental resources such as habitats for protected species.

Clean Air Act

The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources in order to control air pollution in the United States. Under the CAA, the US Environmental Protection Agency (EPA) established limits on six criteria pollutants carbon monoxide, lead, ground-level ozone, nitrogen dioxide, particulate matter, and sulfur dioxide. Standards for these pollutants are defined through the National Ambient Air Quality Standards (NAAQS). Standards are set to protect public health and public welfare. The CAA also gives EPA the authority to limit emissions of air pollutants coming from sources like chemical plants, utilities, and steel mills. Individual states may have stronger air pollution laws, but they may not have weaker pollution limits than those set by EPA. The Clean Air Act requires each state to develop a State Implementation Plan that outlines how it will control air pollution.

Clean Water Act

The Clean Water Act (CWA) governs the management of water resources and controls and monitors water pollution in the United States. The CWA establishes the goals of eliminating the release of toxic substances and other sources of water pollution to ensure that surface waters meet high quality standards. In so doing the CWA prevents the contamination of nearshore, underground, and surface water sources.

Medicine Creek
Photo Credit: Donny Carter

Department of Defense Conservation Partnering Initiative

In 2003, Congress amended Title 10 U.S.C. §2684a and §2692a (Pubic Law (P.L.) 107-314), the National Defense Authorization Act (NDAA), to give authority to the DOD to partner with other federal agencies, state and local governments, and conservation-based non-governmental organizations to set aside lands near military bases for conservation purposes and to prevent incompatible development from encroaching on and interfering with military missions. This law provides an additional tool to support conservation and environmental stewardship on and off military installations.

Department of Defense Minimum Antiterrorism Standards for Buildings (UFC 4-010-01)

The DOD published minimum security standards for use in facility and master planning through Unified Facilities Criteria (UFC) 4-010-01. The purpose of these standards is to provide appropriate, implementable, and enforceable measures to establish a level of protection against terrorist attacks based on the needed level of protection specific to each facility or installation. Security measures are required for four categories of DOD buildings:

- Inhabited Buildings that are routinely occupied by 11 or more personnel at a population density of at least one person per 430 square feet of gross area
- Primary Gathering Buildings, which are inhabited buildings routinely occupied by 50 or more personnel. All areas of such a facility that meet the population density requirement for an inhabited building must be treated as primary gathering
- Billeting, in which 11 or more unaccompanied personnel are routinely housed
- High-Occupancy Family Housing, which has 13 or more units per building

Required security measures, such as allowable standoff distances, vary for facilities contained within a controlled perimeter. As defined by UFC 4-010-01, a controlled perimeter is a physical boundary that possesses sufficient means to channel vehicles to the access control point and where there is a demonstrated capability to search for and detect explosives. Although a controlled perimeter is typically in the form of an installation fence, natural features such as densely wooded terrain or other topographical features that assist in impeding or denying access to an area may qualify as an Antiterrorism / Force Protection measure.

Department of Defense Partners in Flight Program

The DOD Partners in Flight (PIF) program employs habitat-based management strategies to maintain healthy landscapes and training lands. The PIF representatives assist natural resource managers in improving the monitoring, management, and education programs involving birds and bird habitat. The PIF requires a Strategic Plan which identifies actions that support mission activities while protecting bird populations. The PIF program not only helps to ensure mission-critical aviation activity at Fort Sill but also to promote the protection of important local bird species.

DOD Readiness and Environmental Protection Integration

To implement the authority provided by the DOD Conservation Partnering Initiative, the DOD established the Readiness and Environment Protection Integration (REPI) program. This program enables the DOD to work with state and local governments, nongovernmental organizations, and willing landowners to limit encroachment and incompatible land use by preserving undeveloped land. This land preservation could allow for buffers around the installation to be established to help further the installation mission. REPI funds are used to support a variety of DOD partnerships that promote compatible land use. By relieving encroachment pressures, the military is able to test and train in a more effective and efficient manner. Preserving the land surrounding military installations protects habitats for plant and animal species.

DOD Siting Clearinghouse

Section 358 of the 2011 National Defense Authorization Act pertains to studying the impacts of the development of new energy production facilities on military operations and readiness. For example, tall structures constructed for energy production facilities and transmission projects, such as wind turbines and solar power towers, as well as electrical transmission towers sited in or under designated low-altitude military training routes and special use airspace may present a serious collision hazard to military aircraft operations. Additionally, wind turbines located near military test and training ranges can impact airborne military radar capability.

The DOD Siting Clearinghouse serves to coordinate the DOD review of existing applications for energy projects. Several key elements of Section 358 include designation of a senior official and lead organization to conduct the review of energy project applications, a specific time frame for completion of a hazard assessment associated with an application (30 days), specific criteria for DOD objections to projects and a requirement to provide an annual status report to Congress. This legislation facilitates procedural certainty and a predictable process that promotes compatibility between energy independence and military capability.

The DOD Siting Clearinghouse conducts a formal review when required by Section 44718 of Title 49 in the US Code and for projects within military training routes or special use airspace. Developers must file a completed application with the Secretary of Transportation to begin the formal review. The DOD Siting Clearinghouse then submits the application to any DOD components that may be impacted by the development. The DOD components then must provide their comments and recommendations no later than 20 days after receiving the application. Within 30 days of receiving the application the DOD Siting Clearinghouse must evaluate all comments and recommendation to determine if the proposed project will either have no impact, an adverse impact but the impact is sufficiently attenuated, or an adverse impact that needs to be mitigated.

When a determination is made that the proposed development will have an adverse impact, the applicant must discuss the possibility of mitigation within five days of receiving the notification. If an agreement is reached that removes any adverse impact of the proposed project, the application is amended and resubmitted to the Secretary of Transportation. If an agreement to mitigate the impacts is not reached and the DOD Siting Clearinghouse determines that the proposed project would result in an unacceptable risk to national security, then that recommendation is submitted to the senior official. If the senior official also determines an unacceptable risk, that recommendation is submitted to the senior officer. If the senior officer determines an unacceptable risk, the senior officer must

identify which of the three criteria in Section 211.3 of the US Code create the unacceptable risk to national security and convey that determination to the Secretary of Transportation.

During the Mission Compatibility Evaluation process, if a proposed project is determined to have potential adverse impacts to a military base or military readiness, the Department of Defense will establish a Mitigation Response Team (MRT) which is responsible for working with a project developer to identify potential impacts and reasonable mitigation options. This MRT process typically results in a binding Mitigation Agreement between the DOD and the developer, which memorializes the solutions developed through that consultation process.

The DOD Siting Clearinghouse also provides an informal review when requested. This is typically done by a developer to receive a preliminary determination before filing under the requirement of the US Code.

On December 12, 2017, the 2018 National Defense Authorization Act was signed into law, which among other things, included changes to the DOD Siting Clearinghouse, which will be transitioned to the Military Aviation and Installation Assurance Siting Clearinghouse. This new Clearinghouse must provide procedures for energy project developers to consult with affected military installations, facilitating better coordination and communication from the project initiation. Part of the enhanced coordination and communication requires the Clearinghouse to develop procedures for energy project developers to submit the project area and preliminary layout at least one year before the developer plans to begin construction of a proposed energy project is within any DOD operated surveillance radar or military training route. These procedures will help set a more clearly defined trigger for coordination and outreach between affected military installations and energy project developers.

Also, the review period upon receiving an energy project application from the Secretary of Transportation is extended from 30 to 60 days, allowing more time for the Clearinghouse and affected military installations to assess the proposed development of any potential adverse impacts.

Endangered Species Act

The Endangered Species Act (ESA) establishes a program for the conservation of threatened and endangered plants, animals and their habitats. The US Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) are the lead implementing agencies of the ESA. The USFWS has primary responsibility for terrestrial and freshwater organisms, while the marine wildlife is the responsibilities of the National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries Service (NMFS). Under the ESA, species may be listed as either endangered or threatened. “Endangered” means a species is in danger of extinction throughout all or a significant portion of its range. “Threatened” means a species is likely to become endangered within the foreseeable future.

When a species is proposed for listing as endangered or threatened under the ESA, USFWS must consider whether there are areas of habitat believed to be essential to the species' conservation. Those areas may be proposed for designation as a "critical habitat". The determination and designation of a critical habitat is one of the most controversial and confusing aspects of the ESA. A critical habitat designation does not necessarily restrict further development; it is a reminder to federal agencies that they must make special efforts to protect the important characteristics of these areas.

The ESA requires federal agencies, in consultation with the USFWS and/or the NMFS, to ensure that actions they "…authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species.". The Act also prohibits any action that results in a taking of any listed species of endangered plant, fish, or wildlife. The ESA provides a platform for the protection of critical habitat and species that may be at risk of extinction.

Only activities that involve a federal permit, license, or funding and are likely to destroy or adversely modify the area of critical habitat will be affected. If this is the case, USFWS will work with the federal agency and, where appropriate, private or other landowners to amend their project to allow it to proceed without adversely affecting the critical habitat.

The ESA is important as it limits the activities that the military can perform if they pose a risk to any threatened or endangered species. In some cases, presence of a threatened or endangered species may cause reductions to a mission program.

There are two federally listed endangered species that can be periodically found at Fort Sill – the Black-Capped Vireo and the Whooping Crane. Black-Capped Vireo are small birds that can be found on Fort Sill and in the nearby Wichita Mountains Wildlife Refuge between March and September each year. The natural areas found on the installation and the wildlife refuge are some of the last remaining native habitats for this species of bird. Fort Sill has a biological agreement with the USFW to aid in the protection of the Black-Capped Vireo. This agreement does not impact training at Fort Sill. The Whooping Crane has reportedly been seen passing over the area during migration. Whooping Cranes have not been seen on the installation in recent years and as such there is no management plan in place for these birds.

The Black-Capped Vireo is an endangered bird species near Fort Sill

Federal Aviation Act

The Federal Aviation Act provides methods for overseeing and regulating civilian and military use of airspace. The Act requires the Secretary of Transportation to make long-range plans that formulate policy for the orderly development and use of navigable air space. The intent is to serve the needs of both civilian aeronautics and national defense, but the Act does not address specific needs of military agencies. Military planning principles require working alongside local, state, and federal aviation regulations and policies, but sometimes must supersede these due to national security interests. The Federal Aviation Administration (FAA) was created as a result of the Federal Aviation Act and serves a variety of purposes, including the management of airspace over the US.

The 500-foot rule, publicized by the FAA, states that every citizen of the US has "a public right of freedom of transit in air commerce through the navigable air space of the United States". The rule was formally announced in the 1963 Court of Claims ruling in Aaron v. United States and states that flights 500 feet or more above ground level (AGL) do not represent a compensable taking because flights 500 feet AGL enjoy a right of free passage without liability to the owners below.

Another important outcome of the Act is Federal Aviation Regulation Part 77, commonly referred to simply as Part 77 Compliance, which provides the basis for evaluation of vertical obstruction compatibility. This regulation determines compatibility based on the height of structures or natural features in relation to their distance from the ends of a runway, using the elevation of the runway as the measuring point. Using a distance formula from this regulation, local jurisdictions can assess the height restrictions near airfields. Additional information on Part 77 Compliance can be found on the FAA website at http://www.faa.gov/.

The Federal Aviation Act helps to protect areas critical to aviation activity at Fort Sill. Without regulations that dictate structure placement near approach and departure areas of an airfield, certain structures and uses may encroach and inhibit the free use of navigable airspace. Part 77 Compliance establishes standards to determine obstructions within navigable airspace, typically within a certain distance from an airport or airfield. The law defines an obstruction to air navigation as an object of greater height than any of the following heights or surfaces:

- A height of 499 feet AGL at the site of the object
- A height that is 200 feet AGL or above the established airport elevation, whichever is higher, within three nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length. This height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport up to a maximum of 499 feet
- A height within a terminal obstacle clearance area, including an initial approach segment, a departure area, or a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required clearance
- A height within an en route obstacle clearance area, including turn and termination areas, of a federal airway or approved off-airway route, that would increase the minimum obstacle clearance altitude
- The surface of a takeoff and landing area of an airport or any imaginary surface established under Part 77.19, DOD: Part 77.21, and heliports: Part 77.23. However, no part of the takeoff or landing area itself will be considered an obstruction

The FAA has identified certain imaginary surfaces around runways to determine how structures and facilities are evaluated and whether they pose a vertical obstruction in relation to the airspace around a runway. The levels of imaginary surfaces build upon one another and are designed to identify potential obstructions and eliminate obstructions to air navigation and operations, either natural or man-made. The dimension or size of an imaginary surface depends on the runway classification.

Federal Land Policy and Management Act of 1976

The Federal Land Policy and Management Act of 1976 established the authority for public lands to be managed and planned according to national and local interests. Additionally, the law prescribes that public lands that have been identified for development shall uphold and protect the scientific, scenic, historical, ecological, environmental, and other values that are unique to specific geographies. This law provides the stimulus for the various resource management plans that have been developed and prepared for public agencies (e.g., Bureau of Land Management).

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 is a federal regulation that established a US national policy promoting the protection and enhancement of the environment. It requires federal agencies to analyze and consider the potential environmental impact of their actions. The purpose of NEPA is to promote informed decision-making by federal agencies by providing detailed information concerning significant environmental impacts to both agency leaders and the public.

All projects receiving federal funding require NEPA compliance and documentation. NEPA is applicable to all federal agencies, including the military. Not all federal actions require a full Environmental Impact Statement (EIS). In cases where an action may not cause a significant impact, the agency would be allowed to produce a less detailed Environmental Assessment (EA).

A NEPA document can serve as a valuable planning tool for local officials. An EA can assist in the determination of potential impacts that may result from changing military actions or operations and their effect on municipal policies, plans and programs, and the surrounding community. If the EA finds there will be no significant impacts, a Finding of No Significant Impact (FONSI) will be issued. If the EA finds the proposed changes to military actions and operations will create significant impacts, an EIS will be prepared to further detail and outline the impacts upon the environment to the public. An EIS will result in a Record of Decision (ROD) that explains the decision made based on the information presented in the EIS. The EIS also describes the alternatives considered, and outlines mitigation and monitoring plans.

NEPA mandates that the military analyze the impact of its actions and operations on the environment, including surrounding civilian communities. Part of this analysis explores ways to reduce any adverse environmental impact. NEPA helps to ensure that projects receiving federal funding at Fort Sill do not have adverse effects on the local environment. However, this also prohibits what projects the installation may be able to implement. The purpose of NEPA is to identify significant environmental impacts and inform the public of the findings. In some cases, a statement of overriding concern may allow a potentially significant environmental impact to be allowed. Strong public opinion could also prohibit a project from moving forward at its desired capacity.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966 requires federal agencies to consider the effects of a proposed project on properties listed in, or eligible for listing in, the National Register of Historic Places. Since no specific action is being proposed as part of this planning process, the review of cultural resources is focused on the identification of existing resources and not potential effects that would result from a specific proposed action.

National Pollutant Discharge Elimination System

Per the Clean Water Act (CWA), the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge into US waters. Point sources are discrete conveyances such as pipes or man-made ditches. According to the NPDES, individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need a NPDES permit; however, industrial, municipal, and other facilities must obtain permits if they discharge directly to surface waters.

Noise Control Act of 1972

The Noise Control Act of 1972 acknowledged that noise not adequately controlled has the potential to endanger health and quality of life. This Act states that all Americans are entitled to an environment free from noise that can jeopardize their general health and quality of life. At the same time the Act was being developed, military installations were experiencing the impacts related to encroaching urban development adjacent to their boundaries and the resulting complaints regarding noise from military operations.

The Noise Control Act is an important consideration as encroaching development and increased population near military installations often creates compatibility concerns. As communities grow, it is important that the military installation, developers, and the affected communities work together to mitigate the issue of noise and develop ways to coexist.

Operational Noise Management Program

The Operational Noise Management Program provides a methodology for assessing impacts of noise generated by military operations on surrounding communities. This program was established by the Department of the Army to assist installations and surrounding communities develop guidelines for land use planning to mitigate noise and other hazards to the general public while protecting the public investment in the installation. This program encourages compatibility measures for both the US Army and surrounding communities through the development of an Operational Noise Management Plan (ONMP). The Operational Noise Management Handbook, completed in November 2005, provides guidance for the development of an ONMP.

Noise assessment is the cornerstone of the ONMP. Noise impacts translate into several zones for which land use planning guidelines are developed to protect the public. The three noise zones for addressing noise sensitive land uses consistent with federal law are:

Zone I – Noise occurring in this area is compatible with most noise-sensitive land uses, such as housing, schools, and medical facilities. Within Zone 1 is a subdivision known as the Land Use Planning Zone (LUPZ). The LUPZ acts as a buffer to Zone II—allowing for greater noise impacts than Zone I, but less noise impacts than Zone II. Noise-sensitive land uses are still generally acceptable within this area.

Zone II – Noise occurring in this area is generally incompatible with noise-sensitive land uses.

Zone III – Noise occurring in this area is incompatible with noise-sensitive land uses.

Sustainable Range Program

Encroachment towards Army training and firing ranges has become a major concern in recent years. Pressure from urbanization, environmental protection, competition for airspace and electromagnetic frequencies, and reduced public perception of national security needs have limited mission capabilities and operations at multiple installations nationwide. Furthermore, open ranges are increasingly becoming “islands” of biodiversity amidst urban development. These concerns, in addition to public nuisances such as smoke, noise, and lack of accessibility have led to apprehension of the nature and use of military ranges.

The Sustainable Range Program (SRP) is the Army's overall approach to improving the design, operation, use, and management of its ranges to ensure the long-term sustainability of these facilities. The SRP's core programs are the Range and Training Land Program and the Integrated Training Area Management Program, which focus on the doctrinal capability of the Army's ranges and training land. In order to ensure the accessibility and availability of Army ranges and training land, the SRP core programs are integrated with the facilities management, environmental management, munitions management, and safety program functions.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) is a federal law that ensures the quality of drinking water in the United States. The SDWA authorizes the EPA to set national health-based drinking water standards to protect against both naturally-occurring and man-made water contaminants. The SDWA applies to every public water system in the US. A reliable and clean water source is necessary for any population center to function and grow. A decrease in the quality of the drinking water in the Study Area may decrease the amount of people that can reside in the region. If a reliable and clean water source is not available to Fort Sill, it may impact mission activities.

The Sikes Act

The Sikes Act requires the DOD to develop and implement Integrated Natural Resources Management Plans (INRMPs) for military installations across the United States. INRMPs are prepared in cooperation with the USFWS and state fish and wildlife agencies to ensure proper consideration of fish, wildlife, and habitat needs. The Sikes Act requires INRMPs to be reviewed at least every five years with the USFWS and state fish and wildlife agencies. Army Regulation 200-1, "Environmental Protection and Enhancement", and policy memoranda guide the implementation process of the Sikes Act.

Findings from an INRMP could impact operations at an installation by identifying areas where the military needs to better manage the natural resources on the property. Depending on the management action required, this could render the area unusable for certain activities such as weapons firing.

4.2 Fort Sill Plans and Regulations

Fort Sill plans and programs provide guidance and regulations for land uses and development activities on the installation. These tools govern land use decisions that occur inside the fence line or within the boundary of the military mission footprint in relation to the military missions.

These tools provide guidance and establish measures for standard operating procedures during certain events such as weapons firing. There are various installation tools that are instrumental in assisting and guiding land use decisions as they relate to the military mission.

Installation Compatible Use Zone (ICUZ) Study

The Installation Compatible Use Zone (ICUZ) Program's purpose is to minimize community noise impacts while stabilizing and sustaining the Army's mission. The ICUZ focuses on specific land uses surrounding Army installations that are compatible with military noise. The ICUZ study measures noise emanating from military training activities to create appropriate recommendations for noise-impacted areas. Fort Sill's most recent ICUZ study was completed in 2015.

Integrated Cultural Resources Management Plan

The objective of the Integrated Cultural Resources Management Plan (ICRMP) is to balance the management of historic and cultural resources with mission readiness at Fort Sill. The ICRMP supports early identification of cultural and historic resources and defines necessary actions for managing agencies to ensure the protection of resources during military operations and non-military activities.

The ICRMP establishes compliance procedures to properly manage cultural and historical resources, establishing existing conditions and identifying the potential impacts of Fort Sill's mission on them. It also identifies impacts to mission readiness caused by preservation, maintenance, and repair of buildings and the continued use of historic buildings. In addition, the ICRMP establishes a coordination process between the installation and many state or regional agencies including the State Historic Preservation Office, the Advisory Council on Historic Preservation, the National Park Service, Native American groups, and the interested public. This process is subject to Section 106 of the National Historic Preservation Act (NHPA), which establishes a process for working with federal agencies on historic preservation issues.

The ICRMP identifies that Fort Sill currently contains eight sites listed in the National Register of Historic Places (NRHP), including the Fort Sill National Landmark District (Fort Sill NHLD). The Fort Sill NHLD contains the buildings and structures from the installation's early history from 1869 to 1890.

Fort Sill also has nine Native American tribes that have a historic affiliation within the Fort Sill region and participate in cultural resource matters. These nine Native American tribes are:

- Apache Tribe of Oklahoma
- Caddo Nation of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Chickasaw Nation
- Comanche Nation
- Delaware Nation
- Fort Sill Apache Tribe
- Kiowa Indian Tribe of Oklahoma
- Wichita and Affiliated Tribes

Integrated Natural Resources Management Plan

As required by the Sikes Act, an Integrated Natural Resources Management Plan (INRMP) provides the opportunity for the proper inventorying, cataloging, and management of natural resources found on US government-managed lands. The DOD must review or update INRMPs for each installation with identified natural resources every five years to update the needs of local natural resource management policies. These policies affect all aspects of an installation's physical environment, including water quality, biodiversity, ecosystem, habitat quality, and mineral resources. These plans create the opportunity for the DOD and local base commanders to work with other federal, state, and local agencies to properly manage significant local resources for the maximization of compatible mixed use.

The INRMP outlines the various natural resources and addresses other related topics including important habitat found on the installation, soil types, management of noxious weeds and wildland fire, wildlife and riparian management, water resources and water rights, inter-agency responsibilities, and coordination efforts. It also provides the overall management plan for natural resources on Fort Sill to ensure no loss of capability for military training exercises.

Fort Sill utilizes the INRMP to identify natural resources located on the installation that require protection. The Fort Sill INRMP also identifies management measures to ensure the natural resources are protected in concert with the training that occurs on installation.

There are two federally listed endangered species that can be periodically found at Fort Sill, the Black-capped Vireo and the Whooping Crane. However, there are no designated critical habitats for either species at Fort Sill that constrain training operations. The Fort Sill INRMP was last updated in 2014.

Fort Sill Regulation 95-1: General Provisions and Flight Regulations

This regulation establishes responsibilities, procedures, and rules for aircrew training, standardization, and the operation of Army aircraft assigned, attached, or transit to Fort Sill, Oklahoma.

Fort Sill Regulation 95-23: Unmanned Aerial System Flight Regulations

This regulation establishes responsibilities, procedures, and rules for aircrew training, standardization, and the operation of Army aircraft assigned, attached, or transit to Fort Sill, Oklahoma.

Fort Sill Regulation 385-1: Post Range Regulation

This regulation establishes responsibilities, procedures, and rules for all personnel utilizing the Installation Range Complex by personnel assigned, attached or transient to Fort Sill.

Fort Sill Regulation 385-10: Safety Regulation

This regulation prescribes policy, procedures, and responsibilities for the United States Army Fires Center of Excellence and Fort Sill (USAFCOEFS) Accident Prevention Program. It implements requirements of the Occupational Safety and Health (OSHA) Act of 1970 as implemented in Executive Order 12196; 29 Code of Federal Regulations 1960; Department of Defense Instructions 6055 Series; Army Regulation (AR) and Department of the Army (DA) Pamphlet (PAM) 385-10.

Fort Sill Regulation 385-15: Wildlife Aircraft Strike Hazard (WASH) Plan

This regulation provides procedures, guidance and defines responsibilities for Wildlife Management at HPAAF to effectively manage the Wildlife Aircraft Strike Hazard (WASH) plan. It incorporates the provisions of the Environmental Protection and Enhancement AR 200-1, Airspace, Airfields/Heliports, Flight Activities, Air Traffic Control, and Navigational Aids AR 95-2, Army Safety Program AR 385-10, Department of the Army Pamphlet (DA Pam) 385-10, Army Aviation Accident Prevention (DA Pam 385-90) and IMCOM PAM 385-90-1.

Wildlife Aircraft Strike Hazard

A Wildlife Aircraft Strike Hazard (WASH) plan is designed to minimize wildlife and bird strike damage to military aircraft. A WASH plan is designed to manage birds, alert aircrew and operations personnel, and provide increased levels of flight safety, particularly during the critical take-off and landing phases of flight.

The purpose of a WASH plan is to:

- Designate a Wildlife Hazard Working Group (WHWG) and outline each members' responsibilities
- Establish procedures to identify hazardous situations and to aid supervisors and aircrews in avoiding these situations
- Establish procedures for reporting hazardous wildlife activity and altering / discontinuing flying operations
- Establish procedures to identify, provide information, and eliminate or reduce environmental conditions that attract wildlife to the airfield

Fort Sill prepared a WASH plan in 2016 under Fort Sill Regulation 385-15. The WASH plan applies to personnel assigned or attached to airfield operations at Henry Post Army Airfield (HPAAF).

4.3 State of Oklahoma Plans and Programs

The state tools provide further assistance and protection of lands in the State of Oklahoma. The tools authorize or mandate local counties and cities to provide for the protection of the state's valuable industries including the DOD and agriculture. In addition, the state's tools require communities and developers to protect and preserve the state's natural resources, including land and water, through regulatory measures to protect them from over-consumptive practices.

Legislative Initiatives

House Bill 2472

House Bill 2472 was passed in 2004, and permits any municipality that contains an active-duty US Air Force military installation to create an ordinance restricting or prohibiting certain future land uses within five miles of the installation. Although Fort Sill is a US Army installation, this legislation is applicable to Henry Post Army Air Field, and requires such ordinances to be consistent with Fort Sill studies and recommendations.

House Bill 2298

House Bill 2298 was passed in 2017 and eliminates tax credits for wind energy development in the state for wind energy facilities that were not operational by July 1, 2017.

Senate Bill 3561

Senate Bill 3561 passed in May 2018, and addresses wind energy encroachment and adverse impacts to military installations and missions, including military training routes. The Bill requires wind energy developers to submit the Determination of No Hazard from the FAA or an approved mitigation plan from the Military Aviation and Installation Assurance Siting Clearinghouse to Oklahoma's Corporation Commission and Strategic Military Planning Commission. It is the Oklahoma's Strategic Military Planning Commission's duty to notify local base commanders of proposed wind energy developments.

Oklahoma Statutes

Oklahoma Statutes Sections (§) §11-43-101 and §11-43-103 allow municipalities to regulate buildings, structures, and land. However, these statutes do not require municipalities to adopt comprehensive plans or zoning ordinances. Following are the state statutes as they are written.

§11-43-101. General Power of Municipalities

For the purpose of promoting health, safety, morals, or the general welfare of the community, a municipal governing body may regulate and restrict the height, number of stories, and size of buildings and other structures, the percentage of lot that may be occupied, the size of yards, courts and other open spaces, the density of population, and the location and use of buildings, structures and land for trade, industry, residence or other purposes.

§11-43-103. Purpose of regulations – Comprehensive Plan

Municipal regulations as to buildings, structures and land shall be made in accordance with a comprehensive plan and be designed to accomplish any of the following objectives:

1. *To lessen congestion in the streets;*
2. *To secure safety from fire, panic and other dangers;*
3. *To promote health and the general welfare, including the peace and quality of life of the district;*
4. *To provide adequate light and air;*
5. *To prevent the overcrowding of land;*
6. *To promote historical preservation;*
7. *To avoid undue concentration of population; or*
8. *To facilitate the adequate provision of transportation, water, sewerage, schools, parks and other public requirements.*

The regulations shall be made with reasonable consideration, among other things, as to the character of the district and its peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout the municipality. The governing body shall provide the manner in which regulations, restrictions and district boundaries shall be determined, established and enforced, and amended, supplemented or changed.

Oklahoma State Statute §11-43-101.1 also permits municipalities impacted by military installations to restrict or prohibit future uses in areas affected by military training noise. Following is an excerpt from the statute:

Any municipality in this state that is wholly or in part within an Air Installation Compatible Use Zone (AICUZ) study area, Joint Land Use Study (JLUS) area, Army Compatible Use Buffer (ACUB), or an Environmental Noise Management Plan (ENMP) of an active duty, National Guard or Reserve military installation may enact a city ordinance restricting or prohibiting future uses for that incorporated area which lies within the AICUZ, JLUS, ACUB, or ENMP area and which may expose residents to noise greater than sixty-five (65) Day-Night Noise Level (DNL) or accident potential that could affect the public health, safety, and welfare, or interfere with military operations, including aircraft operations. Such authority shall not extend into the corporate limits of another municipality.

Oklahoma County Planning Commission and County Board of Adjustment Authorized

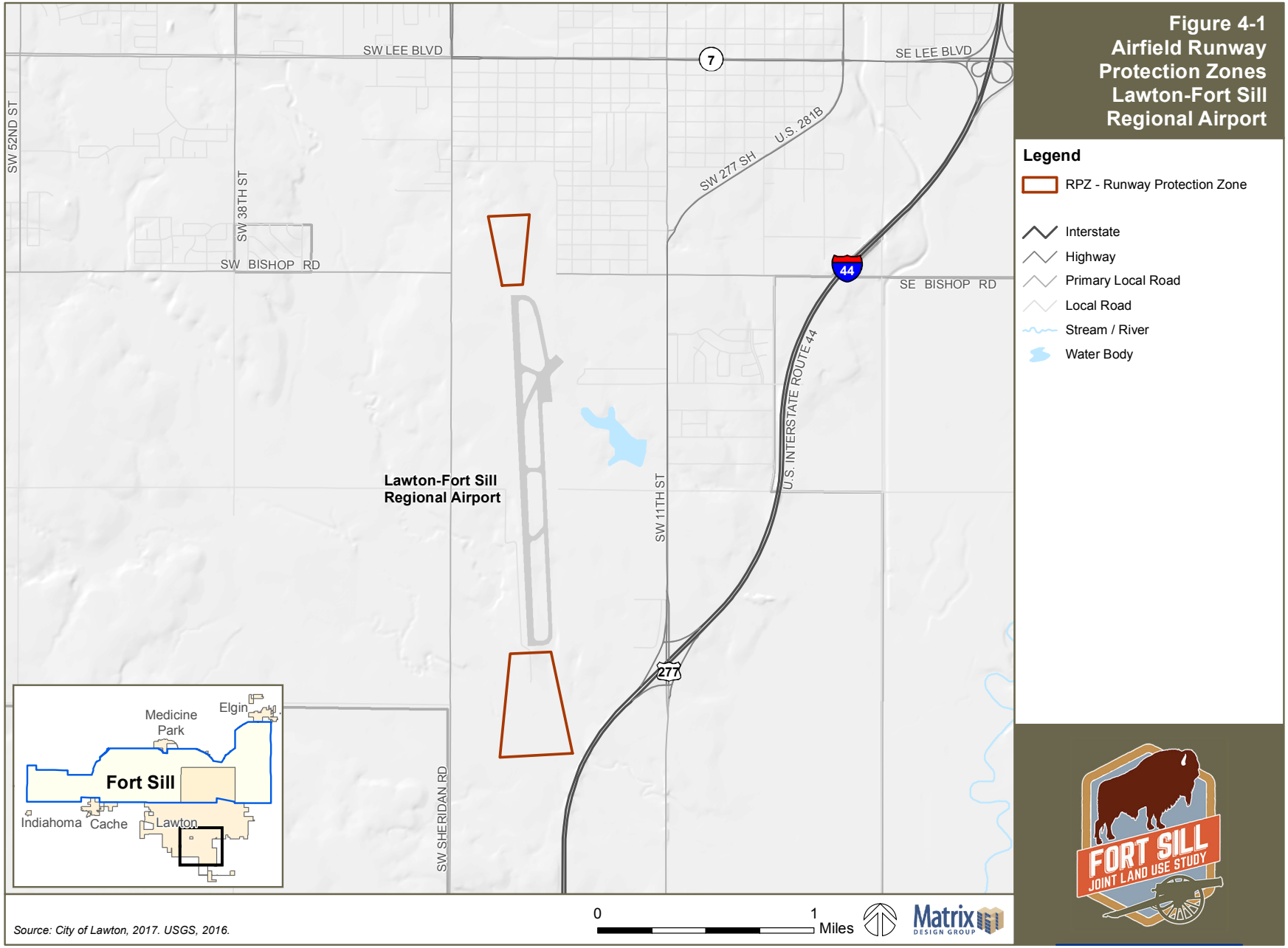
In 1970, the State of Oklahoma created Statute §865.51 which empowered any county in the state to appoint a Planning Commission and a Board of Adjustment for the purpose of county planning in a manner as provided in the statutes. The statutes provide the means to establish county planning but do not mandate it.

Aircraft Pilot and Passenger Protection Act

The Oklahoma Aeronautics Commission created the Aircraft Pilot and Passenger Protection Act in 2010, which established Runway Protection Zones for all public-use airports, including the Lawton-Fort Sill Regional Airport. According to the statute, a Runway Protection Zone is:

A trapezoidal zone centered along the extended runway centerline, beyond each end of the primary surface, two thousand five hundred (2,500) feet long, with an inner width of one thousand (1,000) feet and an outer width of one thousand seven hundred fifty (1,750) feet. The function of the runway protection zone is to enhance the protection of people and property on the ground

Any developer proposing any structure within a Runway Protection Zone must acquire a permit from the Oklahoma Aeronautics Commission prior to initiating construction or installation. The commission has the authority to deny a permit if the structure is considered "incompatible" with normal airport operations. The Runway Protection Zones for Lawton-Fort Sill Regional Airport are depicted on Figure 4-1.


SW LEE BLVD
SE LEE BLVD
7
SW 52ND ST
SW 38TH ST
SW BISHOP RD
SE BISHOP RD
SW 277 SH
U.S. 281B
44
U.S. INTERSTATE ROUTE 44
SW 11TH ST
Lawton-Fort Sill
Regional Airport
277
SW SHERIDAN RD
Medicine
Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: City of Lawton, 2017. USGS, 2016.
0
1
Miles
Matrix
DESIGN GROUP
Figure 4-1
Airfield Runway
Protection Zones
Lawton-Fort Sill
Regional Airport
Legend
RPZ - Runway Protection Zone
Interstate
Highway
Primary Local Road
Local Road
Stream / River
Water Body
FORT SILL
JOINT LAND USE STUDY

4.4 JLUS Jurisdiction Planning Tools

Table 4-1 identifies the various tools that are utilized by each of the JLUS partner communities, and the tools are briefly evaluated regarding the effectiveness of their ability to address compatibility concerns. These tools are discussed in more detail on the following pages.

Table 4-1: Overview of Local Planning Tools for the JLUS Jurisdictions

Jurisdictions	Planning Tools							
	Comprehensive Plan	Zoning Ordinance	Zoning Code Height Restrictions	Lighting / Dark Sky Ordinance	Sound Attenuation Regulations	Alternative Energy Ordinance	Subdivision Regulations	Building Code
Comanche County	☐	☐	☐	☐	☐	☐	☐	❖
Kiowa County	☐	☐	☐	☐	☐	☐	☐	☐
City of Apache	☐	☐	☐	☐	☐	☐	☐	☐
City of Cache	❖	■	■	☐	☐	☐	■	❖
City of Elgin	☐	☐	☐	☐	☐	☐	☐	❖
City of Frederick	☐	☐	■	☐	☐	☐	■	■
City of Lawton	■	■	■	■	☐	☐	■	■
Town of Indiahoma	☐	☐	☐	☐	☐	☐	☐	☐
Town of Medicine Park	☐	■	■	☐	☐	☐	☐	☐
Town of Sterling	☐	■	☐	☐	☐	☐	☐	❖

■ The tool is utilized but does not address land use issue(s) related to military compatibility.

■ The tool is utilized but only partially addresses land use issue(s) related to military compatibility.

☐ The jurisdiction does not employ this tool.

❖ Tool was unavailable for review during the JLUS process.

Comanche County

Comanche County is authorized by state law to plan and regulate land uses, but it has not implemented any planning tools.

City of Cache

Cache Land Use Plan

The City's Land Use Plan (the equivalent of a Comprehensive Plan) was not available at the time of the development of this report.

Zoning Ordinance

The most recent Zoning Ordinance establishes 10 zoning districts. Each zoning district has specific land use regulations regarding permitted land uses, maximum building heights, and minimum lot areas. The Agriculture Residential (A-1) District does not set a maximum height, which could result in vertical obstructions that would encroach upon the Fort Sill mission. Except for the no maximum height for the A-1 District, the city has established compatible heights for all other zoning districts of 35 feet. In addition, there are no standards for lighting established.

Mobile homes, mobile home subdivisions, and modular homes are allowed in the city; however, the city does not set standards for sound attenuation to safeguard against noise impacts coming from the installation. Moreover, these types of home are not constructed with materials to minimize or reduce noise impacts in the interior of the mobile or modular home.

Subdivision Regulations

The tool is utilized but does not address compatibility with Fort Sill.

Building Code

The International Building Code does not contain military compatibility measures for sound transmission from exterior noise to interior.

City of Elgin

City of Elgin does not contain any planning tools that support compatible development with the military.

City of Lawton

2030 Land Use Plan

The City of Lawton's 2030 Land Use Plan (the equivalent of a comprehensive plan) was adopted in 2008 as the basic policy document for future growth of the city. Major General David P. Valcourt represented Fort Sill on the Steering Committee during the 2030 Land Use Plan planning process.

The City of Lawton recognizes Fort Sill as an integral community asset throughout the 2030 Land Use Plan, identifying the city as the "Lawton-Fort Sill" community and the contribution the installation has had on development. The 2030 Land Use Plan includes a Fort Sill Buffer Zone in Chapter 6: Areas of Special Treatment. The Plan states:

> *First, the cooperative development of a land use policy for all areas adjacent to the installation. The entire northern perimeter of Lawton abuts Fort Sill and its training grounds and firing ranges. Artillery firing and military training obviously produce impact noises, which may be incompatible with residential activities. It is not likely that the size of the firing ranges or training areas will grow in size due to the economics of land acquisition. Development of the 2030 Land Use Plan and other planning documents should be developed in concert with Fort Sill.*

Although it is important that the City of Lawton recognizes compatible development near Fort Sill, there are no guidelines or standards for communication and coordination outlined in the 2030 Land Use Plan that inform property owners and / or potential developers on acceptable developments near the installation.

Appendix D of the 2030 Land Use Plan contains a map identifying the Fort Sill Buffer Zones. The buffer zones resemble Fort Sill's ACUB priority areas and show buffer areas outside of Lawton's jurisdictional boundary. Each buffer area is labeled Buffer #1 through Buffer #6; however, there are no descriptions or standards associated with each buffer zone.

Zoning Ordinance

The recent Zoning Ordinance establishes 22 zoning districts. Each zoning district has specific land use regulations regarding permitted land uses, maximum building heights, and minimum lot areas. However, while majority of the zoning regulations and standards do not address compatibility with Fort Sill, the City established the Residential Estate District (RE), which is a residential district designed to be located on the fringe of the urban area of the city. The RE District allows for single-family residential dwellings on a larger lot size, which in this district the lot size may not be smaller than one acre. Schools and churches are also permitted in this district.

While the RE District is a good step forward relative to compatibility, one-acre lot sizes could still pose an encroachment issue if there are 500 or 700 units in one subdivision. This is unlikely, but there is nothing in the ordinance that specifies coordination with Fort Sill regarding these types of subdivisions.

The Ordinance establishes lighting regulations for multi-family residential, but there is no reference to single-family residential development. Moreover, there are no regulations for fully-cutoff, fully-shielded, or Backlight, Uplight, and Glare (BUG)-rated lighting fixtures that reduce light pollution and horizon brightening.

Subdivision Regulations

The City's subdivision regulations do not address compatibility with Fort Sill.

Building Code

The City of Lawton adopted the 2009 edition of the International Building Code. However, the International Building Code does not contain military compatibility measures.

Town of Indiahoma

The Town of Indiahoma has not developed any planning tools that support compatible development with Fort Sill.

Town of Medicine Park

Land Use Plan

The Town of Medicine Park does not currently have an adopted land use or master plan for the community. However, the Town is in the initial phase of the process to develop a plan and is expected to be completed by the end of 2018.

Zoning Ordinance

The recent Zoning Ordinance establishes six zoning districts. However, none of these districts have military compatibility measures. The Zoning Ordinance limits new residential and commercial development to three stories; however, the stories do not have a height limitation associated with them.

Town of Sterling

Zoning Ordinance

The most recent Zoning Ordinance establishes six zoning districts. Each zoning district has specific land use regulations regarding permitted land uses, maximum building heights, and minimum lot areas. However, none of these regulations and standards address compatibility with Fort Sill.

Kiowa County

Kiowa County is authorized by state law to plan and regulate land uses, but it does not implement any planning tools.

City of Apache

The City of Apache does not contain any planning tools that support compatible development with nearby the military installation.

City of Frederick

Zoning Ordinance

As authorized by 1971 Oklahoma Statutes 101-115, Title 3 and HB 359 (1945), the City of Frederick adopted airport zoning in October 1980. Known as the Frederick Regional Airport Hazard Zoning Ordinance, it limits the height of structures and objects of natural growth within the airport environs (approach surfaces/zones, horizontal and conical surfaces/zones, and transitional surfaces/zones). Also, codified in Section 12-295 to 299 of the city's code of ordinances, the airport is zoned as a Heavy Industry District, though "airport" is not a specified use.

Subdivision Regulations

The City's subdivision regulations do not address compatibility with Fort Sill.

Building Code

In 2007, the City of Frederick adopted the 2006 edition of the International Building Code. However, the International Building Code does not contain military compatibility measures.

4.5 Other JLUS References

In the interest of land use compatibility between the military and the local community, the DOD Office of Economic Adjustment (OEA) and other public interest groups, such as the National Association of Counties (NACo), have prepared educational documents and videos that educate and inform the public about encroachment issues and methods that can be used to address existing or future compatibility concerns. Five resources that have been published to inform the public on land use compatibility are identified as follows.

Guides

The Practical Guide to Compatible Civilian Development near Military Installations (July 2007), OEA

This guide offers general information on community development and civilian encroachment issues. The guide can be found at: http://www.oea.gov/.

Joint Land Use Study Program Guidance Manual (November 2006)

This manual provides guidance on the JLUS program, process, and efforts to support compatible development. This manual can be obtained on the OEA internet site at the following address: http://www.oea.gov/.

Encouraging Compatible Land Use between Local Governments and Military Installations: A Best Practices Guide (April 2007), NACo

This guidebook presents case studies of best practices between the military and communities through communication, regulatory approaches, and Joint Land Use Studies. The guide can be accessed on the NACo internet site at the following address: http://www.naco.org/.

State Policy Options: A Report of the National Conference of State Legislatures Task Force on Military and Veterans Affairs (January 2012)

This report provides state legislators and staff information about the range of policy options available to them to sustain their neighboring military installations and the associated testing and training operations. It is designed to encourage a greater understanding of the roles that state legislators, local government officials, land conservation organizations, and the military play in managing development near military bases and protecting natural resources and the health and safety of citizens. This report can be accessed at the following address: http://www.ncsl.org/documents/environ/NCSL_State_Policy_Options_020112_FINAL.pdf.

Collaborative Land Use Planning: A Guide for Military Installations and Local Governments, International City / County Management Association and the Metropolitan Institute at Virginia Tech

This guide provides essential observations about land use policy and procedures, discusses critical questions, and suggests model practices for military commanders to build stronger relationships with local policymakers and planning officials. This guide can be accessed at the following address: https://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=7667&destination=ShowItem.

Working with Local Governments: A Practical Guide for Installations, (May 2012), International City / County Management Association and the National Association of Counties

This guide provides a primer on how local governments operate and what installation personnel can do to engage state and local governments in dialogue on compatibility issues. The guide can be accessed from the following address: https://www.fedcenter.gov/_kd/Items/actions.cfm?action=Show&item_id=6203&destination=ShowItem.

Commander's Guide to Community Involvement (August 2012), Range Commanders Council Sustainability Group
This guide provides tools for proactively addressing compatibility concerns focusing on outreach, land use, urban sprawl and other sustainability areas. The guide includes the latest trends and approaches in community involvement best practices and highlights case studies. This guide can be accessed from the following address: http://www.repi.mil/Portals/44/Documents/Primers/Primer_CommunityInvolvement.pdf.

Local Sustainability Partnering Innovation Lab: Military-Community Partnering for Sustainability at the Local Level (February 2011), Association of Defense Communities (ADC)
This document presents the findings and lessons learned from an "innovation laboratory" conducted at the 2011 ADC Winter Conference. The document reports on this interactive facilitated discussion exercise, focusing on the case study of Camp Bullis, San Antonio, Texas and the collaborative community and military efforts to address local and regional sustainability. This document can be accessed from the following address: http://www.defensecommunities.org/wp-content/uploads/2011/03/ADC-Local-Sustainabilty-Innovation-Lab-Final-After-Action-Report.pdf.

The Base of the Future: A Call for Action by States and Communities (April 2016), Association of Defense Communities
This article examines the common threads that all bases share with their local hosts, and proposes an overarching approach to advise defense communities and states in the development of their own policies regarding adaptation and resilience when dealing with infrastructure, service and economic changes inside and outside the fenceline. Five key components focus on economic development and community planning, expanded sharing of services and infrastructure, mission capability and natural resource conservation, and military involvement and engagement for policy and legislation. This article can be accessed form the following address: http://defensecommunities.org/wp-content/uploads/2015/01/The-Base-of-the-Future_v5.pdf.

Strengthening National Defense: Countering Encroachment through Military-Community Collaboration (2009), National Academy of Public Administration
This report discusses the significant and growing challenges to military readiness created by nearby civilian community growth and proposes recommendations for increased collaboration among key stakeholders—local and state governments, non-profit organizations, the Military Services and installations, and other federal agencies—in order to creatively and effectively address these complex and critical issues. This report can be accessed from the following address: https://ciaonet.org/attachments/26009/uploads.

Installation-Community Partnerships: A New Paradigm for Collaborating in the 21st Century, Journal of Defense Communities
The article explores the changes that are prompting military and community leaders to take a closer look at partnerships, and provides a template for assessing the success of a prospective collaboration. Two case studies are presented — the arrangement under which the city of Monterey, Calif., provides all facility maintenance at the Presidio of Monterey; and the enhanced use lease at Nellis Air Force Base that resulted in the city of North Las Vegas building a $25 million fitness center for the Air Force. This article can be accessed from the following address: http://www.defensecommunities.org/wp-content/uploads/2012/07/P4_BAH_Journal_final.pdf.

Videos

The Base Next Door: Community Planning and the Joint Land Use Study Program, OEA

This informative video discusses the issue of encroachment near military installations as urban development occurs within the vicinity. This video can be accessed on the official OEA YouTube channel at: http://www.youtube.com/watch?v=6UiyWDgLeJM

Managing Growth, Communities Respond, OEA

This video highlights the lessons learned from three communities (Kitsap Naval Base in Bangor, Washington; Fort Drum in Jefferson County, New York; and Fort Leonard Wood in Pulaski County, Missouri) that have successful programs for managing growth near their respective military installations. This video can be accessed on the official OEA YouTube channel at: http://www.youtube.com/watch?v=rea6d3bDp3c

COMPATIBILITY ASSESSMENT

5

Inside Chapter 5...

Compatibility, in relation to military readiness, can be defined as the balance or compromise between community needs and interests and military needs and interests. The goal of compatibility planning is to promote an environment where both community and military can coexist successfully.

A number of factors influence whether community and military plans, programs, and activities are compatible or in conflict. To provide a comprehensive assessment of potential compatibility issues, this JLUS process looked at 25 compatibility factors (topics). This set of factors, is provided on the graphic below, was used to help characterize compatibility issues.

This chapter provides an assessment of the relevant compatibility factors and identified issues. This assessment provides the framework for the recommended strategies presented in the JLUS Report.

COMPATIBILITY FACTORS

AQ	Air Quality	LU	Land Use
AT	Anti-Terrorism / Force Protection	LEG	Legislative Initiatives
BIO	Biological Resources	LG	Light and Glare
COM	Coordination / Communication	MAR	Marine Environments
CR	Cultural Resources	NOI	Noise
DSS	Dust / Smoke / Steam	PS	Public Services
ED	Energy Development	PT	Public Trespassing
FSC	Frequency Spectrum Capacity	RC	Roadway Capacity
FSI	Frequency Spectrum Impedance / Interference	SA	Safety Zones
		SNR	Scarce Natural Resources
HA	Housing Availability	VO	Vertical Obstructions
IE	Infrastructure Extensions	V	Vibration
LAS	Land / Air / Sea Spaces	WQQ	Water Quality / Quantity

Methodology and Evaluation

The methodology for the Fort Sill JLUS consisted of a comprehensive and inclusive discovery process to identify key stakeholder issues associated with the compatibility factors. At the initial Policy Committee (PC), Technical Working Group (TWG) workshops and public forums, stakeholders were asked to identify the location and type of issue in conjunction with compatibility factors they thought existed today or could occur in the future. As a part of the evaluation phase, the PC, TWG, and the public examined and prioritized the extent of existing and potential future compatibility issues that could impact land within or near the Study Area. Other factors and associated issues were analyzed based on available information and similarity with other community JLUS experiences around the country.

The selection and inclusion of strategies is directly and indirectly affected by the evaluation of issues. Issues were prioritized into four different categories with an associated timeframe to determine the timeframe for initiating strategies by the primary and partner agencies. These strategies are provided in the JLUS Report Chapter 6 Implementation Plan.

When reviewing the assessment information in this chapter, it is important to note the following:

- This chapter provides a technical background on the factors and issues discussed based on available information. The intent is to provide an adequate context for awareness, education, and development of JLUS recommendations. It is not designed or intended to be utilized as an exhaustive technical evaluation of existing or future conditions within the Study Area.
- Of the 25 compatibility factors considered, 5 were determined to be inapplicable to this JLUS and not addressed in the compatibility assessment in this chapter. The determination to not include these 5 factors was based on discussions with the Technical Working Group, Stakeholders, and analysis of existing conditions. Where there was no data or information identified to indicate there were any issues impacting compatibility, these factors were omitted from this study:
    - Frequency Spectrum Capacity
    - Housing Availability
    - Marine Environments
    - Public Trespassing
    - Scarce Natural Resources
- Each issue is evaluated based on an applicable set of existing tools. These existing tools are meant to illustrate what is currently in place that can be used to mitigate the compatibility issue. Though existing tools may not always directly aid compatibility, they provide a foundation to help create strategies for future implementation.

5.1 Air Quality (AQ)

Air quality is defined as the degree to which the ambient air is pollution-free, assessed by measuring a number of indicators of pollution. Numerous components of air quality are regulated at the federal and state level. For compatibility, the primary concerns are pollutants that limit visibility, such as particulates, ozone, etc. and potential non-attainment of air quality standards that may limit future operations at an installation or in the area.

Key Terms

National Ambient Air Quality Standards. The National Ambient Air Quality Standards (NAAQS) are standards for outdoor air pollutants established by the Environmental Protection Agency (EPA) under the authority of the Clean Air Act.

Criteria Pollutants. Criteria pollutants are the six principle pollutants harmful to public health and the environment for which the US Environmental Protection Agency (EPA) has set NAAQS.

Attainment Area. An Attainment Area is a geographic area with concentrations of pollutants that are below the levels established by the NAAQS.

Nonattainment Area. A Nonattainment Area is a geographic area where air pollution levels persistently exceed NAAQS, or that contributes to ambient air quality in a nearby area that fails to meet standards.

Ozone (O3). Ozone is a pungent, colorless, toxic gas with direct health effects on humans, including respiratory and eye irritation and possible changes in lung functions. Ozone is created when oxygen, nitrogen oxides (NOx), and volatile organic compounds (VOCs) combine in the presence of sunlight to form O_3. Motor vehicles, industrial emissions, gasoline vapors, and chemical solvents are typically the sources of ozone. At low levels ozone can impact the respiratory system in humans. Ozone can also aggravate asthma-related conditions, decreased lung function, and other respiratory-related functions.

Technical Background

A number of factors can influence air quality in a region. These include but are not limited to a variety of sources and types of pollutants, topographic conditions, and weather. Community originated sources of dust, car emissions and air pollutants can also create adverse impacts on the environment and can potentially limit Fort Sill operations. Permits and funding for important infrastructure can be delayed or denied in non-attainment areas, or perhaps be subject to mitigation measures that increase the costs of project implementation.

Under the Clean Air Act, the EPA established NAAQS for air pollutants. The NAAQS have been set for the six criteria air pollutants. These pollutants are: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2).

Air quality control regions (AQCR) are classified either “attainment” or “nonattainment,” according to whether or not the concentrations of criteria pollutants exceed the NAAQS. An Attainment Area is a geographic area with concentrations of pollutants that are below the levels established by the National Ambient Air Quality Standards (NAAQS). These areas are considered either Nonattainment or unclassified.

A Nonattainment Area is a geographic area where air pollution levels persistently exceed NAAQS, or that contributes to ambient air quality in a nearby area that fails to meet standards. Designating an area as Nonattainment is a formal rulemaking process made by the EPA, typically only after air quality standards have been exceeded for several consecutive years. Nonattainment designation categories are defined as: Marginal, Moderate, Serious, Severe, and Extreme.

Issue Assessment

ISSUE AQ-1	**General Concern Regarding Possible Future Designation as Nonattainment for Ozone in the City of Lawton** *The communities surrounding Fort Sill are currently in Attainment for Ozone (O_3); however, there is a concern that the City of Lawton is close to being designated as Nonattainment Area as the area receives a large amount of Interstate Air Pollution Transport from the Dallas-Fort Worth, TX area. This could have impacts on both the community and the military where construction or operations / training activities could be required to incorporate measures to reduce pollutant emissions.*

In Oklahoma, the authority has been delegated to the Oklahoma Department of Department of Environmental Quality (DEQ) to ensure that the State of Oklahoma is in and maintains compliance with all National Ambient Air Quality Standards (NAAQS). While the City of Lawton is currently in attainment for O_3, a criteria pollutant, the city is potentially close to being designated as a Nonattainment Area according to the 2015 Federal standard for ozone.

Monitoring for ozone and other criteria pollutants is conducted throughout the state through the use of 14 monitoring stations. The state provides live data at the 14 monitoring stations daily recording data every hour and reporting both an average and maximum. Ozone is monitored and tracked by taking an average of the 8-hour daily concentrations of ozone along with the annual fourth-highest daily average. Those two data points are then averaged over a three-year period. There is a monitoring station located near Lawton, which monitors the air pollutants in the JLUS Study Area.

According to the Oklahoma Climatological Survey, prevailing winds in southwest Oklahoma typically come from the south / southeast throughout most of the year. These prevailing winds carry pollutants originating from the Dallas-Fort Worth region and transport them over southwest Oklahoma. This is referred to as Interstate Air Pollution Transport when pollutants from one location are transported to another location via wind patterns. Although these pollutants do not originate in Lawton or from Fort Sill, they are still sampled by the monitoring stations and factored into DEQ's compliance procedures for NAAQS.

The 2015 recorded value for ozone from the monitoring station near the City of Lawton was 0.069 ppm, which is close to meeting and potentially exceeding the 0.070 ppm NAAQS for O_3.

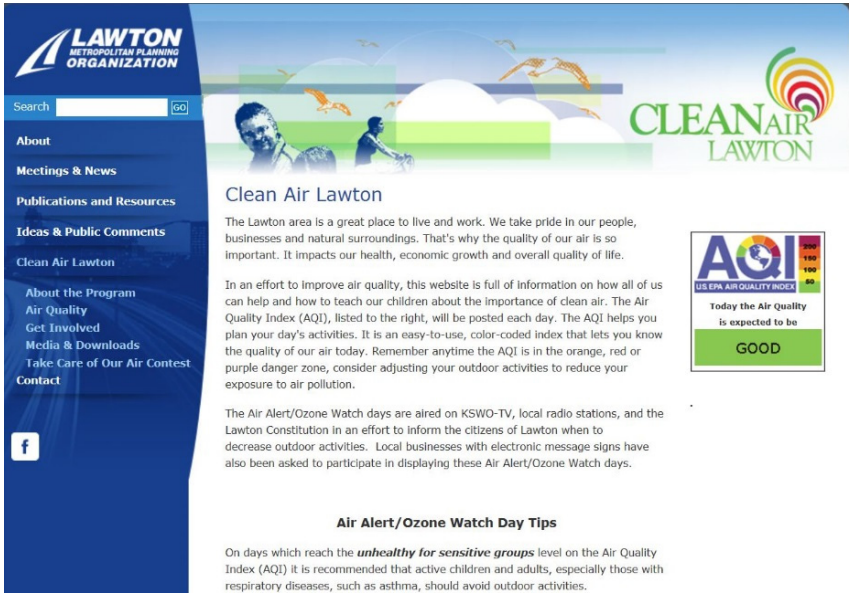
If the City of Lawton becomes designated as a Nonattainment Area then there are actions that must be taken by the jurisdictions and organizations engaging in certain activities to reduce the O_3 value in the area to facilitate attaining compliance. This could potentially impact vehicle operations and construction activities for the military as well as for the communities. These actions are implemented to reduce the level of O_3 in the area, they may have limiting impacts on the military to carry out necessary mission-related operational or training activities which could delay mission execution. In addition, costs of operations could increase for the military and the communities to reduce their carbon footprint.

Compatibility Assessment

In combination with the Interstate Air Pollution Transport from the Dallas-Fort Worth region, the Lawton Metropolitan Area is an area where high-pressure fronts, high temperatures, and light winds converge to create the ideal environment for ozone-forming compounds to combine. Due to this environment, the City of Lawton's businesses, industries, and health and environmental organizations, recognized that O_3 can adversely impact the community. Impacts include not only health-related matters and limiting outdoor activities but economic development opportunities as well, resulting in impacts to quality of life for both citizens and visitors, including Fort Sill personnel and their families. Providing an excellent quality of life to its residents and visitors is important to the local community leadership and JLUS stakeholders.

In addition to the health and quality of life impacts poor air quality has on the community, a nonattainment status could limit and impact Fort Sill's mission and military operations in the region. Reducing pollutant levels required to meet NAAQS compliance could result in the need of new equipment and technologies to decrease emissions at Fort Sill and possibly limit operations associated with air and motor vehicle emissions contributing to ozone formation. Fort Sill must also rely on regional cooperation to achieve attainment levels, which will require awareness and ongoing monitoring by both Fort Sill and the surrounding jurisdictions.

The Lawton Metropolitan Planning Organization (LMPO) formed the LMPO Air Quality Stakeholders Advisory Committee (LMPO AQ SHAC) to bring citizens, businesses, industries, and government together in the Lawton Metropolitan region to voluntarily combat O_3 levels. The LMPO AQ SHAC is designed to inform citizens about the effects of O_3 and encourage voluntary actions to reduce O_3 on days when the O_3 level is high. From this committee, Clean Air Lawton was developed, which is a voluntary program that provides guidance and information about O_3 and tips to reduce O_3 in the area. The Clean Air Lawton informs the public through the LMPO AQ SHAC's website located at: http://www.lawtonmpo.org/clean-air-lawton/.



Clean Air Lawton Website: lawtonmpo.org/clean-air-lawton

The website provides an Air Quality Index (AQI) meter that indicates levels of O_3 within the area. The AQI provides daily air quality reporting and translates what that means for citizens' health concerns.

The following graphic shows the levels of O_3 and the rating of what it means relative to health.

Clean Air Lawton: Air Quality Index

The higher the index level the greater potential for sensitive health groups, e.g. children and the elderly, and the general public to be impacted by air pollution. It is also important to note, that the affects may not occur immediately but rather 24 to 48 hours after the high pollution day.

The levels are further defined in the following paragraphs.

"Good" The AQI value is between 0 and 50. Air quality is considered satisfactory, and air pollution poses little or no risk.

"Moderate" The AQI is between 51 and 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.

"Unhealthy for Sensitive Groups" When AQI values are between 101 and 150, members of sensitive groups may experience health effects. This means they are likely to be affected at lower levels than the general public. For example, people with lung disease are at greater risk from exposure to ozone, while people with either lung disease or heart disease are at greater risk from exposure to particle pollution. The general public is not likely to be affected when the AQI is in this range.

"Unhealthy" Everyone may begin to experience health effects when AQI values are between 151 and 200. Members of sensitive groups may experience more serious health effects.

"Very Unhealthy" AQI values between 201 and 300 trigger a health alert, meaning everyone may experience more serious health effects.

"Hazardous" AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected."

The website also provides information and guidance on how to respond to increasingly worsening conditions. An example includes indications that if the AQI is in the orange, red, or purple, then people should consider modifying their outdoor activities including taking the bus or carpooling rather than driving and minimizing outdoor activities to reduce exposure to air pollutants. In addition, the website provides sample lesson plans for teachers and numerous other tips for users.

While the website provides an abundance of information for the public and certain special groups, there is no mention of how O_3 impacts other organizations including potential constraints on both the military and economic development opportunities for the community. If mandatory actions are required to reduce O_3 in the Lawton area if the region is designated as Nonattainment, there is no discussion about what it means for businesses and possible missed opportunities for enhanced quality of life amenities.

Findings

- A portion of the pollutants within Fort Sill Study Area's ozone is from Interstate Air Pollution Transport from the Dallas-Fort Worth region
- The LMPO AQ SHAC is monitoring O_3 and encouraging voluntary actions in the city among residents and visitors.
- The LMPO AQ SHAC provides a wealth of information about O_3 and its impacts on health through their website at http://www.lawtonmpo.org/clean-air-lawton
- While the Clean Air Lawton program's website provides current AQI status, numerous tips, and other information about impacts to health, the website does not provide information about impacts to the military, economic development, local businesses, and other organizations correlated to Attainment and Nonattainment designation.

Please see the next page.

5.2 Anti-Terrorism / Force Protection (AT)

Anti-Terrorism / Force Protection (AT) relates to the safety of personnel, facilities, and information on an installation from outside threats. Security concerns and trespassing can present immediate compatibility concerns to installations. Due to current world conditions and recent events, military installations are required to meet more restrictive standards to address AT issues. These standards include increased security checks at installation gates and physical changes to enhance security (such as new gate / entry designs). Additional emphasis on both credential and vehicle checks can create traffic backup issues at the entry gates. Traffic backups can create circulation and mobility issues and general safety concerns external to the installation and within local communities.

Key Terms

Unmanned Aerial Vehicle. An Unmanned Aerial Vehicle (UAV), often referred to as a drone in the community, is a powered aerial vehicle that does not carry a human operator. UAVs can fly autonomously or be piloted remotely. UAVs can be expendable or recoverable and can be equipped with cameras and configured to carry a lethal or nonlethal payload.

Issues Assessment

ISSUE AT-1	**General Concern About Breaches of Installation Perimeter** *The primary concern focuses on trespassing issues and vandalism of the Fort Sill fence line. This can cause impacts for Fort Sill; such as potentially delaying operations and training and impacting military readiness.*

Security on Fort Sill is the responsibility of the Directorate of Emergency Services, Physical Security Department. According to Fort Sill's Physical Security Department, accidental or unintentional trespassing has occurred in the past accidentally from hunters and intentionally from vandals. Some trespassing incidents have resulted in vandalism including cutting or knocking down the perimeter security fence along Keenery Road, a dirt road that runs north-south and shares the installation border with the city of Elgin.

The installation perimeter security fence is used to warn and deter intentional and unintentional trespassers as well as demark the secure perimeter around the installation. This segregation provides a safe, suitable facility for training and conducting live-fire training exercises. When the installation perimeter is vandalized or breached, these circumstances can potentially cause delays in training or mission operations as well as increase costs, not only in repair/replacement supplies and materials, but also manpower to the military to make repairs.

Compatibility Assessment

Controlled or managed elk and deer hunting is allowed on the Wichita Mountains Wildlife Refuge as a cooperative effort between the US Fish and Wildlife Service (USFWS) and the Oklahoma Department of Wildlife Conservation (ODWC). A controlled or managed hunt refers to hunting in which there are specific schedules established, guidance on how the hunt will be conducted, and instructions and an information packet provided. While there are specific guidelines and instructions for controlled hunts, hunters may inadvertently trespass on the installation, breaching the perimeter due to proximity to the installation property.

An interactive map on the USFWS website includes the boundaries of both the Wichita Mountains Wildlife Refuge and Fort Sill; however, none of the literature indicates guidance or instruction about Fort Sill as a restricted area and safety related to operations that are ongoing on the installation. Specifically, there is no guidance for when a hunter wounds a deer or elk that then trespasses onto the installation and what the hunter is supposed to do when tracking or retrieving the deer or elk.

The general public is not allowed to hunt on Fort Sill. Fort Sill's authorized hunting program is only open to military personnel, Fort Sill full-time permanent Department of the Army civilians, and their dependents. Those eligible wishing to participate in hunting on Fort Sill must acquire a hunting permit.

According to the 2014-2018 Integrated Natural Resources Management Plan (INRMP) and Environmental Assessment, Fort Sill has delineated areas on the installation that are available for hunting with small arms as well as archery hunting. Additionally, the installation has identified, on a map in the INRMP, areas that no hunting is allowed.

According to the INRMP, Fort Sill and the Wichita Mountains Wildlife Refuge have a partnership to manage a number of items including: ecosystem management for several species; wildfire protection; fish stocking; and trespass issues. However, the INRMP does not specifically discuss the types of trespass or how the partners manage the trespassing that occurs in order to maintain integrity of Fort Sill's restricted area.

The Physical Security Department maintains and regularly inspects the installation including patrolling the installation perimeter fence line. There are "No Trespassing" signs installed every 200 feet along the fence line.

Findings

- Trespassing onto the installation causes safety and security risks.
- The USFWS and OWDC Hunting Program provides guidance, instruction, and rules to follow related to its controlled hunting program. However, Fort Sill is not referenced in any accessible online materials as an organization that is coordinated with during these scheduled events.

ISSUE AT-2	**Concern About Traffic Configuration at Installation Access Points and Vehicle Collisions into Fort Sill's South Boundary Fence** *There is a concern about vehicle collisions into the South Fence at the Rogers Lane / Sheridan Road access where the Bentley, Scott, and 52nd Street Gates are located. The collisions are unintentional; however, damage to federal property can cause additional security risks.*

Rogers Lane is a four-lane road that merges with US Highway 62 at Interstate 44. US Highway 62 is a four-lane divided highway (with a concrete median in the middle configured as a wide curb) that runs east-west parallel to Fort Sill and is maintained by the Oklahoma Department of Transportation (ODOT). According to ODOT, the annual average daily traffic count for the US Highway 62 / Rogers Lane intersection at Fort Sill was 27,100 vehicles in 2015. These two roadways run together for approximately six miles until Rogers Lane diverts from US Highway 62 and turns into a one-lane roadway continuing parallel with Fort Sill's southern border just west of 82nd Street, and US Highway 62 turns south.

One of the reasons this segment of roadway has a high traffic count is that it is a primary access point into Fort Sill. Fort Sill has three gates slightly north of this road segment. Scott Gate and Bentley Gate are located approximately a half-mile north of US Highway 62 / Rogers Lane along Fort Sill Boulevard and Sheridan Road respectively, and 52nd Street Gate is located approximately one mile north along 52nd Street.

The US Highway / Rogers Lane roadway segment has a posted speed limit of 50 miles per hour (mph), and However, the speed limits do not gradually transition from highway speeds to arterial roadway speeds, making the Bentley Gate and the and associated roadways an ideal environment for traffic accidents. In addition, there are minimal queuing lanes at the Bentley Gate to accommodate heavy volumes of traffic entering the installation at peak periods.

This portion of US Highway 62 and Rogers Lane south of Fort Sill has a posted speed limit of 50 miles per hour (mph); Fort Sill Boulevard has a posted speed limit of 35 mph; and Sheridan Road and 52nd Street both have posted speed limits of 40 mph. However, the entrance and exit ramps onto and off of US Highway 62 do not provide merging lanes that motorist to gradually and safely transition into ongoing traffic, which increases the risk of traffic accidents. Additionally, there are minimal queuing lanes during peak gate periods, which can cause traffic to back up onto US Highway 60, decreasing the amount of time motorist have to reduce their speed and come to a safe stop and further increasing the risk of vehicular collisions near Fort Sill's gates.

The primary concerns are the constraints of these roadways and entrance gate facilities when there are accidents near the gate. If an accident occurs, traffic can become congested and cars stack, which makes security challenging. If there is an accident in this area, there are no alternate routes for traffic to be directed to alleviate congestion and ease mobility. In addition, there are no physical barriers preventing unauthorized vehicles and visitors from accessing the Post. These conditions can present a security risk, which can interrupt daily operations and mission activities. Accidents and associated repair activities create an additional strain on an already constrained budget for maintenance and repairs to roadways and other infrastructure. Furthermore, Fort Sill does not recover any compensation from accidents damaging their fence. Rather, the money goes to the US Treasury.

Compatibility Assessment

Despite the accidents that have occurred at this intersection, and after the evaluation of several capital improvement project and road plans, there are no road improvements planned for US Highway 62 / Rogers Lane and the Sheridan Road intersection by either ODOT or the Lawton Metropolitan Planning Organization (MPO).

Findings

- There are no planned road improvements for the US Highway 62 / Rogers Lane exit ramp and Sheridan Road intersection.
- There are no physical barriers at the Fort Sill Bentley Gate preventing unauthorized vehicles and visitors from accessing the installation.

ISSUE AT-3	**Recreational Drones Fly Over Post into Restricted Airspace** *There is a concern about recreational drones flying over the Post into the restricted airspace used by the military for training. There has been one incident in which a recreational drone crashed on to the airfield. Operating drones on or around the installation can be a safety risk to both military personnel and aircraft, adversely impacting Fort Sill's operations and training mission.*

Drone operation near military installations can create security risks for the military in the event a drone is used to capture photographs of federal property or is used to record operations, activities, and / or conversations. These incidents could either be intentional or unintentional, which would cause concern for the military in maintaining a secure installation.

Although the FAA prohibits the use of drones over restricted airspace including national parks, military bases, and within a five-mile radius of medium and large airports, there was a recent incident where a drone crashed on Henry Post Army Airfield (HPAAF) at Fort Sill. This caused the Army to temporarily postpone activities until the drone could be confiscated and evaluated to determine the threat level. This postponement of operations and activities can interfere with training missions and generally, create concern about security.

By 2020, the FAA anticipates the number of UAVs or drones, used in U.S. airspace to reach as high as 30,000. As of May 2016, there were 5,817 UAV registrations in the FAA registry for the state of Oklahoma. It is important to note these numbers are just the registered UAVs.

Table 5.2-1 shows the total number of drones registered within the JLUS Study Area jurisdictions. Only cities and towns that have FAA-registered drones are reported, so total numbers for counties are not included in the list. The Town of Medicine Park does not have a number reported for FAA-registered drones. There are over 150 FAA-registered drones in the JLUS Study Area.

Table 5.2-1 Drone Registrations for the Cities and Towns in the JLUS Study Area, May 2016

Jurisdiction	# of Drones Registered with the FAA
City of Cache	7
City of Elgin	5
City of Lawton	136
Town of Indiahoma	1
Town of Medicine Park	Not reported
Town of Sterling	1
City of Apache	10
City of Frederick	3
Total	**163**

Source: http://www.faa.gov/foia/electronic_reading_room/media/Reg-by-City-State-Zip-12May2016.xlsx

Compatibility Assessment

The FAA prohibits the use and / or operation of UAVs or drones over various airspaces including restricted airspaces. Fort Sill's entire lateral boundaries encompass restricted airspace; therefore, UAVs or drones are prohibited from flying over the installation. For other airspaces the FAA requires notification for drone operations within certain distances instead of complete restriction from use of the airspace. Fort Sill hosts HPAAF and is near the Lawton-Fort Sill Regional Airport (LAW). The FAA only restricts recreational use of drones in FAA designated "Class B" airspace which includes most major airports (Lawton-Fort Sill Regional Airport operates within Class D airspace). In all other airspace classifications all recreational drone operators are required to provide notification to both the airport operator and the Air Traffic Control Tower (ATCT) (if an ATCT exists) within five miles of an airport.

Other FAA UAV restrictions include operating a UAV in and around an active wildfire firefighting operation and within an hour before and after a scheduled major sporting event occurs. The major sporting events referred to are:

- Major league baseball
- National football league
- NCAA Division One Football
- NASCAR Sprint Cup, Indy Car, and Champ Series races

The local regulatory environment within the JLUS Study Area includes the City of Lawton which is the only city that has adopted an ordinance restricting drone use within a five-mile radius around and on airport property. This ordnance includes both HPAAF for the area of the five miles that extends outside the installation boundaries and the Lawton-Fort Sill Regional Airport (LAW). The City's Ordinance designates this five-mile area a "No Drone Zone," which is accepted and authorized by the FAA. The ordinance also requires UAVs to be operated in strict compliance with the FAA rules and regulations regarding the use of drones.

Article 7-3 of the City of Lawton's Zoning Ordinance states:

a. *Unmanned aircraft Systems operations must be conducted in strict compliance with all Federal Aviation Administration regulations application to the particular operation.*
b. *Except for UAS operations specifically authorized by the FAA, the area within five (5) miles of and on airport property is a no drone zone. Unauthorized UAS operations in the no drone zone are strictly prohibited.*

Under Title 14 of the Code of Federal Regulations Section (§) 99.7 "Special Security Instructions", drone flights are restricted up to 400 feet within the lateral boundaries of military facilities. The FAA has created an online interactive mapping tool to bring awareness to drone users and operators of the locations that are restricted or require the compliance with special instructions. Figure 5.2-1 illustrates the "No Drone Zone" and / or the drone restricted airspaces implemented by FAA regulations and local laws in the JLUS Study Area.

The FAA has developed a "No Drone Zone" awareness package, which includes graphics and other tools to assist local and federal governments in promoting areas that are restricted from drone operations. The following graphic illustrates that when an area installs this picture, then the area is prohibited from drone use and operation.

No Drone Zone Graphic developed by the Federal Aviation Administration

The "No Drone Zone" awareness package can be found on the FAA website located at https://www.faa.gov/uas/where_to_fly/no_drone_zone/.

In addition, the DoD passed policy in August of 2017 granting authority to military installations the right to shoot down both private and commercial drones if determined that the drone is a threat to the installation and / or military mission. This new policy covers 133 military installations. Details in how to communicate this new policy to local communities was provided to the military services in August 2017.

To prevent drones from operating over restricted airspaces and military installations, Fort Sill conducted testing with experimental equipment, called Anti-Unmanned aerial vehicle Defense System (AUDS), which detects, tracks, identifies, and defeats UAVs through the use of directed energy (i.e. lasers). This testing occurred during Fort Sill's Maneuver Fires Integrated Experiment in April 2017. The AUDS works with radars to identify a target (drone). Once the target drone is detected, a soldier can use the radar and lock onto the target. Once the target is locked, then the soldier uses a directed laser to interrupt the signal of the drone, blocking the signal between the drone and its operator. Upon signal interruption, the drone will either return to its home base, continue to hover over the area where the signal was interrupted, or fall from the sky.

Findings

- FAA regulations prohibit the operation of drones over military installations, sensitive airspaces, and entertainment and emergency events.
- The City of Lawton Zoning Ordinance restricts the use or operation of drones within a five-mile radius around and on airport property.
- The DoD has the authority to track, defeat, and / or destroy unauthorized commercial and private drones that operate over military installations.

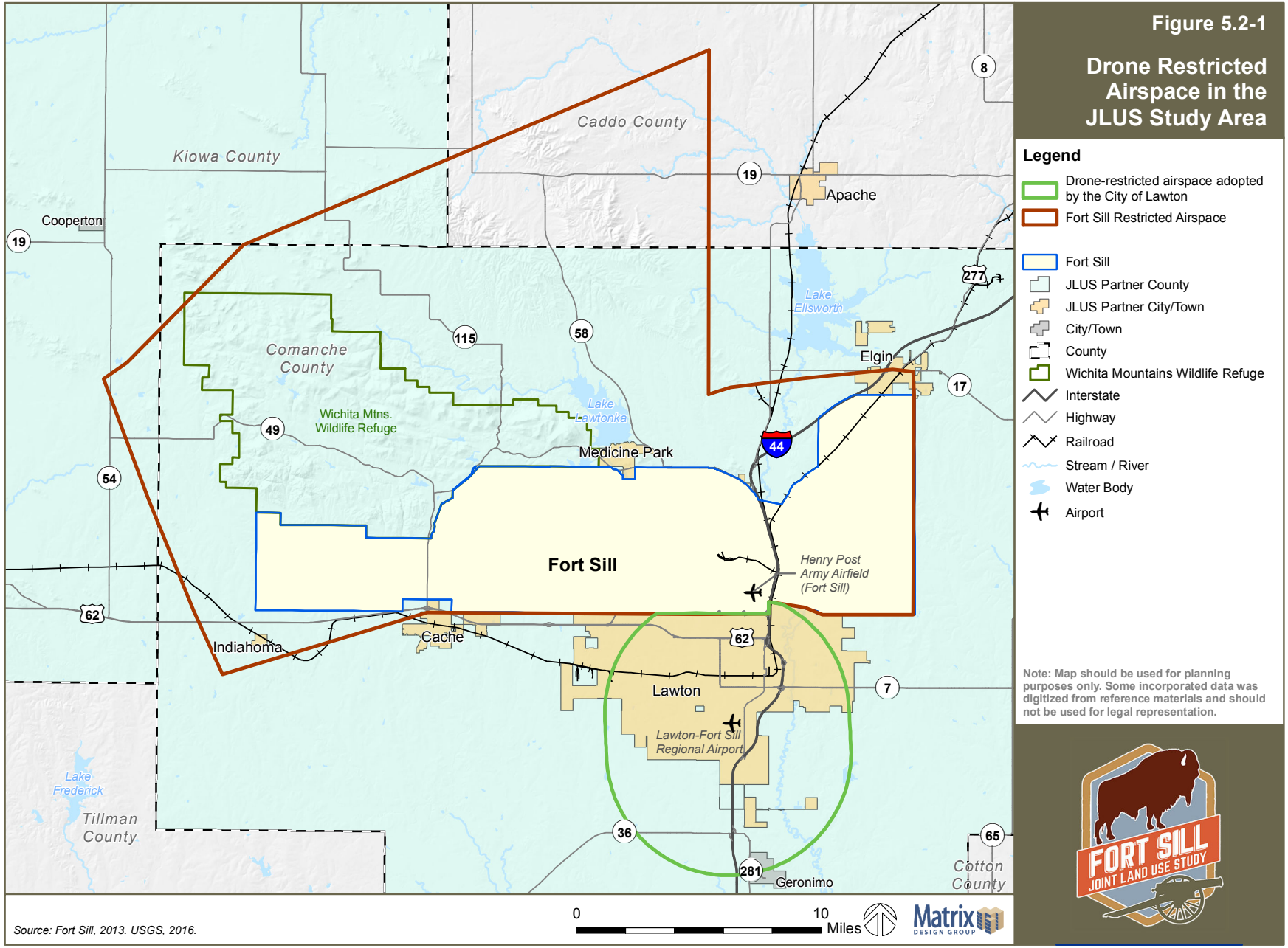


Figure 5.2-1
Drone Restricted Airspace in the JLUS Study Area
Legend
Drone-restricted airspace adopted by the City of Lawton
Fort Sill Restricted Airspace
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
Wichita Mountains Wildlife Refuge
Interstate
Highway
Railroad
Stream / River
Water Body
Airport
Note: Map should be used for planning purposes only. Some incorporated data was digitized from reference materials and should not be used for legal representation.
Kiowa County
Caddo County
Comanche County
Tillman County
Cotton County
Cooperton
Apache
Elgin
Medicine Park
Cache
Indiahoma
Lawton
Geronimo
Fort Sill
Henry Post Army Airfield (Fort Sill)
Lawton-Fort Sill Regional Airport
Wichita Mtns. Wildlife Refuge
Lake Ellsworth
Lake Lawtonka
Lake Frederick
Source: Fort Sill, 2013. USGS, 2016.
0
10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Please see the next page.

5.3 Biological Resources (BIO)

Biological resources include federal and state listed species (threatened and endangered) and their habitats. These resources may also include areas such as wetlands and migratory corridors that are critical to the overall health and productivity of an ecosystem. The presence of sensitive biological resources may require special development considerations and should be included early in the planning process.

Key Terms

Invasive Species. Invasive species are organisms that are introduced into a new ecosystem where they are not native. The introduction of an invasive species will likely cause harm to the environmental or human health.

ISSUE BIO-1	**Invasive Wild Hog Species Impact Military Training Capabilities** *Wild hogs in the JLUS Study Area migrate onto the installation and cause damage to the land and perimeter security fencing because of animal rooting behaviors. The damage hogs cause to federal property add undo maintenance costs and can delay military operations or training resulting in adverse impacts to military readiness at Fort Sill.*

Feral hogs are an invasive species and are thought to have been introduced to the JLUS Study Area for hunting purposes. The hogs have migrated onto the installation and cause damage to federal property. The feral hog population rapidly increases as the species breeds twice a year and can have more than four offspring per litter.

These animals cause harm to the environment, including vegetation, due to their rooting behaviors. Hog rooting disturbs the soil and uproots the vegetation causing property damage. According to the Fort Sill Integrated Natural Resource Management Plan (INRMP), hogs' rooting behaviors can decrease plant cover by as much as 80 percent and increase bare ground by almost 90 percent, which can result in increased erosion.

Military operations and training on Fort sill can be impacted by the damage to the land, particularly grassy areas used for training. Hogs can trample and / or destroy the perimeter security fencing when they traverse the installation. The damage can delay military operations and training, resulting in impacts on military readiness.

Feral hogs on Fort Sill

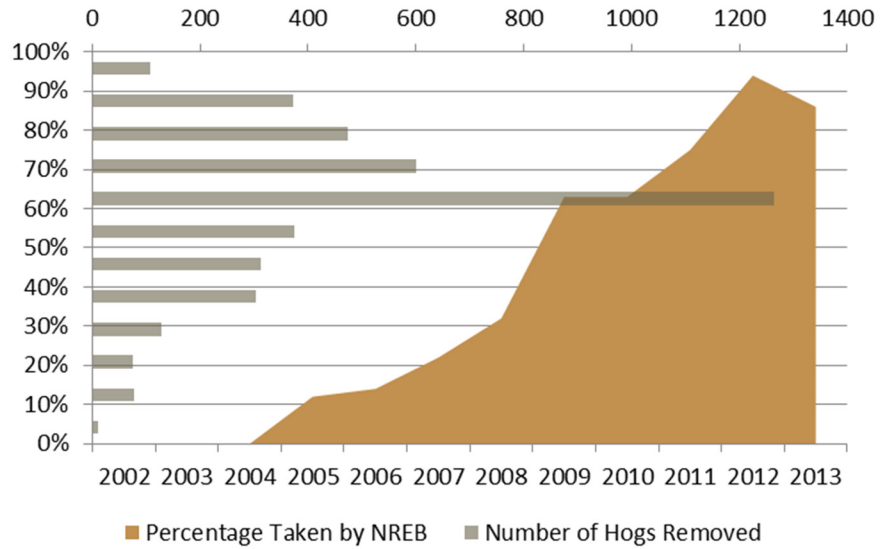
Source: https://www.army.mil/article/74350/Invasive_species_trashing_Fort_Sill

Compatibility Assessment

According to the 2018 INRMP, Fort Sill has implemented a number of removal tactics for feral hogs. In 2011, Fort Sill contracted with the Oklahoma Department of Agriculture Wildlife Services to allow aerial shooting of feral hogs on the installation. This was especially useful in areas were other snare trapping and hunting tactics were proven less effective. Hog removal continues to be a need for the military due to the rapid nature of the species propagation. Fort Sill will continue to use aerial control, traps, snares, dogs, and hunting to control the species.

Figure 5.3-1 shows the historical trend of hogs removed from the installation. The number of hogs removed increased when the Natural Resources and Enforcement Branch (NREB) of the installation became involved in removal tactics.

Figure 5.3-1 Feral Hog Control on Fort Sill, 2002 – 2013



Source: Fort Sill Integrated Natural Resources Management Plan and Environmental Assessment 2014-2018

Findings

- Fort Sill is currently engaged in several different actions to remove and control the feral hog population on the installation to reduce the impacts to federal property and military training.

ISSUE BIO-2	**Invasive Plant Species Increase Wildfire Risk in the JLUS Study Area** *Johnson Grass, an invasive plant species, can be found throughout the JLUS Study Area. This plant provides fuel for wildfires which increases the risk of wildfires.*

Johnson Grass is an invasive plant species that is referred to as a weed. The weed grows in dense clumps or solid stands and can grow as high as eight feet tall. The weed is hearty and fast-spreading, which competes with the native grasses impacting the ecosystem. In addition, tracked vehicles used for military maneuvering can spread the grass seeds, propagating the species throughout the installation. This unintentional propagation of the species can result in an increase in vegetation fuel, which can increase the risk profile for wildfires on the installation.

Compatibility Assessment

At the time of the development of the Fort Sill INRMP, Johnson Grass control was in the experimental stages. Experimental control methods were conducted using in-house resources and agricultural funds. Control methods included using herbicide, cheat grass, and other species of grass in the first year of a 3-year treatment program. During the second year of the program the secondary growth was treated, and during the third year, the final spot treatment was completed.

The Directorate of Public Works, Environmental Quality Division, Natural Resources and Enforcement Branch (NREB) had planned to coordinate with the Integrated Training Area Management (ITAM) program to determine whether a large-scale control program using soil disturbance or ITAM range rehabilitation projects would be feasible. The Johnson Grass control program is planned to be implemented through 2018.

Fort Sill also has an Annual Wildland and Prescribed Fire Operating Plan that details a prescribed burn plan to reduce fuel for incidental fires on the installation.

Findings

- Johnson Grass is an invasive species that provides fuel for wildfires, which can increase the risk of wildfires on the installation.
- There are control programs in place at Fort Sill to reduce the risk of wildfires related to invasive grasses, such as Johnson Grass.

Please see the next page.

5.4 Communication / Coordination (COM)

This chapter refers to the programs and plans that promote interagency communication and coordination. Interagency communication serves the general welfare by promoting a more comprehensive planning process inclusive of all affected stakeholders. Interagency coordination also seeks to develop and include mutually beneficial policies for both communities and the military in local planning documents such as comprehensive plans.

Key Terms

No unique terms in this section.

Issues Assessment

ISSUE COM-1	**Lack of Formalized Community Point of Contact Information Regarding New Development in the JLUS Study Area** *Fort Sill does not have an official community contact to provide the military with information about development occurring outside the installation that could impact the operational training mission.*

Fort Sill personnel learn about new development through observation of construction activities and then seeking information. This is an informal way of learning about new development occurring in the area. Fort Sill has expressed they have no official "go-to" individual or office to inquire about planned or ongoing new development in the area. This irregular, unreliable communication network can potentially create increased communication and coordination issues between the jurisdictions and the military. The unintended consequences can be incompatible development and create a loss of trust.

The local jurisdictions do not communicate proposed development with the military, and there is no codified requirement or jurisdictional delineated official points-of-contact designated that can address concerns with the military in the JLUS Study Area. Depending on the type and location, new development can result in encroachment on Fort Sill, e.g., recent construction of a tall microwave tower by a local community impacted low-altitude flight training activities for Fort Sill. Incompatible development could also result in increased noise complaints and security risks, which can impact training and the overall ability of Fort Sill to execute its mission.

In addition, there is no official requirement for communication and coordination regarding development review in the JLUS Study Area. This lack of coordination can lead to a lack of trust. Additionally, continuation of established unofficial or informal communication and coordination "silos", may not endure as personnel change positions or retire. Unofficial channels of communication are not beneficial for any stakeholder regarding military compatibility planning.

Compatibility Assessment

There is not currently a State of Oklahoma law that requires jurisdictions to communicate and coordinate with military installations on development matters. However, several other states have enacted laws that require jurisdictions to notify the military about proposed development if it is located within a specified distance from the installation or a critical airspace, (e.g. 1,000 feet, 3 miles, or 5 miles). This facilitates mutually beneficial relationship building, encourages communication strengthening, and allows the military to determine if there will or will not be an impact to military training or operations as a partner that is committed to supporting compatible economic development in the region.

Table 5.4-1 provides a list of states that have enacted military notification and coordination laws and the code or law that specifies the notification and coordination.

Citing examples from other states listed in table 5.4-1, the military usually has a number of days between 10 and 30 days to evaluate the proposal and provide comments to the jurisdictions. Then, the jurisdiction considers the feedback from the military and determines if the proposed development should be permitted, permitted with conditions, or denied.

Table 5.4-1 States That Have Enacted Laws for Military Notification of Development

State	Law or State Code
Arizona	Arizona Revised Statutes §9-461.06, 9-462.04, 9-500.28, 11-812, 11-829, 28-8461, 28-8481
California	California Public Resources Code § 21098, California Government Code §§ 65352, 65404, 65940, 65944
Colorado	Colorado Revised Statutes §§ 29-1-207, 30-28-106, 31-23-206
Florida	Florida Statutes § 163.3175
Georgia	Georgia Code Annotated § 36-66-6
Kansas	2010 Kansas Session Laws, Chapter 21
Louisiana	Louisiana Revised Statutes Annotated § 33.4734, 33.4780.52
Massachusetts	Massachusetts General Laws 40B § 4C
Nebraska	Nebraska Revised Statutes § 14-407, 15-1103, 19-923
New Jersey	New Jersey Revised Statutes § 40:55D-12.4, 40:55D-62.1
North Carolina	North Carolina General Statutes § 153A-323, 160A-364
South Carolina	South Carolina Code § 6-29-1530
Texas	Texas Local Government Code § 397.005, 397.006
Virginia	Virginia Code § 15.2-2204
Washington	Washington Revised Code § 36.70A.530
Wisconsin	Wisconsin Statutes § 62.23

Source: National Conference of State Legislatures, 2010-2013

Findings

- There are no Oklahoma state laws enacted that require jurisdictions to notify military installations about proposed development that could impact the military mission and / or training.
- The jurisdictions in the JLUS study area have not formally delineated or designated an official representative to communicate with Fort Sill about proposed development compatibility or land use matters.
- There is a nationwide precedence for establishing and enacting laws that require jurisdictions to communicate or notify a military installation of proposed development to foster communication and partner in compatible economic development.

ISSUE COM-2	**Lack of Public Awareness of Fort Sill Contact Information to Report Concerns** *Public may not know who to notify on Fort Sill regarding concerns or other issues, e.g. noise complaints. This could lead to a delay in responding to and addressing complaints or concerns and also negatively impact community / installation relationships.*

Fort Sill conducts regular field artillery training exercises and other bombing exercises that produce loud noises and generate smoke. This noise, smoke, and other related impacts, e.g. vibration, can impact or disturb the community. When these impacts become a nuisance or are occurring out of the routine schedule for the community, then the community may want to notify the installation of their concerns or ask questions. However, the public may not know who to contact or notify at Fort Sill regarding military training-related impacts.

As such, there is a lack of awareness or knowledge from the public's perspective about who to contact regarding issues. In the past, there have been complaints from the public submitted directly to the range operations administration while other complaints have been submitted to the Public Affairs Officer (PAO), which then get routed to the source that generated the complaint.

The public's lack of awareness of a single contact for Fort Sill that they can communicate their concerns, questions, or complaints to can result in a delayed response from the military and does not facilitate a quick follow-up / follow-through to provide a response to the complainant. This delay in communication and responding to the public's concerns or questions, can create an environment of apathy and / or distrust between the military and the public.

Compatibility Assessment

The Fort Public Affairs Office (PAO) fields all calls related to issues of concern by the civilian populous. The PAO then coordinates with the appropriate agency to determine answers to the concerns / questions and will follow up with concerned citizens. According to the Fort Sill's PAO webpage, the Fort Sill PAO provides advice to the installation and Garrison Commander about community relations and support. However, the webpage located at http://sill-www.army.mil/usag/pao/ does not have an attention-grabbing link that offers the viewer the opportunity to report a complaint or concern or even ask a question. Rather the PAO's webpage provides a main email address of usarmy.sill.imcom-west.mbx.pao-admin@mail.mil and several phone numbers. There is no dedicated link for the external audience or individuals that want to provide or get information from the Army.

The webpage provides a link to a phone directory, but the directory is composed of various individual positions on-Post with their associated unit name or title. The directory may be confusing to non-military personnel since it does not contain topic areas that are useful to many of the community members outside the installation. The website does not feature

topical categories or attention-getting links, such as “Have a noise complaint?”, “Report a fire.”, “Report vandalism.”, and so on. This could be beneficial to Fort Sill to appeal to external audiences and support their requests for inquiries and / or concerns. Additionally, this can be a place to communicate upcoming activities and inform the general public so a number of questions can be headed off by informing the public of the source of their complaint.

The phone directory is linked to Fort Sill’s Home page as well as the Post Operator’s phone number and hours of operation. However, this information on the Home page is located at the bottom of the webpage. There is no link to the PAO’s webpage, phone number, or email address on Fort Sill’s Home page. In addition, when a Fort Sill website search is performed for “noise complaints,” there are no results returned for who to contact or instructions about how to provide the comments to the installation. It should be noted that noise is used as a general concern here, for more details about noise see Section 5.17, Noise.

Findings

- The public may not know who to contact at Fort Sill for reporting noise and vibration as well as fires and vandalism.
- The PAO does not have a presence on Fort Sill’s Home page.
- The PAO webpage does not provide links or linked graphics to click on to report concerns or issues, such as fires starting or vandalism occurring.

ISSUE COM-3	**Coordination and Communication Between Fort Sill and Wichita Mountains Wildlife Refuge is not Formalized** *There is currently an informal relationship between Fort Sill and the Wildlife Refuge to address concerns related to impacts to both the military and the refuge. Situations where no documented agreement or procedure exists may cause delays or confusion on how to address issues, especially if there is a change in personnel.*

Fort Sill and the Wichita Mountains Wildlife Refuge personnel engage in regular informal communication to address matters of concern and issues that occur including management of species and education and information about wildfires. However, this informal communication is built on the foundation of long, established working relationships between individual personnel. There is no formal agreement or set of procedures that recognizes the importance of an ongoing, continuous relationship between the two organizations that share the northwestern boundary of Fort Sill. If one of the current personnel vacates their position, then valuable lessons learned could be lost along with institutional knowledge for their successor. This may create instances of an unreliable communication network, delays in responding to matters and issues from either organization, issues with follow-through when responding to issues, and / or could initiate a deterioration in the long-established working relationship between Fort Sill and the Refuge.

Compatibility Assessment

Fort Sill and the Wichita Mountains Wildlife Refuge have a memorandum of agreement (MOA) for the maintenance and inspection of Lake Elmer Thomas Dam and its associated spillways that are located on Fort Sill. Although this MOA does not cover general communication and coordination procedures for managing various matters that can impact the military and Refuge, it has established a precedent for coordination related to the operation and maintenance of the dam and spillways. This MOA references an Emergency Action Plan developed by Fort Sill in which communication and coordination responsibilities are delineated for both organizations related to emergency situations with the dam and spillways.

Findings

- There are no formalized coordination procedures between Fort Sill and the Wichita Mountain Wildlife Refuge regarding military compatibility concerns for both Fort Sill and the Refuge.
- There is a precedent for coordination agreements between Fort Sill and the Refuge that can be leveraged to address communication.

ISSUE COM-4	**Lack of Notification to the Public on Training that Occurs Outside the Normal Daytime Hours** *There is a lack of notification to the public, local government agencies, and media outlets regarding artillery training that occurs outside the normal daytime hours, such as in the early morning or after midnight.*

Fort Sill conducts numerous training exercises involving small and large weapons necessary to train soldiers for all combat scenarios. In addition to training on numerous weapons, soldiers must also train for all environments both during the day and night to prepare for operations in realistic conditions.

The ranges and training areas are available to be scheduled based on the activity, units needed, mission requirements, and other factors including airspace availability. The airspace immediately located over Fort Sill is activated 24 hours a day, 365 days a year, which means this resource is available for use at all times, including during the late evening hours (after 10:00 pm) and early morning hours (from 12:00 am) for training purposes. Additional information about the available airspace over Fort Sill and the other training areas and ranges is discussed in Background Report Chapter 3, Military Profile.

While a majority of the training occurs during the daylight hours, there are instances where mission needs require training during the nighttime and early morning hours. The primary concern is there is little to no advanced public notification of these instances where training must occur during the nighttime and early morning hours. This can impact quality of life activities,

e.g. sleeping, especially for children. Sleeping can be especially important during the school year, and more specifically around state testing timeframes. In addition to quality of life activities, unannounced nighttime training could create safety concerns among the public, which could result in increased calls to local elected officials, news media, and the military.

Compatibility Assessment

According to Range Operations, the training schedule is scheduled in adequate time to notify media outlets and / or local jurisdiction officials to spread the word about non-routine training or training that is scheduled to occur outside the normal daytime training hours. While training may be scheduled in sufficient time to notify the public. There are currently no notification procedures to inform the public of any range schedules outside the normal daytime hours. The Range Schedule is posted on the Fort Sill Morale Welfare and Recreation (MWR) web page at: http://sill.armymwr.com/us/sill/programs/range-control/. Fort Sill Range Operations could supply the PAO with information and they would disseminate it to the public media.

Findings

- There is a perception that there is little to no communication from Fort Sill to the jurisdictions about training that occurs outside the normal daytime training hours and / or training that is non-routine.
- Training schedules for Fort Sill are often arranged in advance of the training and adequate timing to allow for notification to certain leaders and officials in the community.
- The Range Schedule is posted not the Fort Sill Morale Welfare and Recreation (MWR) but Range Operations does not currently provide PAO with information to disseminate it to the public media regarding non-routine training.

ISSUE COM-5	**No Formal Communication Process Between the Federal Aviation Administration and Fort Sill Regarding Impacts from Wind Turbine Developments to the Radar Field of View** *While the Federal Aviation Administration (FAA) communicates with the installation when there could be vertical obstruction into mission critical airspace, the FAA does not evaluate the wind turbine development impacts on the radar field of view.*

According to the Code of Federal Regulations, Title 14, Chapter 1 Subchapter E Part 77 Safe, Efficient Use, and Preservation of Navigable Airspace, commonly referred to as Part 77 Compliance, the FAA is required to evaluate proposed structures that would exceed 200 feet in height. This evaluation is called an Obstruction Evaluation / Airport Airspace Analysis, or OE/AAA. This evaluation process requires any developer or organization proposing to construct a structure that exceeds 200 feet above ground level to file a notice with the FAA at least 45 days prior to the planned start of construction. The coordination process involves completing FAA Forms 7460-1: Notice of Proposed Construction or Alteration and 7460-2: Supplemental Notice to initiate the OE/AAA.

In addition, in Oklahoma all developers proposing to construct a tall structure(s) within a three-mile area of a public-use airport must coordinate with the Oklahoma Aeronautics Commission (OAC). This rule is not exclusive to wind energy developers, rather it applies to all individuals proposing to construct any tall structure(s). According to the Oklahoma Aircraft Pilot and Passenger Protection Act (APPPA) codified in Oklahoma Statute, Title 25, Chapter 30, Section (§) 1-3, an individual must obtain a permit from the OAC if a structure or an alteration of a structure is within three statute miles of a public-use airport and is in excess of 150 feet above the airport elevation.

The primary concern is there are two organizations with slightly differing rules for coordination, and that further coordination with other organizations, e.g. military installations, is either not occurring in a timely manner or at all. The military depends on navigable airspace to conduct operations in support of national defense strategy. Without appropriate and timely coordination of airspace and structures that can impact airspace, that resource can become constrained and no longer be a viable resource for training.

Compatibility Assessment

According to Part 77 Compliance, the FAA evaluates vertical obstructions through the OE/AAA process as it impacts air navigation. Part 77 Compliance also establishes height provisions through the use of slopes. If a proposed structure or alteration exceeds a defined slope (e.g. 100 horizontal feet to 1 vertical foot), then the structure can be designated as a hazard to air navigation.

According to APPPA, at the time the individual or developer requests coordination with the FAA for an OE/AAA and the FAA determines that further aeronautical studies are required to determine if the proposed construction or alteration would be a hazard to safe air navigation, then the developer is required to provide the OAC with an opportunity to review and evaluate the proposed construction or structure for determination of impact to air navigation. In providing the OAC with a review, the developer would provide all correct copies of records and filings made with the FAA. Upon initiation of the OAC review, then the OAC works to communicate and coordinate with all relevant agencies including the Oklahoma Military Strategic Planning Commission and the military installations.

Only if the FAA determines the need for further aeronautical studies is an OAC review initiated. In order for this to occur the developer has to be aware of this Oklahoma provision and the developer must initiate the OAC review. There are no provisions that require an OAC review of proposed construction or alterations if the proposal does not require further assessment by the FAA. In addition, neither the FAA OE process nor the OAC review specifically address interference of radar viewsheds from wind turbine operations as the FAA OE process and OAE review are based off of airport (runway) elevation.

Findings

- The FAA notifies a tall structure or wind energy facility developer that the proposed construction or alteration needs further aeronautical studies.
- There is a requirement of the developer to initiate the OAC review only if the FAA determines further aeronautical studies are needed.
- If there is no FAA determination of “further aeronautical studies are needed” to initiate the OAC review, then there may not be direct communication or coordination with the local military installation for their review for incompatibility with operations.
- Neither the FAA OE process nor the OAC review specifically address interference of radar viewsheds from wind turbine operations

ISSUE COM-6	**Fort Sill Could Enhance Communicate on a Regular Basis with Surrounding Jurisdictions and the Public** *There is an opportunity to enhance relationships with and responses from surrounding jurisdictions when addressing issues that may arise.*

The role of the Public Affairs Office (PAO) at Fort Sill is to provide Fort Sill and the garrison commanders' advice and support in community relations, community support, media relations and command information. The PAO's primary focus of their communication efforts is between military installations within the region.

To complement this focus, Fort Sill has an opportunity to proactively communicate and build relationships with the local jurisdictions and the public. The lack of communication resources directed to the community and the public can result in unintended mistrust and decreased support for the mission and associated events and ceremonies. With the creation of mistrust, this may also create unintentional delays in responding to and / or addressing matters of concern for the military and vice versa for the military and community.

Compatibility Assessment

On the PAO's webpage located at http://sill-www.army.mil/usag/pao/, it states that the office will provide support to local governments and groups and will accept the request of support for the community if given at least 90 days lead time. This is primarily for events and ceremonial gatherings; however, there is no procedure online that targets the surrounding jurisdictions and the public to disseminate information to them about changes in training schedules, non-routine training, events, and other information that would be pertinent to the surrounding jurisdictions and the public.

The Fires Center of Excellence (FCoE) developed and maintains an official Facebook page, in which there are over 33,000 people following the page. While the FCoE Facebook page focuses on the Fort Sill audience, the PAO posts items pertinent to all, including training noises. This assists in spreading the information informally. However, there is no regular, direct communication like the post shown below to the jurisdictions and the public.

Fires Center of Excellence Public Affairs Office Post on Facebook page on May 16, 2017

Findings

- Fort Sill's PAO does not communicate with the jurisdictions and public on a regular basis. For Fort Sill to be involved in a community event, the installation requests a 90-day advance notice.
- Fort Sill's FCoE has an official Facebook page and uses it to communicate internal to the installation. However, some information is relevant to the external Fort Sill audience.

ISSUE COM-7	**Joint Law Enforcement Meetings are Voluntary and Informal** *There is an informal weekly meeting between local law enforcement organizations, including Fort Sill Military Police and the Federal Bureau of Investigation.*

According to Fort Sill, there is a weekly local law enforcement meeting that occurs on Friday mornings. The composition of the informal group includes representatives from the City of Lawton Police Department, Comanche County Sheriff's Department, Fort Sill Military Police and Physical Security Department, and the Federal Bureau of Investigation. The group meets to discuss issues that have recently occurred or are of concern to any one of the agencies involved in the group. The group discusses issues and / or concerns, roles and responsibilities in managing the issues and concerns, and potential partnerships to address the issues.

This local law enforcement agency is voluntary, and as such participation from the agencies is not required and may vary from week to week. The volunteer nature of this group, while laudable in its initiation, may miss an opportunity to formalize relationships and information sharing that can lead to a consistently informed local and regional law enforcement group. This result can avoid delays in addressing certain issues or concerns, result in

building a stronger, integrated law enforcement response for managing issues and concerns that occur. This includes managing law enforcement issues that directly impact Fort Sill such as the no drone zone—prohibiting and responding to drones that fly over Fort Sill into the military's restricted airspace.

Compatibility Assessment

While there are no tools directly related to this issue, there a several Memoranda of Agreements (MOAs) between Fort Sill and multiple agencies or jurisdictions for managing various functions and / or issues. These MOAs have been established by the participating partners and have delineated roles and responsibilities for managing the issue, concern, or function. The MOAs are regularly reviewed and evaluated to determine effectiveness as aspects change, i.e. the original issue or concern, individuals in one of the participating organizations, or if there is even a need for the agreement.

Findings

- The informal and voluntary nature of the local law enforcement weekly meeting can result in a lack of an integrated response to issues or concerns that occur.
- Fort Sill and multiple agencies have MOAs which delineate engagement and roles and responsibilities that can be leveraged to codify informal meetings.

5.5 Cultural Resources (CR)

Cultural resources are an aspect of past or present human activity that are valued by, or significantly representative of, a culture or that contain significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as artifacts, records, districts, historic archaeological sites, buildings, structures, and objects. Historic properties are cultural resources that are eligible or listed on the National Register of Historic Places. Cultural resources may prevent development, require development constraints, or require special access by Native American tribal governments or other authorities.

The protection of prehistoric and historic resources is provided through the National Historic Preservation Act (NHPA) as a means to protect historical and cultural items within the United States. The NHPA addresses the preservation of cultural resources including cultural landscapes, traditional cultural properties, sacred sites, and historic and archaeological resources. Documentation of cultural resources and NHPA compliance activities at Fort Sill must be coordinated through the Oklahoma State Historic Preservation Office (SHPO).

Cultural resources typically categorized into four types: archaeological, historical, architectural, or traditional cultural properties. Archaeological resources are considered material remains of past human life or activities that provide scientific or social insight into past human cultures. Architectural resources are structures including standing buildings, bridges, dams, canals, etc. of historical, architectural, or engineering significance. Historical cultural resources can be Sites, structures, landscapes, objects or natural features of significance to a traditionally associated group of people. Traditional cultural properties are places where associations with cultural practices or beliefs of a living community occurred in the past or are presently occurring.

Special considerations must be made for any development or expansion of military mission activities within areas of cultural significance or sensitivity.

Key Terms

American Indian Religious Freedom Act (AIRFA). The AIRFA is a US federal law passed in 1978 that protects Native American cultural and religious practices, including accessing sacred sites. All governmental agencies, including the military are required to permit the free exercise of Native American religion and accommodate access to their religious sites, so long as it does not interfere with the agency's function.

Executive Order (EO) 13007. Under EO 13007, federal land must, to the extent possible, accommodate access to Native American ceremonial uses, and avoid adversely impacting sacred Native American sites.

Executive Order (EO) 13175. Under EO 13175, federal agencies must consult with Native American tribes prior to issuing policies that have potential to impact a tribe's community.

National Historic Preservation Act (NHPA). The NHPA was passed in 1966 to preserve historical and archeological sites. This act requires all federal agencies to assess and evaluate potential impacts to such historical and archeological sites.

Native American Graves Protection and Repatriation Act (NAGPRA). The NAGPRA was passed in 1990, requiring federal agencies and projects that receive federal funding to return any Native American artifacts or other sacred objects, including human remains to the Native American lineal descendants.

ISSUE CR-1	**Awareness of Cultural and Sacred Sites Access on Fort Sill** *While there are no access issues with cultural resource sites or sacred sites on Fort Sill, there is a community concern regarding limiting community access to sacred sites and resources in the future. This could constrain interaction between Fort Sill and Native American Tribes in the JLUS Study Area.*

There are nine Native American tribes that have some historic affiliation with Fort Sill, and the surrounding area, which Fort Sill consults with in accordance with NHPA, AIRFA, EO 13007, EO 13175, and NAGPRA. The nine tribes are:

- Apache Tribe of Oklahoma
- Caddo Nation of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Chickasaw Nation
- Comanche Nation
- Delaware Nation
- Fort Sill-Apache Tribe
- Kiowa Indian Tribe of Oklahoma
- Wichita and Affiliated Tribes

Currently, Fort Sill maintains a good relationship with all Native American tribes and their leaders. The installation is proactive in consulting with Native American tribes when considering actions that may potentially impact cultural resources of interest. Likewise, Fort Sill provides Native American's access to sacred sites on-post when requested. The primary concern regarding this issue is if some time in the future the Native American Tribes leadership changes, then there is concern that the long-standing relationship may become constrained. This potential future constraint could impact military mission operations by potentially delaying construction activities and / or operations to permit access to cultural resource interest's on-post.

Compatibility Assessment

The consultation process occurs between Fort Sill's Garrison Commander and the Native American tribe's leaders, but the Garrison Commander may designate certain Fort Sill staff representatives for follow-on activities. This process helps strengthen the relationship between the installation and tribal governments and allows the Native American tribes an opportunity to provide input early in Fort Sill's decision-making process on matters that may impact them. This cultural and historic process is followed on all interactions with the Native American tribes.

Findings

- The existing tools address this issue, which requires no further assessment.
- Fort Sill has a good relationship with Native American Tribes in the JLUS Study Area.

5.6 Dust / Smoke / Steam (DSS)

Dust results from the suspension of particulate matter in the air. Dust as well as smoke can be created by fire (e.g., controlled or prescribed burns, lightning strikes), ground disturbance (e.g., military operations, grading), industrial activities can cause dust, smoke, and steam. If present in sufficient volume, dust, smoke, and steam can be a compatibility issue impacting flight operations (by reducing visibility or causing equipment damage) or otherwise interfering with military operations.

Key Terms

Particulate Matter. Particulate matter (PM) consists of fine metal, smoke, soot, and dust particles suspended in the air. Particulate Matter is measured by two sizes: smaller "fine" particles less than 2.5 micrometers in diameter (PM2.5), or larger "course" particles between 2.5 and 10 micrometers in diameter (PM10).

Prescribed Burn. A controlled fire applied to a predetermined area with appropriate safety precautions.

Soil Parameters. A soil parameter is a characteristic or trait of the soil, including unit weight, unit weight of soil solids, and water content. There are several parameters in which soil is measured and calculated to understand the capacity of the soil, especially related to training activities.

Technical Background

Particles of dust and other materials found in the air are referred to as particulate matter. At certain concentrations, particulate matter can be harmful to humans and animals if inhaled causing strain on the heart and lungs. The term particulate matter (PM) refers to particles suspended in the air less than ten microns in size. PM can be caused by many activities, including driving on unpaved roads and surfaces, wind erosion from unpaved vacant lots, disruption of land from vehicle maneuvers, explosions, aircraft operations, and other earth-moving activities such as construction, farming, demolition, and grading. According to the Environmental Protection Agency (EPA), the primary source of PM is typically incomplete combustion processes, automobile emissions, and dust. The secondary sources are chemical reactions in the atmosphere.

ISSUE DSS-1	**Smoke / Dust Complaints in the Community** *There have been some complaints from the community regarding smoke and dust generated from fires originating at Fort Sill. This issue may become more of a concern in the future depending on the tempo of training.*

There are various activities that occur on Fort Sill which can produce dust such as training using tracked vehicles and fire artillery and demolitions activities. This dust usually disperses into the air, potentially travelling off-installation and into the community depending on where the dust-producing activities occur in proximity to community activities. In addition, dust at Fort Sill can be dispersed through a combination of wind naturally eroding the terrain.

According to the 2014 Fort Sill Integrated Natural Resources Management Plan (INRMP), Fort Sill soils are susceptible to erosion due to the repeated use of artillery firing positions as well as activities of feral hogs that damage vegetation and increases bare ground. Severe erosion limits maneuverability in training areas and leaves sites unusable when muddy in wet weather conditions. Severe erosion can adversely impact field artillery training at Fort Sill by creating stability and trajectory issues when firing artillery.

M-117 bomb detonates on target at Fort Sill

Dust can impact air quality, currently the Lawton area is monitored for ozone and particulate matter less than 2.5 micrometers in diameter (PM2.5). See the Section 5.1 Air Quality for more details on the ozone status.

There are four federal standards for PM2.5, which are:

- Primary and Secondary PM2.5 24-hour standards: 35 micrograms per cubic meter air (µg/m3) (for a 3-year average)
- Primary Annual Arithmetic Mean PM2.5 standard: 12 µg/m3 (for a 3-year average)
- Secondary Annual Arithmetic Average PM2.5 standard: 15 µg/m3 (for a 3-year average)

Oklahoma is in attainment for all federal standards of PM2.5. According to the 2015 data reported from monitoring station in the Lawton Metropolitan Area, for the 24-hour standard, Lawton had a reading of 19.7 µg/m3 out of 35. For the Primary Standard, Lawton's monitoring station reported an annual mean of 8.2 µg/m3 out of 12 µg/m3 [federal standard], and for the Secondary Standard, Lawton's monitoring station reported an annual mean of 8.2 µg/m3 out of 15 µg/m3 [federal standard].

For PM2.5, the Lawton Metropolitan Area is categorized as in attainment regarding air quality. However, there are monitoring stations that continue to report hourly data, which assists the community and the state in planning purposes for preventing nonattainment status of this air pollutant.

Compatibility Assessment

According to the INRMP and as part of the method to maintain the stability of the soil, Fort Sill's Fire Department conducts prescribed burns annually. Prescribed burns are performed for a number of reasons including to temporarily remove vegetation to spur soil and land rehabilitation and to manipulate wildlife habitats. Fort Sill conducts its prescribed burns in mid-February until spring if there is adequate soil moisture and on days when there are no high winds. These seasonal weather conditions are ideal for burning as it limits the potential for fires, smoke, and dust propagation off-installation into the community.

In an effort to manage the production of dust on the installation, the Fort Sill INRMP identifies the goals and objectives for the management of soils and dust production. The goals and objectives that directly address this issue are:

Goal 1. Use soil parameters to manage military activities, protect soil stability, restore training lands, and conserve wildlife habitat.

Objective 1. Use soil inventory data to make decisions regarding land use, rehabilitation options, and wildlife habitat management options.

Objective 2. Use site-specific soil testing for natural resources programs, such as training land rehabilitation, erosion control, and food plots.

Goal 2. Repair damaged soils and use soil parameters to manage military activities, protect soil stability, restore training lands, and conserve wildlife habitat.

Objective 1. Identify erosion control projects, develop appropriate repair designs, and implement repairs as needed.

Findings

- The repeated use of the same artillery firing position can cause erosion, which can produce dust that could impact future air quality.
- The INRMP identified site-specific soil testing and land rehabilitation to achieve to reduce the impact of soil erosion on training activities.
- Currently, Lawton, Oklahoma is in attainment for PM2.5.

ISSUE DSS-2	**Prescribed Burns Conducted by the Wichita Mountains Wildlife Refuge can produce Fugitive Smoke Particles** *There are prescribed burns that occur outside Fort Sill, specifically in the Wichita Mountains that have resulted in adverse impacts to Fort Sill, and have caused delays in training.*

The Wichita Mountains Wildlife Refuge (Refuge) conducts prescribed burns for the restoration of native ecosystems as an ecosystem management tool. The Refuge shares its southern border with Fort Sill. According to the US Fish and Wildlife Service (USFWS), the prescribed burns are often scheduled during winter and summer months, when weather conditions are less likely to disperse inordinate amounts of smoke.

Due to the proximity to Fort Sill, smoke is visible outside of the refuge during prescribed burn operations. Due to weather conditions, residual smoke can still be visible for days after a burn depending on the size of the prescribed burn operation. Smoke and dust from prescribed burns outside of the installation can encroach onto Fort Sill, resulting in temporary impacts to soldier visibility and potentially delays to training and operations. This delay can result in lost hours of training on days when the Refuge conducts its prescribed burns.

Compatibility Assessment

The USFWS is one of five federal agencies that manages and has primary fire program responsibility on federal lands. While Fort Sill and the Refuge have a cooperative relationship, there are no formal agreements in place that delineate roles and responsibilities and formalized communication procedures between the organizations.

The Fort Sill Fire Department maintains a network of firebreaks that is approximately 246 miles long and approximately 40 to 60 feet wide on the installation. These are designed to prevent wildfires originating on or off the installation from propagating. Prescribed fires at Fort Sill are generally performed in late July through August when grass, a primary fire fuel source, has died.

Findings

- There are no formal agreements in place for communication or coordination between Fort Sill and the refuge when prescribed burns are planned.

5.7 Energy Development (ED)

Uncoordinated development of energy resources, including alternative energy sources (such as solar, wind, geothermal, or biofuels) could pose compatibility issues related to vertical obstruction of aviation operations (vertical structures), interference with radar operations (wind generation), or glare (solar energy).

Often during the development of alternative energy siting, temporary structures are erected that can pose a safety to flight if the siting is not coordinated. Additionally, both wind turbine hub height / blade length and transmission line towers and the lines themselves may become vertical obstruction to existing and future military missions.

The rotating blades of a wind turbine create a Doppler effect that can interfere with radio transmissions between air traffic controllers and aircraft and other types of communications, such as satellites or impact weather surveillance radar's ability to accurately forecast weather in areas near the turbines. Other objects such as terrain and stationary structures can also interfere with radar operations, but are easier to block out because they do not move. The rotating blades of the turbines are what causes erratic signal returns that cause anomalies.

Recent reports and studies, such as the 2006 Report to the Congressional Defense Committees on The Effect of Windmill Farms on Military Readiness and the Federal Aviation Administration's (FAA) 2015 A Case Study of Wind Farm Impact on ASR-11 With Focus on Abilene Air Traffic Radar, identify that large numbers of wind turbines located as far as 30+ nautical miles away from a radar system can have a negative impact on the system and interfere with readings.

The impacts on radar are increased with the elevation of the wind turbine in comparison to the radar and height, the number, and the clustering of turbines. The greatest impact is caused by their location proximate to the radar system. Although research is still being conducted, there is no definitive answer to how tall, large, or how many wind turbines must be present to compromise radar operations and it varies on a case-by-case basis, taking into account elevation of the radar, view angles, and elevation of the turbines.

Relative to solar energy, solar facilities could cause glare depending on their materials, type, location, angle and direction, resulting in a reduction of a pilot's view, even at a high altitude.

Key Terms

Alternative Energy. The term alternative energy is applied broadly to energy derived from nontraditional or renewable sources (e.g., solar, hydroelectric, wind).

Line of Sight. Defined as the line between two points; specifically: the straight path between a transmitting antenna (as for radio or television signals) and a receiving antenna when unobstructed by the horizon.

Radar Clutter. Radar clutter is a term used for unwanted signal echoes in electronic systems, particularly in reference to radars. Such echoes are typically returned from ground, sea, rain, animals, manmade and natural obstructions, and atmospheric turbulences, and can cause serious performance issues with radar systems observation of desired navigation display sight picture.

Screening. Screening is blocking out portions of the "field of view" so that aircraft control instrumentation and / or personnel cannot see aircraft that fly behind the "screen."

Viewshed. A viewshed is the geographical area that is visible from a location. With respect to communications. It includes all surrounding points that are in line-of-sight with that location and excludes points that are beyond the horizon or obstructed by terrain and other features (e.g., buildings, trees). Radar viewshed refers to a large geographical area that is visible from a location AND is not necessarily "visible" to humans. In radio communications the viewshed indicates where a specific combination of transmitter, antenna, and terrain allow reception of signal.

Weather Radar Impact Zones. The National Oceanic Atmospheric Administration (NOAA) National Weather Service Radar Operations Center (ROC) developed four "impact zones" around weather surveillance radars to communicate to wind facility developers where certain considerations should be taken when siting turbines to minimize impacts to the radar. These zones vary for each individual weather radar and take terrain, distance, and the number of elevation angles impacted into account. The zones are not enforceable, but are meant to provide information to wind developers on areas where the National Weather Service should be consulted when proposing wind energy development.

The four Weather Radar Impact Zones are defined as:

- **No-Build Zone.** The No-Build Zone is an approximately 2.5-mile radius surrounding a weather radar, in which wind turbine development can cause mechanical damage to the radar and compromise the radar's ability to accurately forecast hazardous weather. It may also pose radiation hazards for those constructing and maintaining the site. The ROC requests that developers do not build any turbines in this area.
- **Mitigation Zone.** The Mitigation Zone extends between approximately 2.5 to 22.5 miles from weather radar. Wind turbines in this zone could penetrate multiple elevation angles of the radar, which could cause deflection and interference that substantially reduces the precision and detection of hazardous weather events. The ROC will work with the developer to get detailed project information, do a thorough impact analysis, and discuss potential mitigation solutions. Significant impacts are likely in this area.
- **Notification Zone.** The Notification Zone is between approximately 22.5 to 27.5 miles from weather radar. Wind Turbines built in this zone are able to be detected and have potential to interfere with the radar's operation. The National Weather Service (NWS) Radar Operations Center requests notifications of wind energy development within this zone. Since impacts are typically minimal beyond 27.5 miles and workarounds are available for penetration of only one elevation angle, the ROC recommends consultation optional; however, the National Oceanic Atmospheric Association would still like to know about the project. Significant impacts are not likely in this area.
- **Consultation Zone.** The Consultation Zone extends up to approximately 37.5 miles from weather radar. Wind turbines that are built within this zone can potentially contaminate radar imagery. Due to the increased potential for impact to operations the ROC requests consultation with the developer to track the project and acquire additional information for a thorough impact analysis. Significant impacts are possible in this area.

ISSUE ED-1	**Existing and Proposed Energy Developments Impact Military Training** *There is existing wind development and several proposed sites that have impacted and have the potential to impact Fort Sill military training missions. This can result in degradation of military readiness not only for Fort Sill, but also for Sheppard Air Force Base (AFB), Altus AFB, Tinker AFB, and Vance AFB all of which use the Fort Sill airspace and range.*

There is one existing wind development within the Fort Sill JLUS Study Area—The Blue Canyon Wind Farm. This wind farm contains a total of 250 wind turbines, the closest of which is located less than five miles north of Fort Sill's northwestern border, and approximately nine miles north of Henry Post Army Air Field (HPAAF) on Fort Sill. The HPAAF is not the only area where air operations occur on Fort Sill. In addition to HPAAF, several AFBs—Sheppard, Altus, Tinker, and Vance—conduct aerial bombing / gunnery training at the Falcon Range located on Quanah Range. The flight paths the pilots travel to perform the aerial bombing can come from all directions, which would pose an issue if energy development facilities are built surrounding the installation in the direct route of the flight paths traveled to perform aerial bombing training. Wind turbines placed in direct routes of flight paths for the Falcon Range and HPAAF can result work-arounds for the Air Force and Army, delaying aviation training operations. This can also eliminate Fort Sill's aerial bombing training capability if work-arounds are unsuccessful and / or infeasible.

Figure 5.7-1 illustrates the existing and proposed wind turbines in the JLUS Study Area. While the existence of only one wind farm may not have a great impact on aviation operations, the cumulative effect of all surrounding wind turbines can have detrimental effects on radar communications and safe air navigation for military operations.

Compatibility Assessment

Section 358 of the 2011 National Defense Authorization Act pertains to studying the impacts of the development of new energy production facilities on military operations and readiness. The DoD Siting Clearinghouse serves to coordinate the DoD review of existing applications for proposed energy projects. Several key elements of Section 358 include designation of a senior official and lead organization to conduct the review of energy project applications, a 30-day review period for completion of an impact assessment associated with an application, specific criteria for DoD objections to projects and a requirement to provide an annual status report to Congress. This legislation facilitates procedural certainty and a predictable process that promotes compatibility between energy independence and military capability. For more information on the DoD Siting Clearinghouse, see Chapter 4, Section 4.1 Federal.

In the State of Oklahoma, the Oklahoma Aeronautics Commission (OAC) is authorized to review proposed energy development applications as part of the Aircraft Pilot and Passenger Protection Act (APPPA). The OAC reviews applications, and gives notice to the Oklahoma Strategic Military Planning Commission and any military airport within the state that may be affected. However, this OAC review is only initiated when a development is within three miles of a public-use airport and is over 150 feet, or the Federal Aviation Administration (FAA) determines there is a need for further aeronautical studies through the Obstruction Evaluation / Airport Airspace Analysis (OE/AAA).

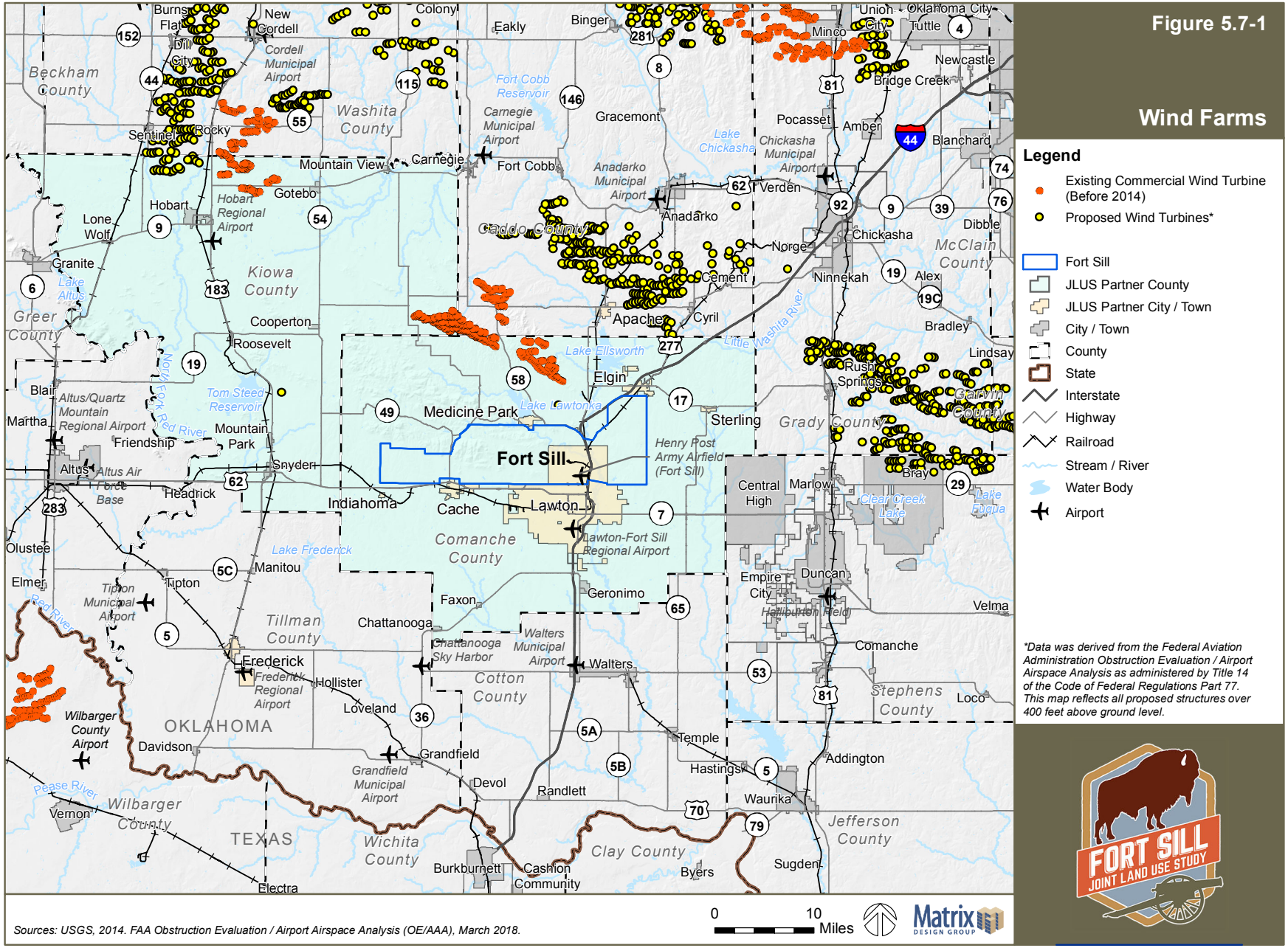


Figure 5.7-1
Wind Farms
Legend
Existing Commercial Wind Turbine (Before 2014)
Proposed Wind Turbines*
Fort Sill
JLUS Partner County
JLUS Partner City / Town
City / Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Airport
*Data was derived from the Federal Aviation Administration Obstruction Evaluation / Airport Airspace Analysis as administered by Title 14 of the Code of Federal Regulations Part 77. This map reflects all proposed structures over 400 feet above ground level.
Sources: USGS, 2014. FAA Obstruction Evaluation / Airport Airspace Analysis (OE/AAA), March 2018.
0
10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY
Fort Sill
Lawton
Medicine Park
Elgin
Sterling
Apache
Cyril
Indiahoma
Cache
Comanche County
Tillman County
Cotton County
Jefferson County
Clay County
Wichita County
Wilbarger County
Kiowa County
Washita County
Caddo County
Grady County
Stephens County
McClain County
Garvin County
Greer County
Beckham County
OKLAHOMA
TEXAS
Lawton-Fort Sill Regional Airport
Henry Post Army Airfield (Fort Sill)
Altus Air Force Base
Altus/Quartz Mountain Regional Airport
Hobart Regional Airport
Cordell Municipal Airport
Carnegie Municipal Airport
Anadarko Municipal Airport
Chickasha Municipal Airport
Tipton Municipal Airport
Frederick Regional Airport
Chattanooga Sky Harbor
Walters Municipal Airport
Grandfield Municipal Airport
Wilbarger County Airport
Halliburton Field
Lake Ellsworth
Lake Lawtonka
Lake Frederick
Lake Chickasha
Tom Steed Reservoir
Fort Cobb Reservoir
Clear Creek Lake
Lake Fuqua
Red River
North Fork Red River
Little Washita River
Pease River
Burns Flat
New Cordell
Colony
Eakly
Binger
Union City
Oklahoma City
Tuttle
Minco
Newcastle
Bridge Creek
Pocasset
Amber
Blanchard
Gracemont
Verden
Anadarko
Chickasha
Norge
Cement
Ninnekah
Alex
Dibble
Bradley
Lindsay
Rush Springs
Bray
Marlow
Central High
Duncan
Empire City
Velma
Comanche
Loco
Addington
Temple
Hastings
Waurika
Randlett
Devol
Grandfield
Davidson
Vernon
Electra
Burkburnett
Cashion Community
Byers
Sugden
Frederick
Hollister
Loveland
Chattanooga
Faxon
Geronimo
Walters
Tipton
Manitou
Olustee
Elmer
Headrick
Snyder
Mountain Park
Friendship
Martha
Blair
Granite
Lone Wolf
Hobart
Gotebo
Roosevelt
Cooperton
Mountain View
Carnegie
Fort Cobb
Sentinel
Rocky
Dill City

Findings

- The cumulative effect of all the wind farms in the region can impact military training by radar communications interference and vertical obstructions.
- There are state laws that have been enacted that establish reviews of proposed energy development by the OAC, but the review is only required if the proposed development is over 150 feet and within 3 miles of a public-use airport, or if it triggers an aeronautical review through the FAA OE/AAA process.
- There are no local laws or agreements that require military coordination or review.
- There are no state laws that require military notification of certain proposed development.

ISSUE ED-2	**Energy Developments Can Impact Radar** *Energy development can impact the airport surveillance radar (ASR) system which is the system that detects and displays aircraft in the terminal area. It provides information that enables ground control to communicate with pilots and aircraft in the area. This can increase air navigation safety risks to pilots and the public.*

Fort Sill uses its Airport Surveillance Radar 8 (ASR-8) to provide information to aircrew and pilots to facilitate the coordinated control and performance of aviation training at Fort Sill. Similar to a weather radar, the ASR-8 collects data through the use of radio or electromagnetic waves to identify other aircraft in the viewshed of the radar. In other words, radars are able to locate an object's position by sending out a signal, or energy wave in all directions. This signal reflects off objects, such as aircraft, birds, and mountains. The energy from the signal is reflected back to the radar. Computers calculate the strength of the signal returned and distance it traveled to estimate the size and location of the object. Multiple signals that return information provide an estimated location, size, speed, and movement of an object. Wind turbines within a radar's line-of-sight can prevent a radar's emitting signal, as well as interfere with the signal when it is returned, weakening the strength of the energy down range of the wind farm and creating clutter. The closer a wind turbine is located to a radar and the quantity of wind turbines have a greater impact on a radar and its efficiency.

The image of the radar returns on the navigation display are used to inform pilots and aircrew about other aircraft traversing the airspace. The ASR-8 can be impacted by tall structures including manmade structures and natural land features, e.g. energy development turbines, and mountains.

Radar data can become contaminated with clutter when wind turbine blades reach a rotating speed of 15 knots (or about 17 miles per hour). The data beyond the clutter also becomes potentially contained, returning weakened signals. Thus, this renders the specific area covered by the radar as an area that has an increased risk associated with it due to the inability to view other aircraft in the radar's viewshed. This can become not only dangerous, but also delay training activities and cost the military millions of dollars in valuable training hours.

Compatibility Assessment

According to Fort Sill, there are natural blind spots that the radar captures such as mountains and tall structures that already exist that the radar operators communicate to aircrew and pilots to avoid. In other words, there are blind spots masking the radars viewshed, so the idea is to not create more blind spots and exacerbate the problem.

The FAA's OE/AAA process is triggered when a proposed structure exceeds 200 feet in height. If through this FAA process, the FAA determines the need for further aeronautical studies, then the energy developer must submit the FAA package to the OAC for review. It is during this OAC review that would trigger a military installation review. However, the OAC review is not required. See Section 5.4 Coordination and Communication, Issue COM-5 for more information on the FAA OE/AAA process and the OAC review.

Some installations have implemented mitigation techniques for developed wind turbines picked up by radars, such as masking, or blacking-out clutter caused by wind turbines on the navigation display. However, this does not improve the weakened signal past the wind turbines. Additionally, the mask or blacked-out area blocks all radar returns in the area, eliminating the visibility of possible other objects that could be used to warn pilots and other air crew.

Findings

- Fort Sill identified natural blind spots as potential locations for certain energy development projects.
- The FAA's OE/AAA process may not include evaluation of radar impacts.
- The spinning blades of wind turbines can contaminate radar data, appearing as clutter when picked up by the radar.
- Wind turbines can weak radar signals beyond wind turbines' rotating blades.
- Mitigation techniques used by other installations are not completely effective.

ISSUE ED-3	**Energy Development Impacting the Frederick Weather Radar** *Fort Sill does not have a weather radar on-installation, so the installation depends on the Frederick weather radar for weather information. Increasing wind energy development in the area of the Frederick Weather Radar could impact weather data collected for the area, which is used by Fort Sill as well as for local and national weather predictions.*

The NOAA National Weather Service ROC operates, in conjunction with the DoD and FAA, all NEXRAD weather radars in the United States to detect precipitation and atmospheric data in order to forecast weather. Federal, state, and local agencies, as well as the general public use this information on a daily basis, making the NEXRAD weather radar system a critical piece of United States infrastructure. Fort Sill uses this information to organize and manage the day-to-day airfield operations and training. The data assessed to make decisions about training operations includes several variables, such as wind speed, wind direction, the range of weather events, altitude of weather, and precipitation. However, the weather radar information is only as good as what the image of radar returns displays on the navigation display. This assists the airfield manager in providing the appropriate guidance to pilots about which runway to use for take-off and landings and which direction to ascend and so on.

The weather radar at the Frederick Regional Airport (KFDR) is approximately 53 miles southwest of Fort Sill, and is used to predict and forecast weather for southwest Oklahoma. The KFDR weather radar is owned and maintained by the DoD, and was specifically sited per DoD requirements to assist in military operations and readiness. The concern is increasing energy developments ongoing in the regional area and its impact on the KFDR weather radar at Frederick Regional Airport.

As mentioned in Issue ED-2, radar returns can become contained by the rotating blades of wind turbines once they reach a rotating speed of about 17 miles per hour, creating clutter. Data beyond the wind turbines are also weakened. This becomes an issue in predicting hazardous weather in a timely manner. Weather radars use 14 elevation angles to scan the atmosphere for inclement weather, with the lowest angles extending the farthest distance. However, the lowest angles are the most impacted when wind turbines are developed within a radar's line-of-sight. This can result in late or missed warnings of severe and hazardous weather.

There are several wind energy facilities that currently exist in the vicinity, including Rocky Ridge Wind Farm and Blue Canyon Wind Farm north-northwest of the Fort Sill-Lawton area. Similar to wind farm impacts to military training and the ASR radar, the cumulative effect of multiple wind farms could result in greater impacts to military training and readiness, and the reduction of the KFDR's weather forecasting capabilities.

Compatibility Assessment

The NOAA National Weather Service ROC developed four "impact zones" around weather surveillance radar to communicate to wind farm developers' areas where certain considerations should be taken when siting turbines to minimize impacts to the radar. Figure 5.7-2 illustrates the four radar impact zones around the Frederick Weather Radar. These zones vary for each individual weather radar and take terrain, distance, and the number of elevation angles impacted into account. However, these impact zones are not enforceable, and the NOAA National Weather Service ROC is not part of the FAA OE/AAA process and is not always made aware of proposed wind energy developments. The Oklahoma Aeronautics Commission also is not required to consult with the NOAA National Weather Service ROC through the APPPA aeronautical review, and does not assess the radar impact zones. Thus, leaving weather radars susceptible to incompatible wind turbine developments.

Findings

- The KFDR weather radar located at the Frederick Regional Airport was specifically sited using DoD requirements.
- Wind turbines impact a weather radars lowest angles, which are critical in forecasting hazardous inclement weather in a timely manner.
- The NOAA National Weather Service ROC impact zones are not an enforceable regulation.
- The NOAA National Weather Service ROC is not included in FAA's OE/AAA process for proposed wind energy developments.
- The OAC Review does not include the weather radar impact zones as an area that should be reviewed and assessed as part of the APPPA aeronautical review.

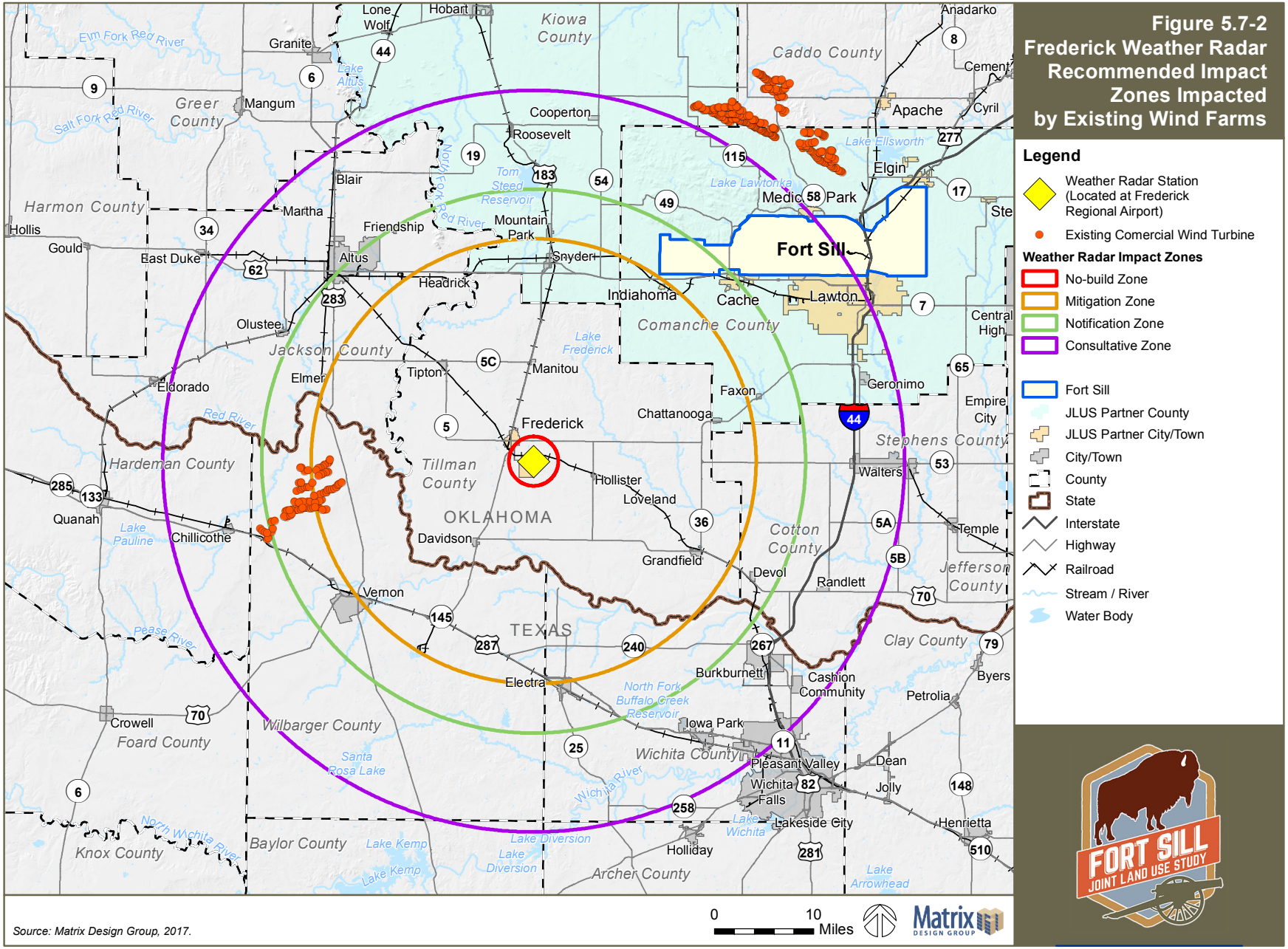


Figure 5.7-2
Frederick Weather Radar Recommended Impact Zones Impacted by Existing Wind Farms
Legend
Weather Radar Station (Located at Frederick Regional Airport)
Existing Comercial Wind Turbine
Weather Radar Impact Zones
No-build Zone
Mitigation Zone
Notification Zone
Consultative Zone
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
State
Interstate
Highway
Railroad
Stream / River
Water Body
Fort Sill
Lawton
Frederick
Elgin
Medicine Park
Indiahoma
Cache
Comanche County
Caddo County
Kiowa County
Tillman County
Jackson County
Harmon County
Greer County
Hardeman County
Wilbarger County
Foard County
Knox County
Baylor County
Archer County
Clay County
Cotton County
Jefferson County
Stephens County
Wichita County
OKLAHOMA
TEXAS
Granite
Hobart
Lone Wolf
Mangum
Cooperton
Roosevelt
Blair
Martha
Friendship
Mountain Park
Snyder
Altus
Headrick
Olustee
East Duke
Gould
Hollis
Tipton
Manitou
Elmer
Eldorado
Chattanooga
Faxon
Geronimo
Empire City
Walters
Temple
Hollister
Loveland
Davidson
Grandfield
Devol
Randlett
Vernon
Quanah
Chillicothe
Crowell
Electra
Burkburnett
Cashion Community
Petrolia
Byers
Iowa Park
Pleasant Valley
Wichita Falls
Lakeside City
Henrietta
Dean
Jolly
Holliday
Anadarko
Cement
Apache
Cyril
Elgin
Central High
Lake Altus
Lake Lawtonka
Lake Ellsworth
Tom Steed Reservoir
North Fork Red River
Elm Fork Red River
Salt Fork Red River
Red River
Lake Pauline
Pease River
Santa Rosa Lake
North Wichita River
Wichita River
Lake Kemp
Lake Diversion
North Fork Buffalo Creek Reservoir
Lake Wichita
Lake Arrowhead
Source: Matrix Design Group, 2017.
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10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

ISSUE ED-4	**Abundant Renewable Energy Resources Provide Opportunities for Energy Development** *The JLUS Study Area and surrounding region has an abundance of renewable energy resources, which makes the area a premier location for energy development. However, the siting of energy development can adversely impact military training and aviation operations that occur in the region.*

The South-Central region of Oklahoma has an abundance of wind energy resource potential. Figure 5.7-3 illustrates the wind energy potential at an altitude of 140 meters, or about 459 feet. The map shows the only area that is considered marginal for wind energy potential is the area over the City of Lawton. Otherwise, Fort Sill is completely surrounded by wind energy resources. Careful planning must be considered in pursuit of the economic benefit of these resources so that development is compatible with military operations. As previously stated, the wind turbines developed within radar viewsheds can create contaminated data and weakened returns, diminishing a radar's effectiveness and adverse impacts to military readiness, such as delays to aviation training and lost hours of training.

Compatibility Assessment

The FAA OE/AAA process is available to assist in reducing the impacts of energy development on radar and safe air navigation. However, the FAA may not evaluate the proposed energy development from a radar viewshed perspective, which could result in missed opportunities for partnering and encroachment on the airspace for military training.

The OAC review is another tool to evaluate the potential impacts of a proposed energy development on safe air navigation; however, the OAC review is only required when a development is within three miles of a public-use airport and is over 150 feet, or the FAA determines there is a need for further aeronautical studies through the OE/AAA.

Recently, the Oklahoma Legislature and the Governor passed a law (House Bill 2298) eliminating the tax credits for wind energy development in the state for wind energy facilities that were not operational by July 1, 2017. While this could assist with reducing incompatible energy development in the state, this could have a backfire effect on the state by making the state less desirable for wind energy development relative to economic development. Thus, the state could lose opportunities for future investment and miss opportunities for generating renewable energy and competing with other states in this area. However, making the environment less desirable for this type of development may benefit safe air navigation for both commercial and military aviation operations.

There are several Oklahoma organizations and agencies including the OAC, the Corporation Commission, and the Oklahoma Military Strategic Planning Commission that are currently working on these energy development issues and concerns.

Findings

- Oklahoma has an abundance of wind energy potential resources.
- House Bill 2298 eliminated tax credits for wind energy development in the state; however, this may have a backfire effect on potential future revenue and energy generation in the state.
- There are several state agencies and organizations that are working on this energy development issue relative to its impacts on aviation operations.

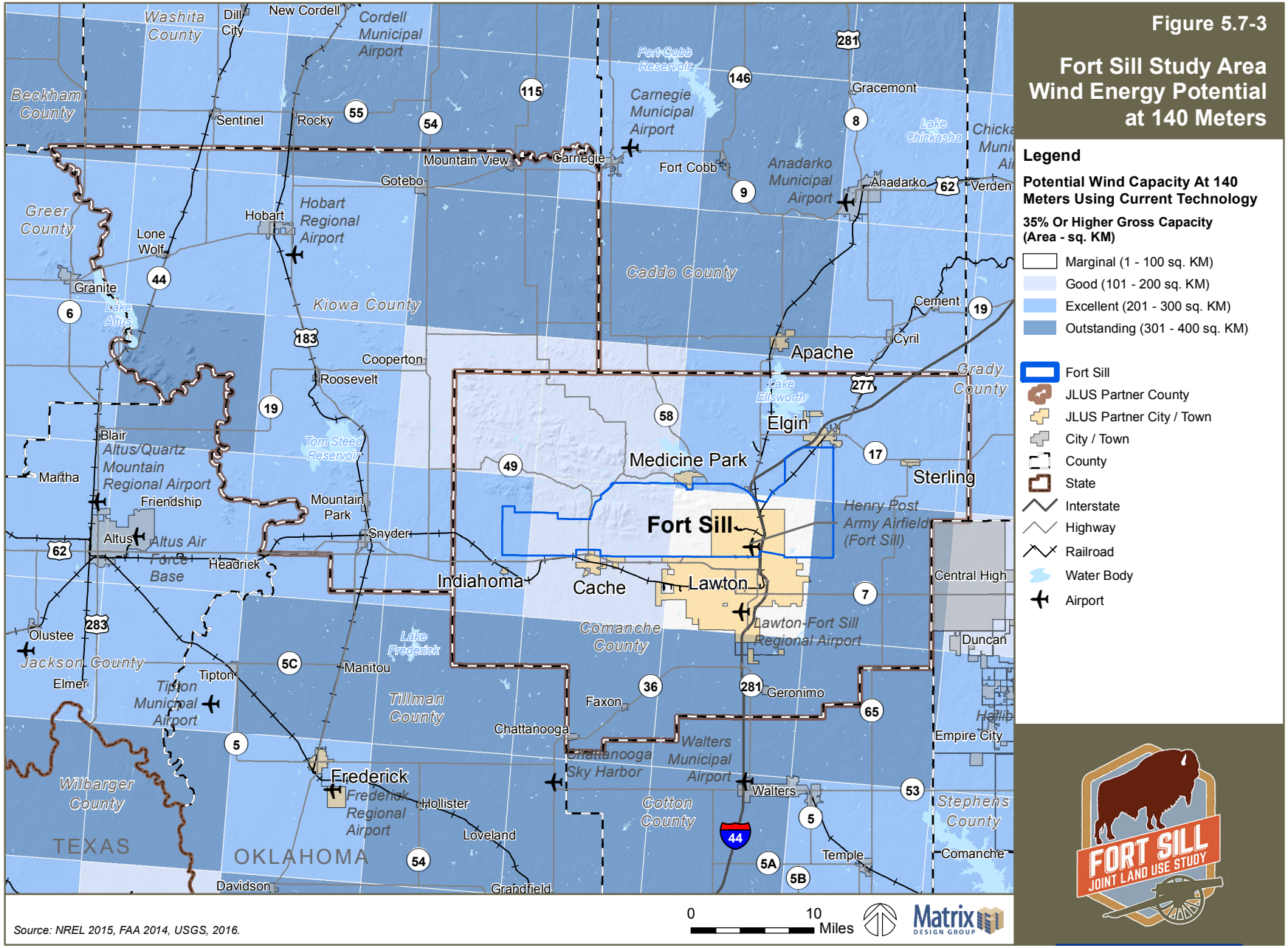
Figure 5.7-3
Fort Sill Study Area
Wind Energy Potential
at 140 Meters
Legend
Potential Wind Capacity At 140 Meters Using Current Technology
35% Or Higher Gross Capacity (Area - sq. KM)
Marginal (1 - 100 sq. KM)
Good (101 - 200 sq. KM)
Excellent (201 - 300 sq. KM)
Outstanding (301 - 400 sq. KM)
Fort Sill
JLUS Partner County
JLUS Partner City / Town
City / Town
County
State
Interstate
Highway
Railroad
Water Body
Airport
Washita County
Beckham County
Greer County
Kiowa County
Caddo County
Grady County
Comanche County
Jackson County
Tillman County
Cotton County
Stephens County
Wilbarger County
TEXAS
OKLAHOMA
Dill City
New Cordell
Cordell Municipal Airport
Sentinel
Rocky
Mountain View
Carnegie
Carnegie Municipal Airport
Fort Cobb Reservoir
Fort Cobb
Gracemont
Anadarko Municipal Airport
Anadarko
Verden
Lake Chickasha
Gotebo
Hobart
Hobart Regional Airport
Lone Wolf
Granite
Lake Altus
Cooperton
Roosevelt
Tom Steed Reservoir
Cement
Cyril
Apache
Lake Ellsworth
Elgin
Medicine Park
Sterling
Blair
Altus/Quartz Mountain Regional Airport
Martha
Friendship
Altus
Altus Air Force Base
Mountain Park
Snyder
Headrick
Fort Sill
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Central High
Lawton-Fort Sill Regional Airport
Olustee
Elmer
Tipton
Tipton Municipal Airport
Manitou
Lake Frederick
Duncan
Faxon
Geronimo
Chattanooga
Chattanooga Sky Harbor
Walters Municipal Airport
Walters
Empire City
Frederick
Frederick Regional Airport
Hollister
Loveland
Davidson
Grandfield
Temple
Comanche
0
10
Miles
Source: NREL 2015, FAA 2014, USGS, 2016.
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5.8 Frequency Spectrum Interference (FSI)

Frequency spectrum is the entire range of electromagnetic frequencies used for communications and other transmissions. Frequencies include communication channels for radio, cellular phones, and television. In the performance of typical operations, the military relies on a range of frequencies for communications and support systems. Similarly, public and private users rely on a range of frequencies in the use of cellular telephones and other wireless devices on a daily basis. Sometimes competition for frequencies cause encroachment resulting in unintentional interference. Careful management of the use and assignment for use of frequencies is an important tool in managing this limited resource.

Key Terms

Frequency. In the frequency spectrum, the number of complete oscillations per second of energy (such as sound or electromagnetic radiation) in the form of waves.

Radio Frequency. Any of the electromagnetic wave frequencies that lie in the range extending from below 3 kilohertz to about 300 gigahertz including the frequencies used for communications signals (as for radio and television broadcasting and cell-phone and satellite transmissions) or radar signals.

Signal. The sound or image conveyed in telegraphy, telephony, radio, radar, or television

Spectrum. The range of electromagnetic radio frequencies used in the transmission of sound, data and television.

Transceiver. A device comprising both a transmitter and a receiver that are combined and share common circuitry or a single housing. When no circuitry is common between transmit and receive functions, the device is a transmitter-receiver.

Transmission. The passage of radio waves in the space between transmitting and receiving stations; *such as* transmitting by radio or television.

ISSUE FSI-1	**Uncoordinated Development Can Impact Radar Communications** *Certain uncoordinated development such as tall structures (e.g. cellular towers and existing wind farms) can interfere with radar communications producing false signals. This can impede and interfere with aviation and aircraft operations, which can result in degradation of military training effectiveness.*

The military's uninterrupted use of assigned frequencies is required for safe and effective testing and aviation operations. The amount and range of the military's frequency spectrum needs for testing, evaluation, and training are generally increasing, while the remaining unassigned frequency spectrum available for DoD use is generally decreasing. Any device that uses the electromagnetic spectrum to perform its primary function can be described as spectrum dependent. These devices include transmitters, receivers, and,

in some applications, a transmitter and receiver combined in the same unit called a transceiver.

The two federal agencies that authorize the use of the electromagnetic spectrum are the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA). According to the NTIA Office of Spectrum Management:

> *Almost every agency of the federal government uses the spectrum in performing mandated missions. The DoD uses the spectrum extensively for tactical and non-tactical uses. In the United States, tactical uses are generally limited to a number of specific testing sites and training facilities, but DoD's non-tactical applications are extensive and include aircraft command and control, mobile communication in and around military bases, and air field and long distance communications using satellites.*

Frequency interference is related to transmissions, their sources, and competing sources. Interference can result from several factors including:

- Using a new transmission frequency that is near an existing frequency in the spectrum;
- Reducing the physical distance between two antennas transmitting on a similar frequency;
- Increasing the power of a similar transmission signal;
- Using poorly adjusted transmission devices that transmit outside their assigned frequency or produce an electromagnetic signal that interferes with a signal transmission; and
- Using existing electronic sources created by portable systems that affect entire communities utilizing Wi-Fi broadband systems and industrial sources that produce electronic noise by-product.

Man-made sources of radio frequency (RF) energy are generally intended to make use of the electromagnetic environment for communications, radar, lighting, etc.

The safe transport of all individual flights between airports is based on radio frequencies being available and interference free so that all of the aviation systems function properly. The FAA's Spectrum Engineering Services Office are responsible for ensuring radio frequency assets are always clear and available, both now and in the future.

The management and regulation of the use of radio frequencies is becoming more complex as technology rapidly expands and as demand for wireless applications (cell phones and wireless broadband) continues to soar. At the same time, the safety of operating aviation systems remains of paramount importance.

Cellular towers and tall structures including buildings and alternative energy development facilities can pose a threat to the equipment used to maintain communications and perform successful test and operations by a radar. The locations and elevations of these towers can potentially interfere with communication signals between radar tracking devices and their selected targets, such as aircraft.

Compatibility Assessment

When cellular communications developers provide a permit application or other documentation to the FAA to initiate the Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) process. If the FAA determines that further aeronautical studies are needed, the energy developer or communications developer must submit the same package to the Oklahoma Aeronautics Commission (OAC) for review. It is through the OAC review that the evaluation and coordination of other state agencies and organizations occurs. The OAC communicates and coordinates with all relevant agencies including the Oklahoma Military Strategic Planning Commission and potentially affected military installations. See the information provided in

the issue write-up for Communications-5 (COM-5) for more details on the FAA OE/AAA process and OAC review.

The concern is that the FAA may not be indicating that certain development needs further aeronautical studies, which then further OAC review of the proposed development is not triggered. Thus, if the OAC review is not triggered by the FAA, then neither the State's Aeronautics Commission, the Military Strategic Planning Commission, nor the military installations have the opportunity to evaluate the proposed development for impacts to safe air navigation. This can result in lost training hours, unnecessary safety hazards, and missed opportunities for partnering among stakeholders.

Findings

- If the FAA does not determine a proposed development needs further aeronautical studies based on its evaluation, then the OAC review process is not triggered.
- If the OAC process is not triggered, then the Oklahoma Commissions (Aeronautics and Military) do have the opportunity to provide input into the proposed development, which could result in incompatible development.

Please see the next page.

5.9 Infrastructure Extensions (IE)

Infrastructure refers to public facilities and services such as sewer, water, electric, and roadways that are required to support development (existing and proposed).

Public facilities and services should be sized appropriately for the type of urban or rural development they serve, but also limited to the existing and planned needs and requirements of the area. For example, the provision of a safe transportation system, including all modes of transportation (automobile, mass transit, railway, highway, bicycle, pedestrian, air, water, etc.), is an important infrastructure component. Adequate transportation infrastructure contributes to local, regional, and state accessibility.

Infrastructure plays an important role in land use compatibility. Infrastructure can enhance the interdependent needs and operations of both a military installation and a community by providing needed services, such as sanitary sewer treatment and transportation systems. Conversely, infrastructure can create encroachment issues if expanded without consideration of the consequences of future development of either entity. The extension or expansion of community infrastructure adjacent to a military installation or operating areas proximate to an installation has the potential to induce growth, potentially resulting in incompatible uses and conflicts between a military mission and communities. Within comprehensive planning, infrastructure extensions can serve as a mechanism to guide development into appropriate compatible areas, protect sensitive land uses, and improve opportunities between community land uses and military missions.

ISSUE IE-1	**Uncoordinated Infrastructure Extensions in Unincorporated Areas May Lead to Incompatible Development** *Not all jurisdictions within the JLUS Study Area utilize zoning to help manage development. Concerns about uncoordinated infrastructure extensions into unincorporated areas of the county could result in incompatible development.*

Compatibility Assessment

As outlined in the 2015 City of Lawton capital improvement plan update and shown on the City Sewer Map, the Nine Mile Creek Sewer Project is a phased construction project that will develop a new sewer main diagonally across east Lawton, from the wastewater plant south of Lawton northeast to Rogers Lane. This project will make land viable for development both within the city and potentially in unincorporated areas of Comanche County. The County of Comanche Commissioners approved a permit from the City of Lawton for the sewer line project as noted in the December 14, 2015 proceedings that included language "to construct sanitary sewer lines on the east side of town to facilitate growth." Phase 1 of the project is currently underway with Phase 2 planned in the future. Phase I work includes the installation of approximately 38,000 feet of sewer line ranging from 12 inches to 54 inches running from the existing Wastewater Treatment Plant south of Lawton to just north of SE Lee Boulevard. The eventual northeastern extent limit of the planned sewer line extension is just south of the Fort Sill East Range area.

As indicated in the Fort Sill 2015 ICUZ, this area (both on and off base) is subject to noise from explosive and large arms activities on the East Range. Both the Land Use Planning Zone (LUPZ) and Zone II noise zones extend off base into this area. Future development in this area has the potential to be impacted by noise, therefore there are certain land uses that would be incompatible with the military mission.

The Fort Sill / Henry Post Army Air Field (HPAAF) has two flight corridors identified in the 2015 ICUZ that provide for aircraft departures and arrivals over the general area near the northeastern extent of the planned sewer line. If future development were to occur in the area, there could be potential incompatibilities depending on what is proposed.

The unincorporated areas of Comanche County are not covered by traditional land use policy such as a comprehensive plan or land use controls such as zoning ordinances, so development is not as managed as it is in the city of Lawton. Without the benefit of planning oversight and zoning regulations to guide future development, there is the potential for the planned sewer line to encourage incompatible development in the unincorporated county areas south east of Fort Sill. In addition, the lack of planning and zoning processes makes it difficult for Fort Sill to be involved in reviewing future development to ensure compatibility with the Fort Sill mission.

Examples of incompatible development in unincorporated areas of the county that could be exacerbated by the availability of sewer line connections include:

- New housing developments or subdivisions that are developed as an outcome of the sewer line extension in the area east of the City of Lawton could be impacted by noise from Fort Sill East Range operations.
- Community facilities such as places of worship, schools, shopping, etc., that may result from future development if the area grows as a result of the sewer line extension, may not be compatible in areas close to the Fort Sill boundary due to noise impacts.
- Other utilities development (e.g. electrical lines, communications towers) that occurs as a result of future development encouraged by the sewer line extension has the potential to create vertical obstructions for HPAAF flight operations.

Similarly, Kiowa County does not implement land use policies or controls to manage growth and development within the undeveloped areas of the county, which can lead to incompatible development between Fort Sill and Altus Airforce Base. Tradewind Energy, a wind and solar energy developer that developed the Rocky Ridge Wind Farm, has reportedly proposed a new solar energy development south of Snyder in southwest Kiowa County, and is expected to be one of the largest in the U.S. If this project is not sufficiently coordinated with both Fort Sill and Altus Air Force Base, the development could impact flight routes between the two military installations.

Findings

- The City of Lawton is building the Nine Mile Creek sewer extension on the east side of the city that has the potential to expand development both in the City and in unincorporated areas of Comanche County. The northeastern extent of the proposed sewer extension is just south of the Fort Sill East Range and within the LUPZ and Zone II noise areas.
- Uncoordinated infrastructure extensions including sewer lines combined with the lack of land use plans and zoning controls in unincorporated Comanche County may result in new incompatible development in areas near Fort Sill.
- A lack of zoning controls could permit incompatible development with Fort Sill and other surrounding military installations that utilize Fort Sill for training.

Please see the next page.

5.10 Land, Air, and Sea Spaces Competition (LAS)

The military manages or uses land, air, and sea space to accomplish testing, training, and operational missions. These resources must be available and of a sufficient size, cohesiveness, and quality to accommodate effective training and testing. Military and civilian air and sea operations can compete for limited air and sea space, especially when the usage areas are in close proximity to each other. Use of this shared resource can impact future growth in operations for all users.

The land, air, and sea spaces used by the military can be owned by the DOD, designated for DOD use by a federal or state agency, provided through easements or other agreements with public or private entities, or maintained as a historic usage right. Public and private requests to share or assume some of these resources may have a negative impact on military training and test objectives.

Key Terms

General Aviation. General aviation is defined as aviation activity that is not commercial or military. This term typically covers all civil aviation operations other than scheduled air services and non-scheduled air transport operations for hire.

Controlled and Uncontrolled Airspace Descriptions

To help air traffic controllers and pilots manage varying traffic conditions in the sky, United States airspace is defined into two categories, regulatory and non-regulatory. Within these two categories, there are four types: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, nature of the operations conducted within these airspaces.

Airspace is further divided into six different classes (Controlled airspaces A, B, C, D, E, and Uncontrolled Airspace G). These classes each have different requirements for entry into the airspace, pilot qualifications, radio and transponder equipment, and Visual Flight Rules (VFR) weather minimums.

Class D Airspace. Both Fort Sill and Lawton-Fort Sill Regional Airport (LAW) have Class D airspace surrounding them. Class D airspace is defined as a cylindrical shape encompassing an area within a five-nautical mile (NM) radius of the center of an airfield that extends upward to 2,500 feet mean sea level (MSL). Given the proximity of the airfields, there is not enough space to provide the full five-NM radius, because of the overlap in airspace for Fort Sill and LAW. However, the FAA designs and individually tailors Class D airspace to be able to contain instrument procedures. Use of Class D airspace requires the use of two-way communication with Air Traffic Control, which must be established prior to entering Class D airspace.

Class E Airspace. A majority of the airspace over the United States is Class E airspace, which is controlled airspace that provides sufficient airspace for the safe control and separation of aircraft during instrument flight rule operations. Class E airspace typically extends up to, but not including, 18,000 feet MSL (the lower limit of Class A airspace). All airspace above Flight Level (FL) 600 is Class E airspace.

ISSUE LAS-1	**State Route 115 Requires Closure to Perform Certain Military Training Activities** *The 75th Field Artillery Brigade (FA BDE) is required to close State Route 115 when firing rockets from Quanah Range to West Range. The 75th FA BDE is only permitted to keep the road closed for a maximum of 15 minutes at any one time.*

The 75th Field Artillery Brigade (FA BDE) conducts Multiple Launch Rocket System (MLRS) firing training. This type of training requires a large military footprint, firing from Quanah Range to West Range. There is a public roadway this is impacted by this type of training, State Route 115. State Route 115 is a north-south four-lane state highway. The average daily traffic (ADT) volume, or "traffic count", for State Route 115 is 960 vehicles/day (v/d) for the south end and 250 v/d for the north end. State Route 115 is comparable to other similar roadways in the county relative to traffic counts, which means this roadway is utilized as much as other similar roadways in the JLUS Study Area.

If the area begins to develop and grow at a rapid rate, the demand for State Highway 115 could increase and thus, could negatively impact rocket firing training requirements at Fort Sill. While development and growth are inevitable, the area growing at a rapid rate is unlikely.

Compatibility Assessment

According to Fort Sill Regulation 385-1 Post Range Safety, Fort Sill positions personnel as roadguards to prevent vehicles from passing during firing. In addition, the Army is only allowed to close the State Highway 115 for 15 minutes at a time. The following are the stipulations as stated in the Regulation:

a. Requirements for roadguards are outlined on range safety cards issued by Range Operations. Traffic Control Points (TCP) locations will be coordinated and approved by Range Operations when outside an area scheduled by the unit.

b. Place roadguards / barriers temporarily on roads and trails in the range area to prevent access to danger areas.

c. Vehicles will not cross barriers without permission from Range Operations.

d. Remove barriers as soon as possible after conclusion of the mission dictating their use.

e. Roadguards will control traffic on public highways (e.g., State Highway 115) only during firing of ammunition not approved for overhead fire (e.g., MLRS firing). The highway will be closed only during actual firing and for no longer than 15 minutes at a time. To close the highway, the Range Safety Officer (RSO) and Officer in Charge (OIC) will ensure the following:

> *(1) Guards are equipped with radio or wire communications with the unit Fire Department Chief (FDC).*
>
> *(2) Guards are posted outside of the safety fan.*
>
> *(3) The controlling FDC notifies the guards on the highway when actual firing is to commence and has ended.*

(4) The guards stop traffic during actual firing.

(5) In the event emergency-type vehicles (e.g., ambulances, fire trucks, police cars) are approaching on the highway, the guards will immediately notify FDC. The FDC will issue check fire and notify the guards to let the emergency vehicles proceed.

(6) Stop school buses for no more than 5 minutes.

f. Roadguards will not close improved surface roads (gravel or pavement) for more than 15 minutes at a time.

g. Roadguards will wear reflective vests at all times and carry baton flashlights when it is dark or visibility is reduced to 500 feet or less.

h. Range Operations and/or Department of Emergency Services (DES) will emplace temporary barricades as necessary for safety reasons.

i. Privately Owned Vehicles (POVs) will not cross any low water crossing barricade. Unit commanders may make the decision to bypass barricades for military vehicles. Use discretion in making this decision. Running water can exert extreme force on the side of a vehicle, washing even the heavy vehicles downstream.

Currently, these are adequate measures that control the impact to the public who travel by way of State Route 115 during MLRS training.

Findings

- The current actions address this issue and no further assessment is needed at this time.
- If growth and development increase at a rate faster than projected, then this issue should be re-evaluated for compatibility.

ISSUE LAS-2	**City of Lawton Water Line Traverses Fort Sill** *Four waterlines from Lake Lawtonka to City of Lawton run through Fort Sill. When these waterlines need maintenance or if the pipes break, then training operations can be postponed, delayed, or canceled to enable the Lawton Water Department to safely repair the waterlines.*

There are four waterlines within the same water easement corridor that carry water from Lake Lawtonka and the Lawton Water Treatment Plant to the City of Lawton and Fort Sill. Due to Fort Sill's size and location between Lake Lawtonka and Lawton, these waterlines travel directly through Fort Sill's boundary. As illustrated in Figure 5.10-1, these waterlines actually travel through the West Range Impact Area, near the edge of the range's Dudded Impact Area.

As with all municipal infrastructure, these waterlines require regular maintenance and repairs to keep them working properly and efficiently, necessitating the Lawton Water Department to come on installation to attend. However, since the waterline travels near the West Range Impact Area, training activities must be adjusted or ceased to allow the Lawton

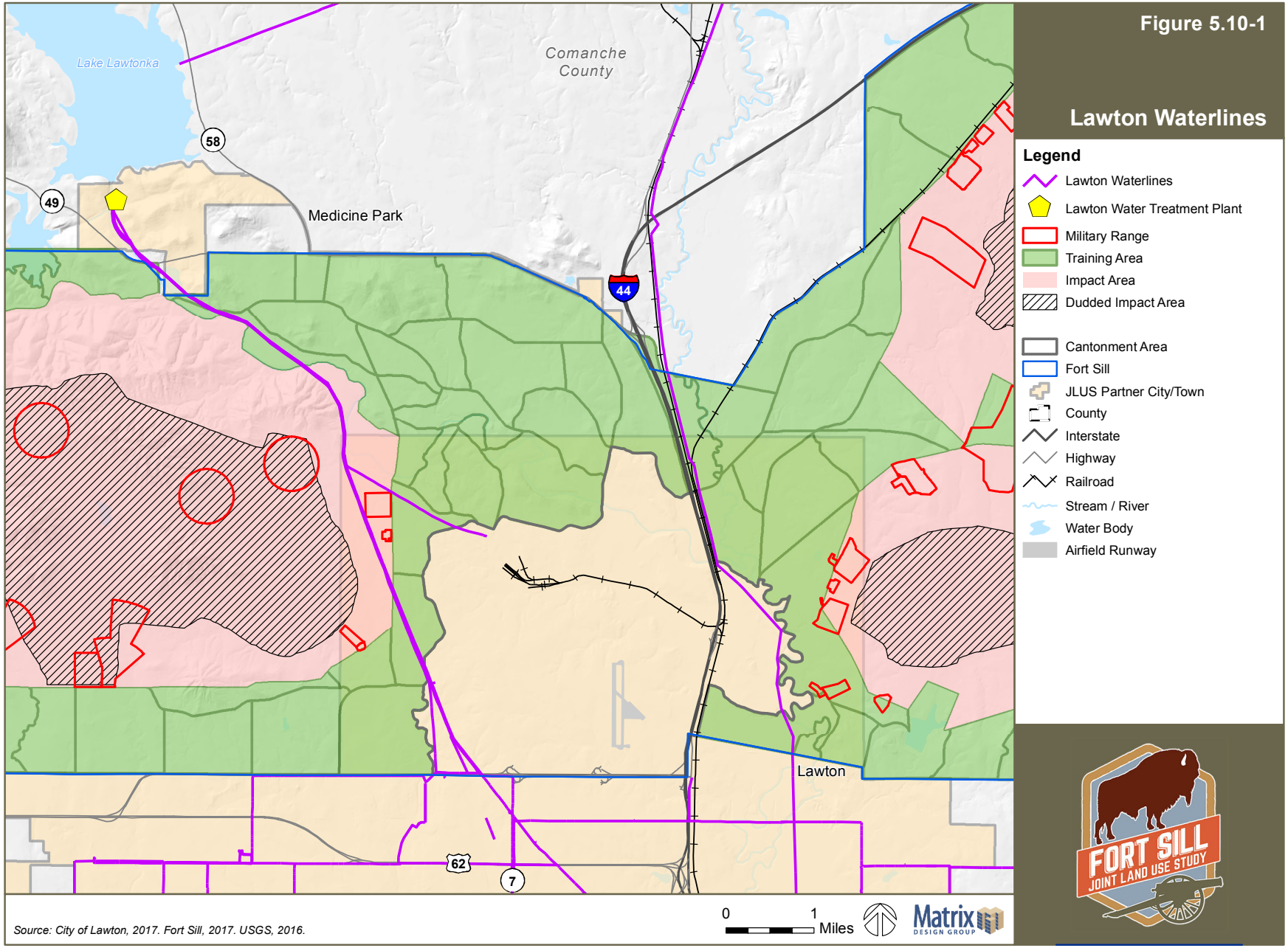
Figure 5.10-1
Lawton Waterlines
Legend
Lawton Waterlines
Lawton Water Treatment Plant
Military Range
Training Area
Impact Area
Dudded Impact Area
Cantonment Area
Fort Sill
JLUS Partner City/Town
County
Interstate
Highway
Railroad
Stream / River
Water Body
Airfield Runway
Lake Lawtonka
Comanche County
Medicine Park
Lawton
58
49
44
62
7
Source: City of Lawton, 2017. Fort Sill, 2017. USGS, 2016.
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Water Department to safely perform work on the waterlines and make any necessary repairs. According to the City of Lawton Director of Field Utilities, Lawton Water Department employees access Fort Sill approximately four days a week to maintain the waterlines.

Depending on the training activity at West Range, the Surface Danger Zone (SDZ) can be adjusted to allow Lawton Water Department personnel to work on the waterlines near the West Range Impact Area and continue to conduct training exercises. In the event of an emergency repair, there are two rifle ranges that must postpone training to allow the Lawton Water Department to make the necessary repairs.

The City of Lawton has had a strong working relationship that has facilitated ease of access to maintain, operate and on occasion repair the City of Lawton infrastructure located within the Ft Sill boundary. The mission at Ft Sill is impacted when access is required to service the infrastructure, and any delay in accessing the infrastructure can adversely impact delivery of services to local residents. As these waterlines age, the frequency of maintenance and repairs will increase, creating more delays to Fort Sill's training activities and exercises at West Range.

Findings

- There are four City of Lawton waterlines that travel through Fort Sill, near the West Range Impact Area.
- The City of Lawton Water Department accesses Fort Sill approximately four days a week to work on the waterlines located on the installation.
- Fort Sill must adjust or postpone training activities to allow the Lawton Water Department to come on installation and make repairs to the waterlines.

ISSUE LAS-3	**Need for Additional Land and Airspace to Train on Advanced, Larger Weapons Systems** *There is a need for additional land and airspace to train on advanced, larger weapons systems, however land resources both on- and off-installation are scarce or are already used for other purposes that serve in a dual capacity to protect the military training and provide some economic activity.*

Compatibility Assessment

Fort Sill is responsible for providing a wide array of training requirements to thousands of U.S. Army soldiers on an annual basis. This includes basic combat training for new U.S. Army soldiers, ordnance training for military personnel from around the world, as well as the use of field artillery. In addition, the U.S. Marines and U.S. Air Force, along with multiple military reserve organizations, use Fort Sill land and airspace resources to conduct training missions. These critical military training needs require significant land areas to ensure realistic and safe environments to carry out necessary operations.

Fort Sill has three primary range areas used to support military training; the Quanah Range, the West Range, and the East Range. Within these three ranges there are multiple firing areas, maneuver areas and impact areas used regularly to support military readiness (see chapter 3 for details on mission activities). However, Fort Sill does not have a sufficient amount of land area to implement live fire Air Defense Artillery and Reserve Component Maneuver units. Currently, these units are limited to simulation devices for training exercises.

According to the most recent Fort Sill Range Complex Master Plan (RCMP), there is a requirement for 93,827 acres of training land with only 43,468 acres currently available. This shortfall of 50,359 is more than double the currently available land area. Previous studies have documented greater training acreage shortfalls depending on assumptions and potential future training missions. As documented in the RCMP, the installation does not consider outright acquisition of additional land a priority at this time. The primary objectives for Fort Sill training land areas identified in the RCMP are:

- Provide training land to Fort Sill Initial Entry Training (IET) schools to meet Program of Instruction (POI) requirements.
- Provide training land to Fort Sill and supported Operating Force units (including Mobilizing Units) to meet collective training requirements to meet training standards.
- Provide training land to Fort Sill Professional Military Education (PME) and functional course schools to meet program of instruction (POI) requirements.

The RCMP indicates that there are limited options for increasing training areas within the Fort Sill footprint (e.g. possible use of non-dudded impact areas for maneuver training), but also notes real property records corrections will result in some areas (e.g. landfills, recreations areas, safety buffers) incorrectly identified as training acreage being removed as available for training.

Fort Sill has also developed and obtained Department of the Army approval for six Army Compatible Use Buffer (ACUB) areas along the northeastern, eastern, southern, and western installation boundaries. The total area of these six buffers is 19,415 acres. Land Legacy is the third party that will manage the land. This ongoing initiative does not change the acreage available for training land, but helps to ensure that units at Fort Sill can use the full extent of existing training acreage on the installation.

While Fort Sill continues to ensure military readiness for the soldiers trained, the RCMP clearly states “measures must be taken to expand available training land.”

Additionally, as technology and weaponry advance, weapon systems may require more land area for training. For example, Fort Sill would test new laser technology, but does not have enough airspace to safely test the new technology.

Findings

- Fort Sill has identified a shortfall of more than 50,000 acres in training acreage to carry out its required training mission in support of U.S. Army and other military service forces.
- Currently there is inadequate acreage available within the existing installation footprint that could be used to expand training areas.
- Air Defense Artillery and Reserve Component Maneuver units are limited to simulation devices for training exercises due to an insufficient amount of land area needed to implement live fire training.
- Fort Sill has successfully pursued obtaining ACUB areas along the perimeter of the installation, however this will not add acreage available for training activities.
- At this time, the installation is not making acquiring additional land through outright acquisition a priority, however there are other options that could potentially provide access to increased training acreage without the military taking ownership of the land.

ISSUE LAS-4	**General Concern About Heavy Aircraft Landing at Lawton-Fort Sill Regional Airport** *There is a concern about Fort Sill using the Lawton-Fort Sill Regional Airport to transport troops for mobilization exercises and activities. The concern is focused on Fort Sill using heavy aircraft, which tend to damage runways that are not equipped to handle the weight of the cargo of larger transport aircraft.*

The Lawton-Fort Sill Regional Airport is located approximately 3 miles south of Fort Sill. Historically the airport has been used for civil aviation needs as well as by Fort Sill, Vance Air Force Base (AFB), Sheppard AFB and Naval Air Station (NAS) Joint Reserve Base Fort Worth for military aviation operational / training needs. While not officially a "Joint-Use Airport", in 2006 Fort Sill and the Lawton Metropolitan Area Airport Authority (LMAAA) signed a Memorandum of Agreement (MOA) authorizing the installation to conduct military aviation operations at the airport. The MOA allowed heavy military aircraft sorties (e.g. C-5, C-17) and both training and mobilization operations.

In 2014, an airfield pavements engineering assessment at the airport identified pavement deterioration on the runway as a result of heavy aircraft take-off and landing operations. In response, in February 2014, the LMAAA voted to suspend military heavy aircraft operations except for emergency situations. As a result, Fort Sill was no longer able to conduct military heavy aircraft aviation operations at the airport.

Compatibility Assessment

After the LMAAA action to suspend military heavy aircraft operations, a more in-depth pavements condition assessment was conducted in support of a Pavements Management Program at the airport. This pavements condition analysis indicated the runway was not in poor condition as originally stated, but was in very good condition. In addition, it was found that key portions of the runway had a thickness of 24 inches of concrete versus what was originally incorrectly documented as 12 inches. This additional load-bearing capacity provided by the thicker concrete was a significant finding that was not properly documented previously and was a significant component in the February 2014 decision to suspend heavy aircraft operations. As a result, the LMAAA voted in October 2014 to approve reopening the airport to military heavy aircraft operations.

According to the Lawton-Fort Sill Airport Director, the airport is fully prepared to support current and future known military aviation operations. The 2008 Airport Master Plan supports this position as well.

Findings

- This issue is closed based on the information provided that indicates the Fort Sill-Lawton Airport is fully capable of supporting current and future known military heavy aircraft operations.

ISSUE LAS-5	**Concern About General Aviation Airspace Intrusions** *There have been general aviation intrusions into Fort Sill's controlled airspace, which can postpone, delay, or cancel military training and operations.*

Compatibility Assessment

Airspace on and around Fort Sill is controlled via special use airspace, specifically restricted areas. There are eight restricted airspace (RA) areas and one temporary restricted airspace that are critical for the training and testing operations conducted on and around Fort Sill. The RAs help ensure knowledgeable military and civil aviation personnel remain clear of potential hazards while also help provide for the safety of the general public. The RAs are active during specific days and times as indicated in the applicable notice filed with the local controlling aviation authority to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the safety of the flight or "Notice to Airmen" (NOTAMs).

The Lawton-Fort Sill Regional Airport is located approximately six miles south of the HPAAF and the overlapping airspace around both airfields is D / E class airspace. The Lawton-Fort Sill Regional Airport serves primarily civilian aviation needs, but also supports military operations based on existing agreements.

The managed airspace surrounding the Lawton-Fort Sill Regional Airport abuts the R-5601 restricted airspace surrounding Fort Sill and as noted previously overlaps the airspace around the HPAAF. With the airspace areas in close proximity, there are opportunities for less vigilant civilian aircraft operators to inadvertently intrude into the active RAs around Fort Sill. The Lawton-Fort Sill Regional Airport Director noted that there have been instances in the past when this has occurred.

When these incursions occur, there is the potential for impacts to any military operations ongoing in the RAs. These impacts may include delays to military training or even temporary suspension of military operations.

Findings

- The class D / E airspace for Lawton-Fort Sill Regional Airport and the Henry Post Army Airfield overlap.
- The airspace around the Lawton-Fort Sill Regional Airport abuts the R-5601 restricted airspace on and around Fort Sill.
- It has been noted there have been inadvertent incursions by civil aviation operators into the restricted airspace when active.
- If incursions occur into the R-5601 airspace when active, there is the likelihood of negative impacts to the Fort Sill mission.

ISSUE LAS-6	**Potential for Airspace Competition** *There is a need to protect the airspace over Fort Sill from encroachment as several military missions depend on this airspace and the facilities at Fort Sill to execute their missions. Congested airspace would impact the ability of all the military installations in the region to perform their missions.*

Control of airspace on and around Fort Sill is critical to the success of the military operations conducted by the U.S. Army and other military services that use Fort Sill airspace resources. The various ground-to-ground, ground-to-air, and air-to-ground operations (e.g. artillery, missiles, aircraft) dictate the use of restricted airspace to protect the general public and civil airspace

activities as well as to ensure success of the military training and testing conducted on and around Fort Sill. Chapter 3, section 3.7, provides a detailed background on the Fort Sill mission footprint including airspace control.

Compatibility Assessment

The FAA manages airspace in the United States and is the authority for establishing special use airspace including restricted airspace areas. Currently Fort Sill has eight RAs that cover three dimensional areas on and off the installation. Two of the RAs, R-5601G and R-5601H were recently established in 2017 by the FAA at the request of the U.S. Army. In addition, two new restricted airspace areas R-5602A and R-5602B are finalized and active. The areas covered by the RAs including the vertical elevations are dictated by missions needs and to ensure safety of all operators / public.

The R-5601G and R-5601H were established in 2017 to support fighter and bomber aircraft conducting non-eye safe laser firing and maneuvering on the West Range Targeting Area and the East Range Targeting Area. These newer restricted airspace areas ensure realistic U.S. Army training on current tactics for employing hazardous targeting laser systems and weapons capabilities at longer ranges from the target area. These restricted airspace areas are communicated to aviation personnel via Notice to Airmen (NOTAMs) to ensure awareness and allow aviation personnel to take the necessary precautions / actions.

Proposed restricted airspace areas R-5602A and R-5602B are required to support emerging kinetic and directed energy weapons training requirements for the U.S. Army and other military services using the Fort Sill airspace / range resources. Newly developed weapons systems require high altitude segregated airspace and these proposed restricted airspace areas increase the vertical elevation of existing restricted airspace at Fort Sill.

Fort Sill and the U.S. Army have taken and continues to take the necessary actions to ensure available special use airspace over and around the installation and training / testing ranges. Their efforts, as evidenced by working closely with the FAA to add restricted airspace areas ensure current and known missions at Fort Sill will have adequate airspace resources. The current Range Complex Master Plan (RCMP) indicates that with these new additions to restricted airspace will ensure Fort Sill can meet all current training requirements.

Findings

- Fort Sill requires special use airspace in the form of restricted airspace areas to ensure successful mission execution and maintaining separation from civil aviation operations and the general public.
- The U.S. Army and Fort Sill have worked closely with the FAA to establish and propose new restricted airspace necessary to support new weapons systems that require larger areas and higher altitudes to safely conduct training / testing.
- Actions are underway and ongoing to address the issue of protecting key airspace areas on and around Fort Sill.

ISSUE LAS-7	**Henry Post Army Airfield's Runway Cannot Extended to Support Efficient Troop Deployment** *Due to Henry Post Army Airfield's position at the southern edge of Fort Sill, adjacent to residential areas of the City of Lawton, the runway cannot be extended to support larger aircraft suitable for rapid deployment of troops.*

Compatibility Assessment

Fort Sill is expected to be able to deploy the 75th Fires Brigade and 31st Air Defense Artillery Brigade on demand. However, Henry Post Army Airfield (HPAA) only has a runway length of approximately 5,000 feet, which is insufficient for large heavy aircraft suitable for deploying soldiers, such as the C5 and C17. Currently, Fort Sill buses troops either 53 miles to Altus Air Force Base (AFB), or 87 miles to Tinker AFB for large-scale deployments. Unfortunately, due to HPAA's position and proximity to the City of Lawton, the airfield is unable to expand its runway to support larger aircraft required for rapid deployment.

As mentioned in Issue LAS-4, the LMAAA and Fort Sill have a MOA for the military use of the LAW, which has runway of approximately 8,500-foot runway suitable for C5 and C17 aircraft. Although LAW can support large aircraft, the airport does not have the proper facilities to process passengers and equipment prior to deployment. The LMAAA has proposed an Arrival/Departure Airfield Control Group area that would support such deployments, but the project has not yet been funded.

Findings

- Henry Post Army Airfield cannot support large aircraft, such as the C5 and C17, capable of deploying troops.
- Fort Sill currently transports troops to either Altus AFB or Tinker AFB for deployment.
- The Lawton Metropolitan Area Airport Authority has proposed an Arrival/Departure Airfield Control Group area to support deployments from Fort Sill, but the project has not yet been funded.

5.11 Land Use (LU)

The basis of land use planning and regulation relates to the government's role in protecting the public's health, safety, and welfare. Local jurisdictions' comprehensive or land use plans and zoning ordinances can be the most effective tools for preventing or resolving land use compatibility issues. These tools ensure the separation of land uses that differ significantly in character. Land use separation also applies to properties where the use of one property may adversely impact the use of another. For instance, industrial uses are often separated from residential uses to avoid impacts from noise, odors, lighting.

Key Terms

Land Use Planning. Land use planning stems from the Supreme Court decision of *Euclid vs. Ambler* which enabled jurisdictions to regulate land use through zoning land in order to protect the public's health, safety, morals, and welfare. Zoning is a land use regulation tool used by local jurisdictions that generally controls for use, density, intensity, building heights, and setbacks on a parcel or lot. Most states, enacted enabling legislation for local jurisdictions to also create and adopt comprehensive plans which are land use documents that broadly establish a vision, goals, policies, and implementation activities for a jurisdiction over a long-range period of time, typically ten to twenty years, to promote compatible land use, guide growth, and logical development.

Local jurisdictions' comprehensive plans and zoning ordinances are the most effective tools to avoid and resolve land use compatibility issues. These tools ensure similar and compatible land uses are properly located and can co-exist while separating land uses that differ significantly in use and potential nuisance.

Sensitive Land Uses. In terms of compatibility assessment, sensitive land uses are uses that are susceptible to, and effected by, nuisances such as noise, dust and air pollution. Sensitive land uses typically include residential areas, hospitals, convalescent homes and facilities, schools, libraries, churches, recreational areas, and other similar land uses.

Army Compatible Use Buffer (ACUB) Program. The ACUB Program permits Army installations to work with other organization partners (e.g., land trusts) to acquire land development rights to establish buffer zones that can help protect habitats, sensitive areas, and military training areas without acquiring any new land for Army ownership.

Encroachment. In terms of compatibility, encroachment refers to the development of conflicting uses of land, air, water, or other resources that may individually or cumulatively impact the military's ability to carry out its testing and training mission. This may include private development being built in the vicinity of a military installation, whether or not it is within a specific military operational footprint such as noise or safety.

Unmanned Aerial Systems (UAS). Unmanned aerial systems also known as drones are small aircraft that are capable of operating without an internal, manned pilot; are tethered by a radio control link; and can be preprogrammed for both flight and payload operations prior to launch.

Technical Background

Land use planning around military installations is similar to the civilian process for evaluating other types of land uses. For instance, local jurisdictions consider compatibility factors such as noise when locating residential developments near commercial or industrial uses. As land between local municipalities is developed – or land between a local municipality and the perimeter of a military installation is developed, both entities are affected. New residents, tenants, or building owners are typically not fully aware of the implications of locating in close proximity to an active military installation and / or training area.

Among the most pressing factors causing incompatibility with installations containing a military airfield and weapons training are the proximate areas of encroaching development, as well as off-installation light pollution from that development which may impact the military operations. The development of land uses incompatible with the installation's military operations threatens that installation's mission success and its continued existence.

ISSUE LU-1	**Concern About Uncoordinated Growth and Development in Surrounding Communities** *There is a concern about growth and incompatible development outside the installation in surrounding communities that is not coordinated with Fort Sill. Development can unintentionally impact military training and operations if it is not coordinated with the military.*

While there is not rapid growth, the JLUS Study Area jurisdictions has experienced slow but steady growth. Table 5.11-1 outlines the changes in population in the JLUS Study Area jurisdictions and shows the number and percentage change between 2000 and 2015.

The majority of the growth has occurred in the cities of Cache and Elgin, and the Town of Sterling. The City of Elgin has experienced the most growth from 2000 to 2015, which causes concern for the military as there is already incompatible development in the city due to the noise that is generated from the military training that occurs in the north-northeast portion of the installation and the residential land uses that are located within one mile of the installation boundary.

There is little to no land use controls that the JLUS Jurisdictions have implemented to protect the residents and visitors from neighboring land uses, such as military training. This military training can generate noise, vibration, and smoke that impacts community activities and quality of life.

Table 5.11-1. Population Changes in the JLUS Study Area Jurisdictions Between 2000 and 2010

Jurisdiction	2000	2010	2015 Estimated Population	Number Change 2000 – 2015	Percent Change 2000 – 2015
State of Oklahoma	3,450,654	3,751,351	3,849,733	399,079	11.6%
Comanche County	**114,996**	**124,098**	**125,531**	**10,535**	**9.2%**
Kiowa County	**10,227**	**9,446**	**9,302**	**-925**	**-9.04%**
City of Cache	2,371	2,796	2,919	548	23.1%
City of Elgin	1,210	2,156	2,702	1,492	123.3%
City of Lawton	92,757	96,867	97,589	4,832	5.2%
Town of Indiahoma	374	344	346	-28	-7.5%
Town of Medicine Park	373	382	233	-140	-37.5%
Town of Sterling	762	820	850	88	11.5%
City of Apache	1,616	1,444	1,282	-334	-20.7%
City of Frederick	4,637	3,910	3,804	-833	-18.0%

Source: US Census, Quick Facts 2000; American Community Survey 2010, 2011-2015

Compatibility Assessment

The DoD has developed recommended land use guidelines to assist community planners with planning land uses around military installations in which noise and safety zones. Section 5.17, Noise and 5.20, Safety Zones in this report provide tables that outline the recommended land uses for communities planning land uses around military installations that may generate noise and / or conduct aviation operations in which airfield safety hazards may be an impact to community activities if not coordinated with the military.

The State of Oklahoma through OS §11-4301.17 has provided the authority for jurisdictions who are located in an AICUZ Report area, JLUS Study Area, or Environmental Noise Management Plan Study Area to enact an ordinance that would protect the residents of the jurisdiction from noise greater than a 65 decibel (dB) noise level and other safety impacts by planning future land uses that prevent the exposure of the public to these military-related impacts. None of the jurisdictions in the JLUS Study Area have enacted an ordinance that establishes standards related to military compatibility.

There are no other local relevant tools that address this issue. However, the jurisdictions do have the authority to enact and implement zoning ordinances.

At the time of the development of this report, the City of Elgin had not provided a copy of its land use plan or zoning ordinance for evaluation.

Findings

- The County has not adopted a land use plan or enacted a zoning ordinance that protects residents from impacts generated by military training nearby.
- None of the jurisdictions have enacted an ordinance that establishes military compatibility standards relative to planning land uses around Fort Sill.

ISSUE LU-2	**Existing Incompatible Land Uses Within One Mile Around Fort Sill** *There are existing incompatible land uses within one-mile of Fort Sill's boundary. This can lead to additional incompatible development due to lack of adequate land use controls in surrounding communities.*

Due to the noise generated by the ongoing range activities and operations, noise and airfield safety zone impacts land uses off-installation most significantly within one mile of the installation in every direction. It should be noted, there is minimal impact to the Wichita Mountains Wildlife Refuge as range activities and operations are designed to avoid impacts to the Refuge as much as practical.

The primary concern is the growth of a majority of the jurisdictions located within one mile of the installation boundary. This is causes concern for the military especially because the only jurisdiction that implements land use planning tools is the City of Lawton. These conditions make it likely that noise sensitive land uses would be allowed to locate near the installation where heavy artillery are fired for the purposes of military training, which could result in increased encroachment.

Compatibility Assessment

Since 2006, Fort Sill has been actively pursuing easements and the purchase of development rights through the ACUB program from willing landowners that own property adjacent to the installation and / or within one mile of the installation boundary. The Army has identified these parcels into four different priorities—1, 2, 3, and 4.

Fort Sill has been utilizing the ACUB as a funding mechanism and has identified all land within one mile of the installation for an ACUB transaction. Currently, Fort Sill has protected approximately 3,390 acres of land within one mile of the installation in various locations.

The Army has identified another 9,311 acres of potential land that could be protected through the use of ACUB program dollars. Additionally, the Army identified another 5,766 acres of land within one mile of the installation boundary that is owned by either other public agencies, schools, or Native American tribes. While the ACUB program is a good tool to use to protect land that are of priority for the DOD, it can be a lengthy process before a completed transaction occurs. Also, there are other installations that apply and compete for ACUB funding, which can result in a slow-moving process to obtain the needed dollars to secure all the remaining property around Fort Sill within one mile of the boundary.

The Readiness Environmental Protection Integration (REPI) program is similar to the ACUB program in that its purpose is to assist the DOD with funding land transactions with willing landowners to agree to sell the development rights of their land. Fort Sill has used the REPI program as well to complement the efforts of the ACUB program. However, the REPI program process is also lengthy and may be slow-moving since the funding is budgeted through Congress.

At the local level, jurisdictions can implement land use planning tools including developing a land use plan and adopting a zoning ordinance. These tools serve to protect the jurisdiction's residents and visitors from

military training and operations impacts such as noise and safety hazards. The DOD has several tools to assist communities when planning land uses near an active military installation. The tools include a set of recommended land uses for various high noise and safety areas. See Section 5.17 Noise for the table that recommends land uses associated with aircraft and range noise. See Section 5.20, Safety for the table that recommends land uses associated with aircraft safety and the Henry Post Army Airfield.

Findings

- The City of Lawton is the only jurisdiction that has implemented a zoning ordinance that can be used to provide some protection against encroachment to the installation and impacts to the residents.
- Of the 18,467 acres within one mile from the installation boundary and identified through the ACUB program, about 18% have been completed and protected through the use of ACUB program funding.
- There is also about 5,766 acres that are owned by other agencies including other public agencies, schools, and Native American tribes.

ISSUE LU-3	**Incompatible Development in the City of Elgin** *There is incompatible development in the City of Elgin near the Fort Sill perimeter security fence, which results in noise complaints and a safety hazard.*

The City of Elgin is located north-northeast of Fort Sill's East Range where numerous artillery and other military training occur. The East Range contains improvised explosive device (IED) lanes, firing points, and an impact area. There are also other training areas nearby that provide numerous capabilities for the Army to prepare and train in small and large arms. While these activities occur within Fort Sill's boundary, these operations generate noise that radiates off-installation and impacts nearby land uses. Certain land uses are recommended as incompatible land uses according to the DOD tools available, the Federal Interagency Committee on Urban Noise (FICUN), and the Department of Defense Instruction 4165.57 (DODI 4165.57) for the Air Installation Compatible Use Zone (AICUZ) Program.

The City of Elgin is most impacted by the medium to large range noise zones, which means the field artillery, e.g. Howitzers, are the weapons used which generate the large noise zones. There are residential uses within these medium to large arms noise zones. Residential uses are typically conditionally compatible as they are evaluated under the lower decibel (dB) ranges, e.g. 57 dB to 62 dB. However, as noise is louder and noise sensitive land uses are located nearer the noise, then the land uses are impacted by the louder noises at decibel ranges greater than 65 dB.

Compatibility Assessment

At the time of the development of this report, the City of Elgin's land use plan and zoning ordinance was not available.

The FICUN and the DODI 4165.57 are discussed in detail in Section 5.17, Noise.

Findings

- Residential uses within the City of Elgin are impacted by noise emanating from military training at Fort Sill's East Range.
- The City of Elgin has not provided a land use plan or a zoning ordinance to evaluate land uses and zoning within the city limits.

ISSUE LU-4	**Lawton-Fort Sill Regional Airport Lacks Adequate Land Use Controls Around the Facility to Support Long-term Military Activities** *Currently, the Lawton-Fort Sill Regional Airport supports Fort Sill and has planned for increased support in the future if demand is required. However, there are several land uses outside the airport that could be incompatible development due to a lack of sufficient land use controls.*

The Lawton-Fort Sill Regional Airport (LAW) is located approximately three miles south of Fort Sill. Historically the airport has been used for civil aviation needs as well as by Fort Sill, Altus AFB, Vance AFB, Sheppard AFB, and Naval Air Station Joint Reserve Base Fort Worth for military aviation operational / training needs.

While not officially a "Joint-Use Airport", in 2006 Fort Sill and the Lawton Metropolitan Area Airport Authority (LMAAA) signed a Memorandum of Agreement (MOA) authorizing the installation to conduct military aviation operations at the airport. The MOA allowed heavy military aircraft sorties (e.g. C-5, C-17) and included both training and mobilization operations. The primary concern is LAW does not have sufficient land use controls around the airport facility to provide for the greatest protection of the area for potential future use by the military.

Compatibility Assessment

In 2013 the airport and the Air Force Air Education and Training Command (AETC) signed a Letter of Agreement authorizing use of the airport for AETC aircraft to conduct landing / takeoff / touch and go operations as well as provide ramp space of aircraft parking. In conjunction with this agreement, the FAA, Lawton-Fort Sill Regional Airport, Fort Sill Aviation and Sheppard AFB have a 2011 Letter of Agreement allowing training aircraft to make use of airport facilities and services including Air Traffic Control Tower (ATCT) support, use of the airfield for aircraft operations, and refueling support.

The Fort Sill Army Radar Approach Control (RAPCON) and the Lawton-Fort Sill Regional Airport have a 2011 Mutual Aid Agreement in support of airport emergency services. These agreements document the close working relationship the Lawton Fort-Sill Regional Airport has with the military and the desire of both organizations to leverage resources to the benefit of both. These agreements are conditional tools with minimal long-term value.

The 2008 Lawton-Fort Sill Regional Airport Master Plan provides a long-term plan for the Airport development to ensure future requirements are identified, planned, and implemented. The plan calls out military support, specifically Fort Sill, as one of the primary future needs. The Plan also makes recommendations regarding land use planning and zoning to ensure future development is compatible with airport operations. Examples include noise district overlay development density standards, height restrictions, prohibited uses, etc. The Plan also mentions the development of a special zoning district for the Airport property which would provide the airport flexibility in development and streamline future development proposals.

The 2030 Lawton Land Use Plan makes minimal mention of the airport, describing it as a commercial airport per FAA regulations and grouping it as a public facility on the Land Use Plan Map. The Lawton City Code Chapter 7 includes provisions for the Lawton-Fort Sill Regional Airport under the section dealing with business, but there is nothing in Chapter 18 for planning and zoning and land use associated with the airport.

The lack of ordinances for compatible land use around the airport increases the potential for incompatible development around the airport and may also discourage the military from using the facility in the future. The Airport Zoning Act, Title 3, Oklahoma Statutes 1991, Section 100 provides jurisdictions the authority to adopt airport zoning regulations.

Figure 5.11-1 illustrates the difference between the DoD recommended Airfield Safety Zones and the existing Runway Protection Zones at the Lawton-Fort Sill Regional Airport established under the Oklahoma Aircraft Pilot and Passenger Protection Act (APPPA). As shown on the graphic, the DoD recommended Safety Zones extend much farther than the existing Runway Protection Zones. For more information about the APPPA and Runway Protection Zones, see Chapter 4.

Figures 5.11-2 illustrates the compatibility assessment of the future land uses within the DoD Airfield Safety Zones. The use of the DoD Airfield Safety Zones for the LAW Airfield Safety Zones provides extra protection for the City and the military should the City of Lawton accept this and use this information in consideration of future planning and zoning efforts.

The LAW clear zone contains several acres of low density residential, industrial, and public facility land uses, which are considered incompatible. Recommended uses within clear zones should be free and clear of all types of development, ground movement including stacking hay bales, and any other earth movement activities.

Figure 5.11-3 illustrates the compatibility assessment for zoning in the recommended DoD Airfield Safety Zones for the LAW. As shown in the map, there are several incompatible zoning districts located in the recommended clear zones. Table 5.11-2 lists the incompatible zoning districts that currently exist in the DoD recommended Clear Zones for LAW.

Findings

- The Lawton Fort-Sill Regional Airport supports both civil and military aviation needs. There are multiple agreements in place that document military use of the airport.
- The Lawton City Code capture the Lawton Fort-Sill Regional Airport under Chapter 7 which deals primarily with business criteria, but the Code lacks provisions for planning and zoning around the Airport.
- The 2008 Lawton-Fort Sill Regional Airport Master Plan includes recommendations for land use planning and zoning around the airport.
- Oklahoma provides jurisdictions the ability to adopt airport zoning regulations via The Airport Zoning Act, Title 3 Oklahoma Statutes 1991, Section 100. The City of Lawton has not adopted specific land use and zoning around the airport.
- There are several incompatible land uses and zoning districts within the LAW clear zone.

Table 5.11-2. City of Lawton Zoning Districts within DoD Recommended Clear Zones for the LAW Airport

Zoning District	Zoning District Description	Acres in CZs	Compatibility Assessment
R-1	Single-Family Dwelling District	29.1	Incompatible
R-2	Two-Family Dwelling District	17.7	Incompatible
R-3	Multiple-Family Dwelling District	2.3	Incompatible
R-4	High-Density Apartment District	4.2	Incompatible
I-1	Restricted Manufacturing and Warehouse District	9.8	Incompatible
I-4	Heavy Industrial District	6.5	Incompatible
P-F	Public Facilities District	142.1	Incompatible

Source: City of Lawton Code of Ordinances, Amended 2000

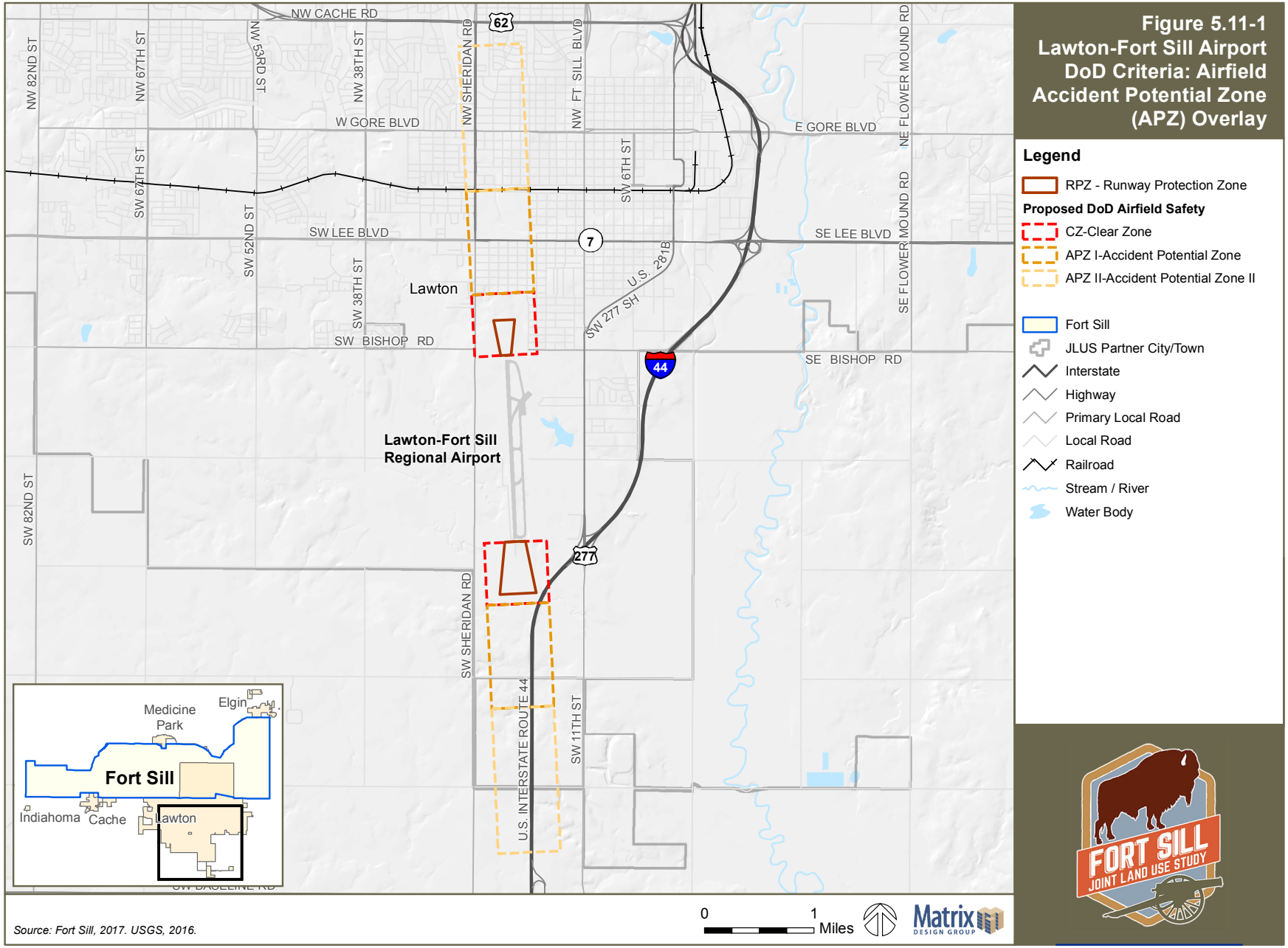


Figure 5.11-1
Lawton-Fort Sill Airport DoD Criteria: Airfield Accident Potential Zone (APZ) Overlay

Legend

- RPZ - Runway Protection Zone

Proposed DoD Airfield Safety

- CZ-Clear Zone
- APZ I-Accident Potential Zone
- APZ II-Accident Potential Zone II

- Fort Sill
- JLUS Partner City/Town
- Interstate
- Highway
- Primary Local Road
- Local Road
- Railroad
- Stream / River
- Water Body

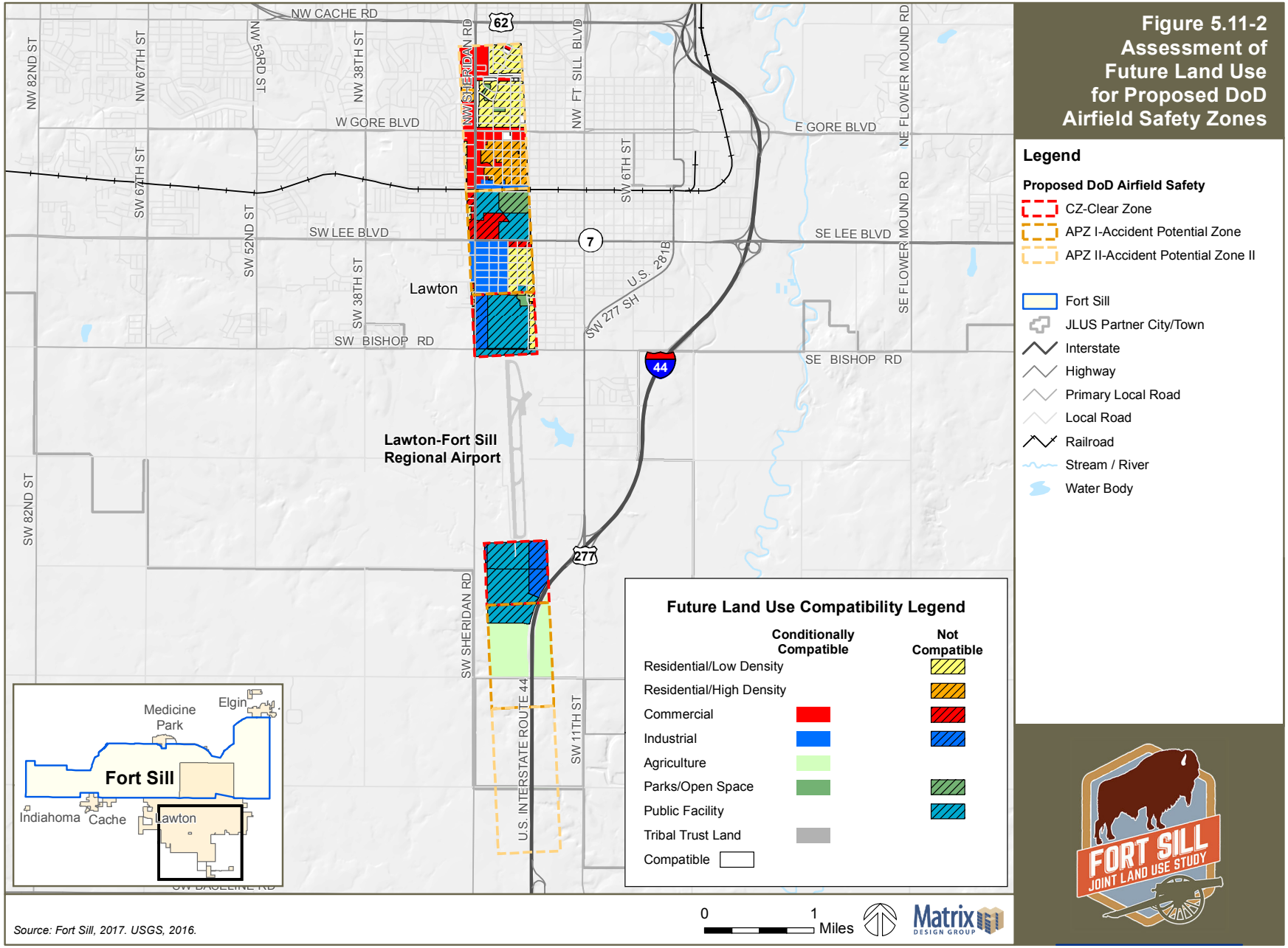


Figure 5.11-2 Assessment of Future Land Use for Proposed DoD Airfield Safety Zones

Legend

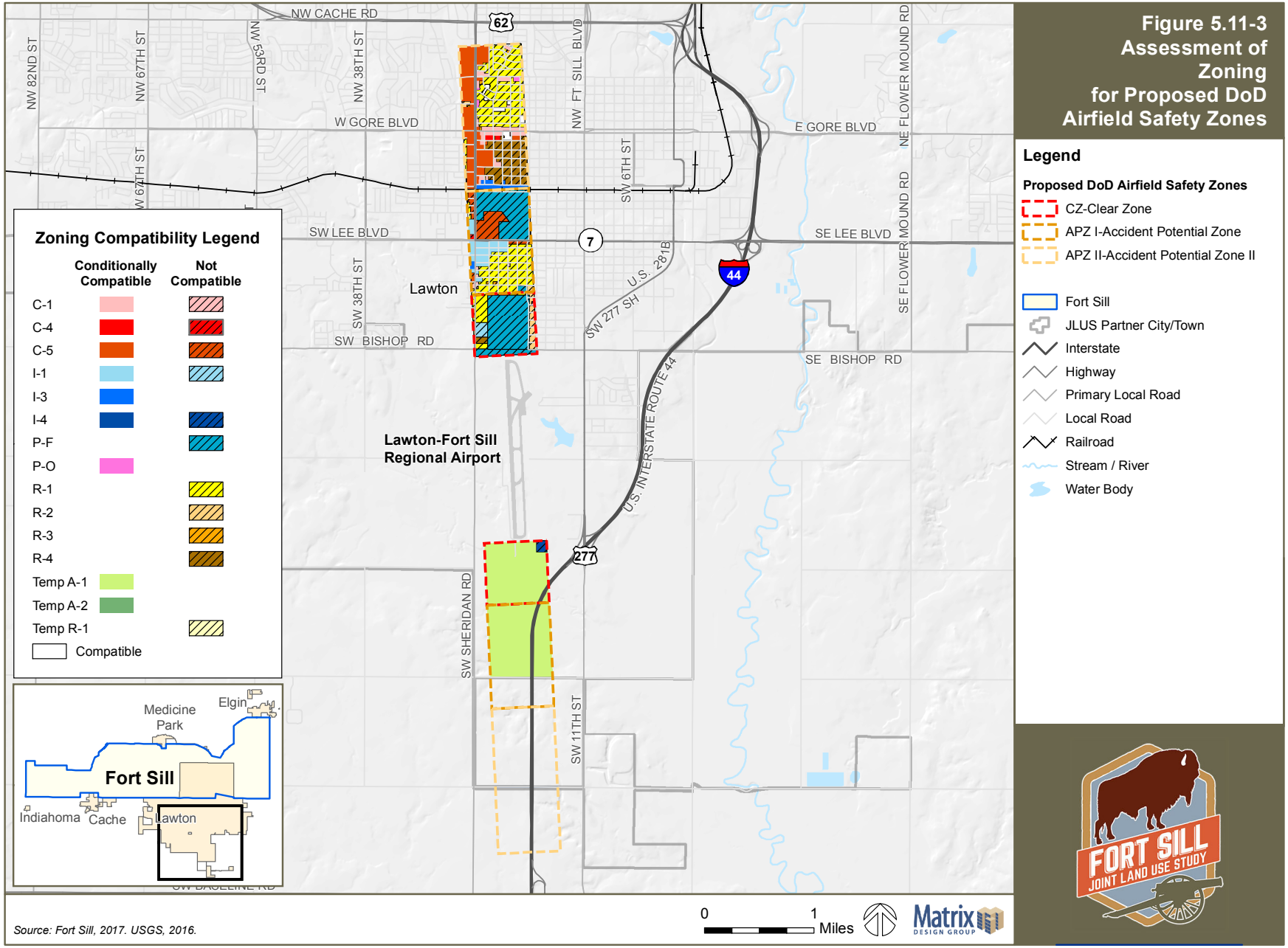
Proposed DoD Airfield Safety

- CZ-Clear Zone
- APZ I-Accident Potential Zone
- APZ II-Accident Potential Zone II

- Fort Sill
- JLUS Partner City/Town
- Interstate
- Highway
- Primary Local Road
- Local Road
- Railroad
- Stream / River
- Water Body

Future Land Use Compatibility Legend

	Conditionally Compatible	Not Compatible
Residential/Low Density		
Residential/High Density		
Commercial		
Industrial		
Agriculture		
Parks/Open Space		
Public Facility		
Tribal Trust Land		
Compatible		


NW CACHE RD
62
NW 82ND ST
NW 67TH ST
NW 53RD ST
NW 38TH ST
NW FT SILL BLVD
NE FLOWER MOUND RD
W GORE BLVD
E GORE BLVD
SW 6TH ST
SW LEE BLVD
7
SE LEE BLVD
SE FLOWER MOUND RD
U.S. 281B
44
Lawton
SW 277 SH
SW BISHOP RD
SE BISHOP RD
U.S. INTERSTATE ROUTE 44
Lawton-Fort Sill
Regional Airport
277
SW SHERIDAN RD
SW 11TH ST
Zoning Compatibility Legend
Conditionally Compatible
Not Compatible
C-1
C-4
C-5
I-1
I-3
I-4
P-F
P-O
R-1
R-2
R-3
R-4
Temp A-1
Temp A-2
Temp R-1
Compatible
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: Fort Sill, 2017. USGS, 2016.
0
1
Miles
Matrix DESIGN GROUP
Figure 5.11-3
Assessment of Zoning for Proposed DoD Airfield Safety Zones
Legend
Proposed DoD Airfield Safety Zones
CZ-Clear Zone
APZ I-Accident Potential Zone
APZ II-Accident Potential Zone II
Fort Sill
JLUS Partner City/Town
Interstate
Highway
Primary Local Road
Local Road
Railroad
Stream / River
Water Body
FORT SILL JOINT LAND USE STUDY

5.12 Legislative Initiatives (LEG)

Legislative initiatives are federal, state, or local laws and regulations that may have a direct or indirect effect on a military installation to conduct its current or future mission. They can also constrain development potential in areas surrounding the installation.

Key Terms

There are no unique terms in this section.

ISSUE LEG-1	**There is a Need for Enhanced Military Compatibility Legislation** *While there is existing legislation that provides some level of protection for the military regarding encroachment, there is a need to enhance the legislation to provide clarity to define more protections of the federal investment in the state and encourage compatible economic growth around military installations that can positively impact the local communities.*

Oklahoma created the Oklahoma Strategic Military Planning Commission in 2003 to evaluate state policies affecting the state's military facilities. The Commission is also charged with preventing the closure or downsizing of the state's military assets, maximizing the state's input into the federal Base Realignment and Closure (BRAC) process, protecting the communities' and residents' interests relevant to the BRAC process, and encouraging and promoting the state's military assets for the relocation of outside mission responsibilities and resources.

Since 2003, Oklahoma has been engaged in protecting the state's military installations and resources including airspace. The State has enacted laws that assist surrounding jurisdictions in land use planning around military installations and a grant program authorized for jurisdictions to apply to assist in the jurisdictions when an adverse base realignment and closure action has occurred. The most recent change or amendment in 2006 granted authority to jurisdictions that had land uses: within an Air Installation Compatible Use Zone (AICUZ) study area; a Joint Land Use Study (JLUS) study area; an Army Compatible Use Buffer (ACUB) area, or an Environmental Noise Management Plan area, to enact ordinances that would prohibit future land uses that would expose citizens to noise levels greater than a 65 day-night noise level (DNL) or accident potential.

The primary concern with the existing laws is it has been over 10 years since the last time an amendment was adopted for military compatibility legislation in the state of Oklahoma. Military mission needs and requirements have changed in the past 10 years. Commercial industry has changed in the past 10 years including the Energy Development industry to include tax credits without or little regulatory controls. With these changes, the current laws are not adequately addressing the concerns of the military relative to protecting military resources, e.g. airspace, land uses, and communication and coordination and where those interests intersect.

Compatibility Assessment

Oklahoma Statutes (OS) Section 11-43-101.1 has granted the authority for certain jurisdictions around military installation operations to enact ordinances to protect the public health, safety, and welfare; the laws do not require jurisdictions to enact laws to protect the public from all of the military training impacts. The law is specific in saying that the ordinances shall be consistent with the recommendations from an ACUB, AICUZ, or JLUS Report. The law also states that jurisdictions should restrict land uses that violate any Federal Aviation Regulations.

The following are further required standards should a jurisdiction enact an ordinance:

> *Uses that interfere or impair visibility with military operations, including ground operations, such as steam, dust or smoke into the air unless the substance is generated from an agricultural use;*
>
> *Uses that interfere with pilot vision and aerial or ground-based night vision training;*
>
> *Uses that interfere with military ground and aircraft communications and navigational equipment by producing electrical emissions;*
>
> *Uses that attract birds or waterfowl (such as sanitary landfill operations, maintenance of feeding stations);*
>
> *Structures within ten feet of defined aircraft approach, departure, or transitional surfaces; or 100 feet beneath a low-level military aircraft training route as provided by the Federal Aviation Administration;*
>
> *Expose persons to noise greater than 65 DNL;*
>
> *Uses that detract from the aesthetic appearance or make for an unsightly entrance to a military installation (such as automobile salvage yards, disposal sites, waste storage).*

These are all good military compatibility standards to include in any ordinance that is required. Currently, the law does not require jurisdictions to implement these standards. In addition, Oklahoma has not enacted a law that requires jurisdictions to communicate and coordinate with the military regarding proposed development and the impact it could have on military training operations.

Relative to the Oklahoma Strategic Military Planning Commission (OS §74-5401 and §74-5402), the law states that the Commission's charge is to prevent adverse Base Realignment and Closure (BRAC) actions occurring to the state's military assets; however, there is minimal impact that the Commission can have on the Federal BRAC process. While the Commission can provide studies, numbers and statistics when called upon, but the ultimate decision about BRAC actions is a Congressional action.

In recent years, the Commission has informally expanded its scope of responsibilities by advocating for solutions to military encroachment related actions and establishing policies to assist in preventing the realignment and closure of Oklahoma's military missions. The Commission is involved in the energy development issues impacting several installations in Oklahoma including Fort Sill, Vance AFB, and Altus AFB. This energy development issue also impacts northern Texas military installations (e.g. Sheppard AFB) that train using Oklahoma's military installations and ranges. Currently, there is ongoing communication and coordination between the Commission and the installations about the impacts from wind energy farms in the state. In addition, the State recently passed a law that makes Oklahoma a less desirable location for wind farms to develop in the state by eliminating the tax credit incentive that the State was giving to wind energy developers. While this law does not make it as desirable to locate wind farms in Oklahoma, the law also can have adverse impacts on state revenues and

energy rates because the State is not providing a tax credit. Energy developers may either choose not to develop in Oklahoma or raise the costs it takes to build and construct the wind farms passing those costs on to the power company distributers and to the general public consumers.

In addition, in Oklahoma all developers proposing to construct tall structure(s) within a three-statute mile area of a public-use airport must coordinate with the Oklahoma Aeronautics Commission (OAC). This rule is not exclusive to wind energy developers, rather it applies to all individuals proposing to construct any tall structure(s). According to Oklahoma Statute, Title 25, Chapter 30, Section (§) 1-3 (25:30-1-3), an individual should obtain a permit from the OAC if a structure or an alteration of a structure is within three statute miles of a public-use airport and is in excess of 150 feet above the airport elevation. It is important to note determination of excess is based on the runway elevation. This does not apply to structures that are more than three miles away from a public use airport, thus tall structure impacts on radars are not considered under this law.

According to Oklahoma Statute 25:30-11-1, at the time the individual or developer requests coordination with the FAA for an OE and the FAA determines that further aeronautical studies are required to determine if the proposed construction or alteration would be a hazard to safe air navigation, then the developer is required to provide the OAC with an opportunity to review and evaluate the proposed construction or structure for determination of impact to air navigation. In providing the OAC with a review, the developer would provide all correct copies of records and filings made with the FAA. Upon initiation of the OAC review, then the OAC works to communicate and coordinate with all relevant agencies including the Oklahoma Military Strategic Planning Commission and the military installations.

Oklahoma Statute 25:30-11-1 is only triggered if the FAA determines that further aeronautical studies are needed to determine impact to air navigation. Like the aforementioned law, this part of the law is only activated when structures are identified within a three-mile radius of a public use airport or exceeds 150 feet within this three-mile area. This law does not consider impacts to radars from the development of tall structures and an OAC review is only required if the FAA determines the need for further aeronautical studies to identify issues for safe air navigation.

Findings

- Oklahoma's Land Use Planning around Military Installations Law (OS §11-43-101.1) does not require jurisdictions to implement the law. It provides the authority for jurisdictions to enact ordinances that should comply with the findings from various military studies' recommendations and FAA regulations.
- Oklahoma has not adopted a law that requires jurisdictions and the military to communicate and coordinate on land use planning, e.g. development siting review, to determine if proposed development would be potential incompatible resulting in an adverse impact to military training operations.
- Oklahoma does not have legislation that protects military training assets from the impacts of the Energy Development Industry.
- The Commission is not required by law within their scope of responsibilities to evaluate and determine policies that would address encroachment and military compatibility.
- If there is no FAA determination of "further aeronautical studies are needed" to initiate the OAC review, then there may not be direct communication or coordination with the local military installation for their review for incompatibility with operations.
- In the FAA OE process, the FAA is evaluating the airport environment based on the airport runway elevation. This evaluation does not include evaluation of potential impacts to radar view sheds.

Please see the next page.

5.13 Light and Glare (LG)

This factor refers to man-made lighting (street lights, airfield lighting, building lights) and glare (direct or reflected light) that disrupts vision. Light sources from commercial, industrial, recreational, and residential uses at night can cause excessive glare and illumination, impacting the use of military night vision devices and air operations. Conversely, high intensity light sources generated from a military area (such as ramp lighting) may have a negative impact on the adjacent community.

Key Terms

Candela. A candela refers to the amount of luminous intensity.

Foot Candle. A foot candle refers to a unit of illumination equal to a source that emits one candela at a distance of one foot.

Lumen. A lumen refers to the measurement of light emitted from one candela.

Technical Background

Under dark sky conditions, the use of night vision goggles (NVG) allows military personnel to view objects up to a distance of 984 feet. Lighting located outside of an installation can decrease the NVG effectiveness to a distance of 164 feet. Off-installation lighting, such as street lights or other elevated structures that are lit at night also produce a halo effect around objects, which further reduces visibility and resolution for air and ground personnel.

The amount of ambient light experienced on the ground is a function of:

- intensity of nearby light sources (up to 20 miles away);
- distance from the sources;
- spectra of the light sources (blue light decays faster in the atmosphere);
- density of the cloud deck;
- height of the cloud; and
- relative humidity.

In measuring light pollution, the proximity to a developed area has a significant effect on the amount of light pollution that saturates the sky. With the proximity twice as close to developed areas the sky glow appears to be approximately six times brighter.

Sky glow from communities typically diminishes in the later hours of the night, when businesses close and some lights are turned off. It follows that the area and amount of light pollution can / will increase as development continues to progress outward from a community. Increased light pollution can cause an increase in the amount of sky glow and ultimately create compatibility issues with military missions.

The impacts of the use of outdoor lighting on the dark skies over a military installation are primarily determined by two principal factors – the amount of developed land (density) and the distance of the developed land from the installation. The relationship between density and distance is best demonstrated using an estimate of urban sky glow called Walker's Law.

The relationship captured through the use of Walker's Law formula was developed based on measurements of sky glow for a number of cities in California. The following formula is used to estimate sky glow at an observing site looking at a zenith angle of 45 degrees toward an urban source:

$$I = C \times P \times R(n)$$

Where:

"I" = Percent increase of the night sky brightness above the natural background at 45 degrees down from directly overhead (facing the community, directly overhead is roughly ¼ of this value),

"C" = 0.01 for "R" values between 10 and 50 km, and

"P" = Population of the community,

"R" = Distance, in kilometers (km), from the observing site to the center of the community,

"n" = 2.5 for "R" values between 10 and 50 km

According to the National Oceanic and Atmospheric Administration (NOAA), the assumed radius of a community is a function of its population, ranging from 2.5 km to 24-km. Walker's law applies if the installation is outside the city radius. If located inside the community radius, the sky glow increases in a linear manner toward the center by another factor of 2.5.

Consider the following examples:

Scenario 1: A 100-acre development located 2 kilometers from the installation with a density of 6 units per acre (assuming 2.5 persons per household) would impact the sky background by over 260 percent (nearly 663 percent with NOAA factor).

Scenario 2: A 100-acre development located 20 kilometers from the installation with a density of 6 units per acre (assuming 2.5 persons per household) would impact the sky background by approximately less than one percent (just over two percent with NOAA factor).

If the density was decreased to one unit per acre the resulting scenarios would result in the following increased sky glow:

Scenario 1: Approximately 44 percent (almost 111 percent with NOAA factor).

Scenario 2: Approximately less than one percent (still less than one percent with NOAA factor).

In general, the following trends are demonstrated:

- The denser the urban development, the greater the potential for light intrusion.
- The closer development is to the installation, the greater the potential is for light intrusion.

ISSUE LG-1	**Continued Reduction of Nighttime Training Capability** *In the past, the 75th Field Artillery Brigade performed night vision training throughout the entire installation. However currently, there is too much light pollution from development causing horizon brightening at night. This can reduce the effectiveness of the training and the potential future capability of receiving more missions for this purpose.*

Fort Sill is located in a relatively rural area of Oklahoma but is surrounded by small cities and towns that have developed over time and continue to grow and modernize. As noted in the Technical Background, the intensity of light sources up to 20 miles away can have an impact on horizon brightening and light pollution. Continued development (and the accompanying increase in light sources) around Fort Sill can adversely affect the military's ability to conduct nighttime training. The City of Lawton, immediately on the southern border of Fort Sill is the largest jurisdiction and has had and continues to have most of the development. This development has resulted in the increase of various lighting sources to support the community activities including residences and businesses along with supporting transportation functions such as roadways and airports.

Fort Sill is a major U.S. Army training / testing facility and conducts a wide variety of operations from troop combat training to artillery range operations. In addition, the HPAAF is located on Fort Sill and it, along with unmanned aerial systems on the installation's ranges make use of the airspace over and around Fort Sill. A key aspect to all military training is using realistic scenarios under conditions that would likely be faced in real world military conflicts. This includes the capability to function in nighttime environments. In the past the 75th Field Artillery Brigade used much of the Fort Sill authorized footprint for night vision training. As a result of continued growth and development in the surrounding community, light pollution in the night sky has increased. the Brigade has been forced to limit the areas on Fort Sill it can conduct nighttime training and in some cases, modify its activities to overcome the impacts from reduced NVG visibility. This has the potential to impact military readiness and reduce the ability of Fort Sill to carry out its assigned mission. Additional light pollution in the surrounding community could further impact to nighttime training at Fort Sill, potentially eliminating nighttime training all together.

Compatibility Assessment

The Lawton City Code under 6-1-5-187 Site Lighting Provisions, regulates lighting within the city boundaries for parking lots. Beneficial items included in this ordinance from a dark skies perspective include:

- *"Light sources (light bulbs) shall not be visible. They shall be shielded to reflect the light down on the ground and not onto the adjacent streets or adjacent property. Any light fixture installation that would interfere by reason of glare or distraction with traffic movement on the adjoining streets or produce other traffic hazards is prohibited."*

- *"Glare control: Full cut-off fixtures (ninety (90) degrees from vertical) shall be required for all light sources greater than two thousand (2,000) initial lumens (approximately the equivalent of a one hundred fifty (150) watt incandescent bulb)."*

Other jurisdictions in the vicinity of Fort Sill do not have ordinances directed at minimizing light pollution. Oklahoma does not have legislation intended to reduce nighttime lighting and glare impacts.

As a best practices reference, the state of Texas has adopted Local Government Code §§240.031 et seq., intended to reduce light impacts on military installations. In summary, this code requires specific counties within

five miles of a military facility to regulate outdoor lighting if requested to do so by the installation commander. The intent is to protect against light pollution that may impact the military missions and enhance a dark skies environment.

In addition, other states including Arizona, New Mexico and Colorado have adopted laws to reduce light pollution, not only to address the impacts to military night time training but also to preserve and protect natural resources and maintain dark skies. Cochise County in Arizona has adopted a Light Pollution Code as well. The National Conference for State Legislatures on Military Sustainability provides additional information on dark skies and light pollution.

Findings

- Light pollution has already impacted military nighttime training activities at Fort Sill.
- The 75th Field Artillery Brigade at Fort Sill has had to reduce on-base locations and activities as a result of increased light pollution from surrounding development.
- Continued light pollution impacts from incompatible development have the potential to impact Fort Sill's ability to conduct nighttime training operations in the future.
- The City of Lawton is the only jurisdiction near Fort Sill that has adopted an ordinance intended to reduce nighttime parking lot lighting impacts.

ISSUE LG-2	**There are Minimal to No Lighting Controls in the Jurisdictions Around Fort Sill** *Fort Sill's mission requires nighttime training to effectively prepare for a variety of military conflicts worldwide. A dark skies environment is required to effectively execute nighttime training with and without night vision devices. The local regulatory environment does not provide adequate protection of the dark skies for military training.*

The Fort Sill mission requires nighttime training with both, night vision goggles or other night vision devices and without night vision devices. In the past, the Army was capable of using the whole Fort Sill Military Reservation for nighttime training. However, in recent years, the only area of the installation that has the optimal nighttime environment is in the western portion of the Post away from the southern installation boundary, specifically west of Gerace Way. There is development south of the installation in the cities of Cache and Lawton. This development causes horizon brightening in the evening as there are little to no lighting requirements for new development and redevelopment in the cities. This lack of adequate lighting controls in the jurisdictions can result in increased light pollution and horizon brightening, which would increasingly limit the Army to train in the optimal nighttime environment. This would result in the lost capability of the Army conducting nighttime training at Fort Sill.

Compatibility Assessment

The State of Oklahoma has not established legislation aimed at reducing light pollution to protect the natural environment, dark skies, or the military training assets.

The City of Lawton has established lighting regulations for the Downtown Lawton Overlay District. In the regulations, the City requires spacing between light fixtures of anywhere from 50 to 100 feet and the emission of

light should not exceed 0.2-foot candles beyond the adjacent property line. The spacing will allow for other landscaping features to be adequately located as well as avoid uncomfortable glare onto adjacent land uses.

These are good compatibility measures; however, this only applies to the downtown area which is an area that encompasses the following area—

> "*the area bounded by the north right-of-way line of Ferris Avenue, the north right-of-way line of Gore Boulevard, the west right-of-way line of 4th Street; and the east right-of-way line of Railroad Street; and the area bounded by the north right-of-way line of Gore Boulevard, the south right-of-way line of SW C Avenue, the west right-of-way line of 7th Street, and the east right-of-way line of Railroad Street.*"

Downtown Lawton is approximately 4.5 miles from the southern boundary of the installation. This is of concern as studies have shown that light impacts from as far as 25 miles away can impact night vision devices and potentially render the devices ineffective for use in military training.

Lawton's Downtown Overlay District Design Policy also establishes regulations for luminaries to be translucent or glare-free. However, there is no indication or examples of translucent or glare-free luminaires in the ordinance.

Regarding the remaining portion of the city, regulations are not as well defined when it comes to lighting, including properties that are within a mile of the installation boundary. There are no general provisions or rules for lighting in the zoning ordinance.

However according to Chapter 6 of the Zoning Ordinance (Section 6-1-5-187), Building, Construction, and Housing, indicates that site lighting for parking lots is not required. However, the regulation stipulates that if lighting will be included in the site plan, then it should provide for the effective lighting of the site for functionality and security. The ordinance establishes that parking lot lighting, if used, the fixtures must be full cutoff fixtures if the light source emits greater than 2,000 lumens (which are the same as a 150-watt incandescent bulb). If the light source emits less than 2,000 lumens, then the fixture must be designed so that the bulb is not visible and facing downward to avoid light trespass on adjacent properties.

These are good measures for compatibility regarding lighting of parking lots; however, there are no general rules or provisions for the use of lights for commercial uses and residential uses, especially near the southern boundary of Fort Sill.

The City of Cache Zoning Ordinance only minimally addresses lighting for land uses within its jurisdiction. The City of Cache only stipulates the commercial land uses must not direct lighting on any adjacent property, especially residential properties, to avoid annoying glare. There are no measures or regulations that define how to avoid annoying glare or to prevent light pollution.

Findings

- The City of Lawton only addresses lighting for parking lots and the downtown overlay district.
- The City of Cache only addresses lighting in its commercial zoning district, which only stipulates that lighting should avoid annoying glare on adjacent land uses, especially adjacent residential land uses.
- Other states and counties have adopted laws and regulations to help minimize light pollution to benefit their communities.
- Oklahoma has not established lighting regulations for the protection of the dark skies environment or for the state's military training assets.
- No other jurisdictions in the JLUS Study Area have established lighting regulations.

Please see the next page.

5.14 Noise (NOI)

Sound is the mechanical energy transmitted by pressure waves in a compressible medium such as air. More simply stated, sound is what we hear. As sounds reach unwanted levels, this is referred to as noise. The central issue of noise is the impact, or perceived impact, on people, animals (wild and domestic), and general land use compatibility. Exposure to high noise levels can have a significant impact on human activity, health, and safety.

Technical Background

Due to the technical nature of this topic and its importance to the JLUS process, this section provides a discussion of the characteristics of sound and the modeling process used to evaluate noise impacts. The following key terms are used to describe noise.

Ambient Noise. The total noise associated with an existing environment, which usually comprises sounds from many sources, both near and far.

Attenuation. Reduction in the level of sound resulting from absorption by the surrounding topography, the atmosphere, distance from the source, barriers, construction techniques and materials, and other factors.

Decibel (dB). The dB is a unit used to measure the intensity of a sound or the power level of an electrical signal by comparing it with a given level on a logarithmic scale. In general use, a degree of loudness.

A-Weighted Decibel (dBA). The dBA is the most commonly weighted sound filter used to measure perceived loudness versus actual sound intensity. The human ear responds differently to frequencies. For example, the human hearing system perceives mid-frequency sounds as louder than low and high frequency sounds. To accommodate this condition when measuring sound levels, filters need to be installed into sound meters. The results are a more accurate measurement of sound for the human hearing system.

Day-Night Average Sound Level (DNL). An average sound exposure over a 24-hour period. During the nighttime period (10:00 p.m. to 7:00 a.m.), averages are artificially increased by 10 decibel (dB). This weighting reflects the added intrusiveness and the greater disturbance potential of nighttime noise events attributable to the fact that community background noise typically decreases by 10 dB at night.

Noise Contours. Connecting points of equal noise exposure. Typically expressed in five dBA increments (i.e., 60, 65, 70, 75, etc.). Noise contours can be represented on maps similar to the way contour lines on a topographical map are depicted.

Noise Zones. The Army uses a series of noise zones to identify noise levels associated with military operations and what types of land uses are either compatible or not recommended within the specific zones. The Army utilizes three Noise Zones (I, II, III) and one Land Use Planning Zone (LUPZ), which is a subdivision of Noise Zone I.

- **Noise Zone I** is the noise zone that includes all areas in which the PK15(met) decibels are less than 87 (for small arms), the A-weighted average day night level (ADNL) is less than 65 (for aircraft), and/or the C-weighted average day night level (CDNL) is less than 62 (for large

arms and explosions). This area is usually the furthest zone away from the noise source and is generally suitable for all types of land use.

  - There is also a **Land Use Planning Zone (LUPZ)**, which is a part of Noise Zone I, at the upper end of Noise Zone I and includes areas where the CDNL is between 57 and 62 or the ADNL is between 60 and 65. It does not include land for PK15(met). This zone accounts for variability in seasonal operations where certain times of the year may include greater than normal frequency in operations. Noise sensitive uses are generally acceptable within this area; however, this may vary on a case-by-case basis.

- **Noise Zone II** includes areas where the PK15(met) decibels are between 87 and 104, the ADNL is between 65 and 75, and/or the CDNL is between 62 and 70. Although local conditions such as availability of developable land or cost may require noise sensitive land uses in Zone II, this type of land use is strongly discouraged on the installation and in surrounding communities. All viable alternatives should be considered to limit development in Zone II to non-sensitive activities such as industry, manufacturing, transportation, agriculture, and resource protection.
- **Noise Zone III** is the zone located closest to the source of noise. It includes PK15(met) decibels greater than 104, ADNL greater than 75, and/or CDNL greater than 70. No noise sensitive uses should occur within this area due to the severity of noise.

Impulsive Peak Noise Levels [PK15 (met)]. Noise may be experienced outside of the noise zones from infrequent louds event that can lead to complaints even if the average noise levels are "compatible." Another accepted method for predicting impacts of noise created by the firing of weapons is to consider the PK 15(met) metric. The PK 15(met) metric is the calculated maximum (i.e., peak) noise level that is expected normally to be heard when a single weapon is fired one time. That peak noise level that is created from firing a single weapon one time is expected to occasionally (i.e. 15% of the time) exceed the PK 15 (met) because of the effects of weather and other meteorological conditions on noise propagation. These "peak contours" for single events show the expected sound level when a weapon was fired regardless of whether one or one thousand shots are fired. Since weather conditions can cause noise levels to vary significantly, a range of peak levels are calculated based on weather conditions that favor or hinder sound propagation. The peak noise contours are referred to as the "PK15 (met)" contours. This means that peak level depicted by the contour would be exceeded 15% of the time.

The reason for plotting the "PK15 (met)" versus the "average" peak is that if the average peak were plotted, weather conditions would be expected to cause a single event to reach levels higher than portrayed by the contours 50% of the time, and conversely, 50% of the events would be lower. By plotting the "PK15 (met)", events would be expected to fall within the contours 85% of the time. This gives the installation and the community a realistic means to consider the areas impacted by testing and training noise without putting stipulations on land that would only receive high sound levels under infrequent weather conditions.

Noise Sensitive Receptors. Army Regulation (AR) 200-1 lists housing, schools, and medical facilities as examples of Noise Sensitive Receptors, or land uses, which are identified as land uses that are acceptable within the Noise Zone I, normally not recommended in Noise Zone II, and not recommended in Noise Zone III.

Characteristics of Sound

It is important to understand that there is no single perfect way of measuring sound, due to variations used by different entities when conducting sound studies or sound modeling as well as the subjective response from individuals and their comfort levels with varying intensity and characteristics of sounds. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of

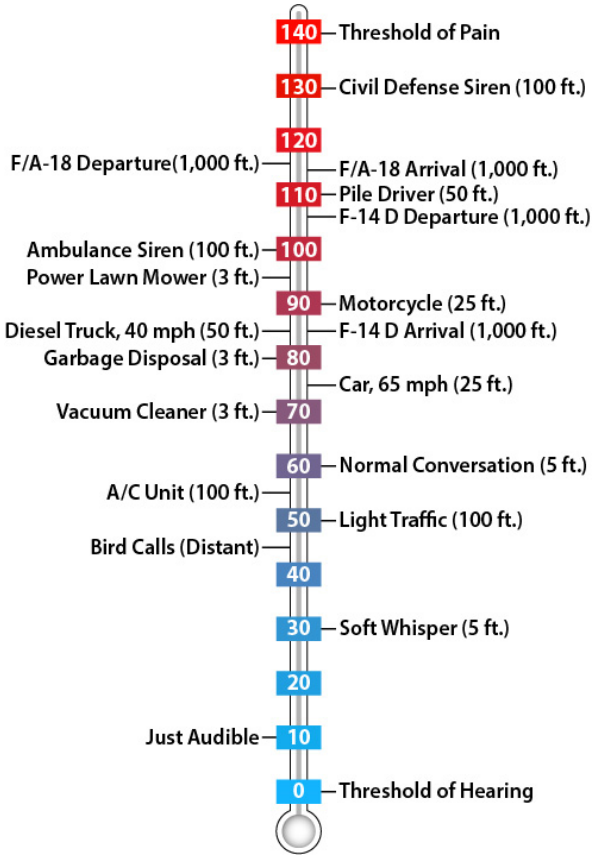
propagation, and the pressure level or energy content (amplitude). The sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. The dB scale is used to quantify sound intensity. Because sound pressure can vary by over one trillion times within the range of human hearing, a logarithmic loudness scale (i.e., dB scale) is used to present sound intensity levels in a convenient format.

Since the human ear is not equally sensitive to all frequencies within the entire spectrum, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity in a process called "A-weighting" written as dBA. In this document, all sound or noise levels are measured in A-weighted decibels (dBA), which are units of sound pressure adjusted to the range of human hearing with intensity greater than the ambient or background sound pressure. The threshold of human hearing is approximately 0 dBA and normal speech has a sound level of approximately 60 dBA. Sound levels above 120 dBA are typically when discomfort begins to be felt inside the human ear, and sound levels between 130 to 140 dBA and above are felt as pain and may cause permanent damage to the ear.

The human ear can detect changes in sound levels of approximately three dBA under normal conditions. Changes of one to three dBA are typically noticeable under controlled conditions, while changes of less than 1 dBA are only discernible under controlled, extremely quiet conditions. A change of 5 dBA is typically noticeable to the general public in an outdoor environment.

Figure 5.14-1 summarizes typical A-weighted sound levels for a range of indoor and outdoor activities.

Figure 5.14-1. Sound Levels Comparison in dB



Environmental noise fluctuates over time. While some noise fluctuations are minor, others can be substantial. These fluctuations include regular and random patterns, how fast the noise fluctuates, and the amount of variation. Weather patterns can have a strong effect on how far sound travels and how loud it is. Certain weather events can change the consistency of the air and either cause sound to travel further and be louder or can reduce the distance at which it can be heard. Temperature and wind velocity are examples of factors that can affect sound travel. Sound tends to travel further in cold temperatures. Specific combinations of temperature and wind direction can create atmospheric refraction, which is when atmospheric conditions bend and/or focus sound waves towards some areas and away from others. When describing noise impacts, it is common to look at the average noise over an average day.

According to the DoD and the FAA, [Airport Noise Compatibility Planning (14 CFR Part 150)] 65 dBA DNL is defined as the threshold for significant noise exposure. Noise exposure within the 55 to 65 DNL noise contours is regarded as moderate and land use controls such as the regulation of types of land uses permitted or the potential use of sound attenuation in buildings should be considered. Federal guidelines have been adopted to guide appropriate development and land use planning for noise contours greater than 65 DNL, and noise sensitive uses such as residential and schools should not be built under these areas without proper sound mitigation. It should be noted that the DNL contours represent an average sound level over a 24-hour period and that individual instances may be louder than the noise contour in which they are located. In addition, noise may still cause an annoyance if it is below 65 dBA DNL.

It is important to recognize that noise contours, as depicted on maps, are intended as a planning tool and do not represent a clear change in noise threshold at each contour. Changes in noise levels may not be perceptible several hundred feet to either side of a particular contour line and can vary with temperature, humidity, wind, and other environmental factors.

ISSUE NOI-1	**Aircraft Training Operations Generates Noise at Henry Post Army Airfield that can Impact Land Uses Off-Installation South of the Airfield** *Aircraft training occurs at Fort Sill's Henry Post Army Airfield that is located in southeastern portion of the cantonment area. The noise modeling developed for the aircraft training shows that noise contours extend off the installation and can impact land uses in the northern part of the City of Lawton.*

Compatibility Assessment

Fort Sill accommodates a broad spectrum of aviation training, the majority of which originates at the Henry Post Army Airfield (HPAAF), located at the southern end of the cantonment area. HPAAF has one runway designated 17/35 measuring 5,000 by 200 feet running in a north-south orientation. On average, HPAAF is used five days per week, with minimal flights occurring during nighttime hours (10:00 pm-7:00 am). The majority of aircraft activity occurs from the T-38 Talon and T-6 Texan trainer fixed-wing aircraft. The T-38 is a two seat, twin-engine supersonic jet, while the T-6 is a single-engine turboprop aircraft. Additional aircraft that utilize HPAAF include other fixed wing aircraft—C-130, UC-35, C-12 as well as several types of Army helicopters.

To develop aircraft operations noise information, aircraft flight data is used to derive average daily operations by runway and type of aircraft. Analysis of Fort Sill's aircraft operations included the types of aircraft, flight patterns, variations in altitude, number of operations, ground run-up information, and hours of operations. NOISEMAP, a computer modeling program for aircraft operations, was used to produce a map showing noise levels and correlated noise contours.

As documented in the Fort Sill 2015 Installation Compatible Use Zone Study (ICUZ), the following operations related Noise Zones extend from HPAAF:

- Land Use Planning Zone (LUPZ), [a part of Noise Zone I] (60-65 dB ADNL) extends beyond the installation boundary due south slightly more than one-half of a mile into Lawton
- Noise Zone II (70-80 dB ADNL) extends beyond the installation boundary in similar fashion approximately one-third of a mile.
- Noise Zone III is contained within Fort Sill.

Figure 5.14-2 shows the evaluation of the future land uses under the aircraft training noise contours at HPAAF. Figure 5.14-3 illustrates the evaluation of the City of Lawton's zoning districts under the aircraft training noise contours at HPAAF.

The current Lawton Zoning Ordinance establishes 22 zoning districts intended to encourage the most appropriate use of land within the City boundaries. Each zoning district has specific land use regulations regarding permitted land uses, maximum building heights, and minimum lot areas. While the City Code has provisions for noise related to traditional community concerns (vehicles, animals, machinery, etc.) there are no ordinances related to airport / aircraft operations and associated management of incompatible development. As such, there are residential, commercial and public facilities land use zones that underlie the noise contours generated by HPAAF operations.

Lawton zoning ordinances also allow schools and daycare centers in residential zones. These uses would also require noise attenuation where noise levels exceed 65 dBA making them conditionally compatible as well. Mobile home parks are incompatible in Zone II. The Federal Interagency Committee on Urban Noise (FICUN) guidelines as shown in Table 5.14-2 allow for residential zoning in the LUPZ and Zone II areas, however noise attenuation is required where noise levels exceed 65 dBA and therefore are considered conditionally compatible in the LUPZ and Zone II.

Table 5.14-1 shows the land use zones and the approximate number of acres included in the HPAAF LUPZ and Zone II noise contours.

Table 5.14-1. City of Lawton Zoning Districts and Acres Impacted by Aircraft Training Noise at HPAAF

City of Lawton Zoning District	LUPZ Acres	Compatibility Assessment	Zone II Acres	Compatibility Assessment
Local Commercial District (C-1)	0.86	Conditional	0.00	
Tourist Commercial District (C-4)	30.15	Compatible	4.82	Conditional
General Commercial District (C-5)	14.15	Compatible	0.71	Conditional
Public Facilities (P-F)	62.29	Conditional	1.82	Conditional
Single-Family Dwelling District (R-1)	186.61	Conditional	20.58	Conditional*
Two-Family Dwelling District (R-2)	21.94	Conditional	3.88	Conditional*
Multiple-Family Dwelling District (R-3)	4.46	Conditional	3.84	Conditional*
High-Density Apartment District (R-4)	13.69	Conditional	3.32	Conditional*

*Mobile home parks or courts are incompatible

Source: City of Lawton Code of Ordinances, amended 2000; Federal Interagency Committee on Urban Noise, 1980

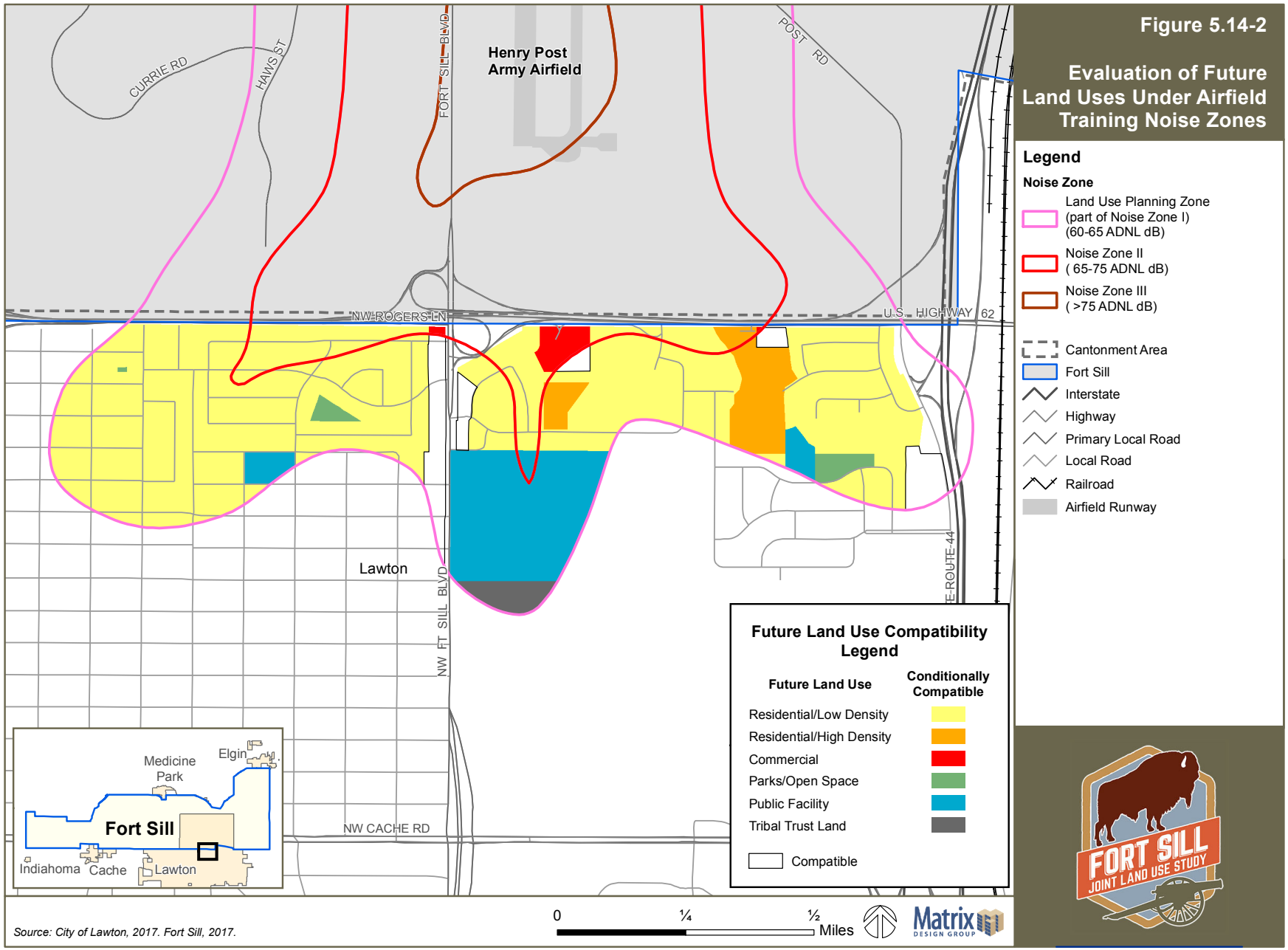


Figure 5.14-2
Evaluation of Future Land Uses Under Airfield Training Noise Zones
Legend
Noise Zone
Land Use Planning Zone (part of Noise Zone I) (60-65 ADNL dB)
Noise Zone II (65-75 ADNL dB)
Noise Zone III (>75 ADNL dB)
Cantonment Area
Fort Sill
Interstate
Highway
Primary Local Road
Local Road
Railroad
Airfield Runway
Henry Post Army Airfield
CURRIE RD
HAWS ST
FORT SILL BLVD
POST RD
NW ROGERS LN
U.S. HIGHWAY 62
Lawton
NW FT SILL BLVD
NW CACHE RD
Future Land Use Compatibility Legend
Future Land Use
Conditionally Compatible
Residential/Low Density
Residential/High Density
Commercial
Parks/Open Space
Public Facility
Tribal Trust Land
Compatible
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: City of Lawton, 2017. Fort Sill, 2017.
0
¼
½
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

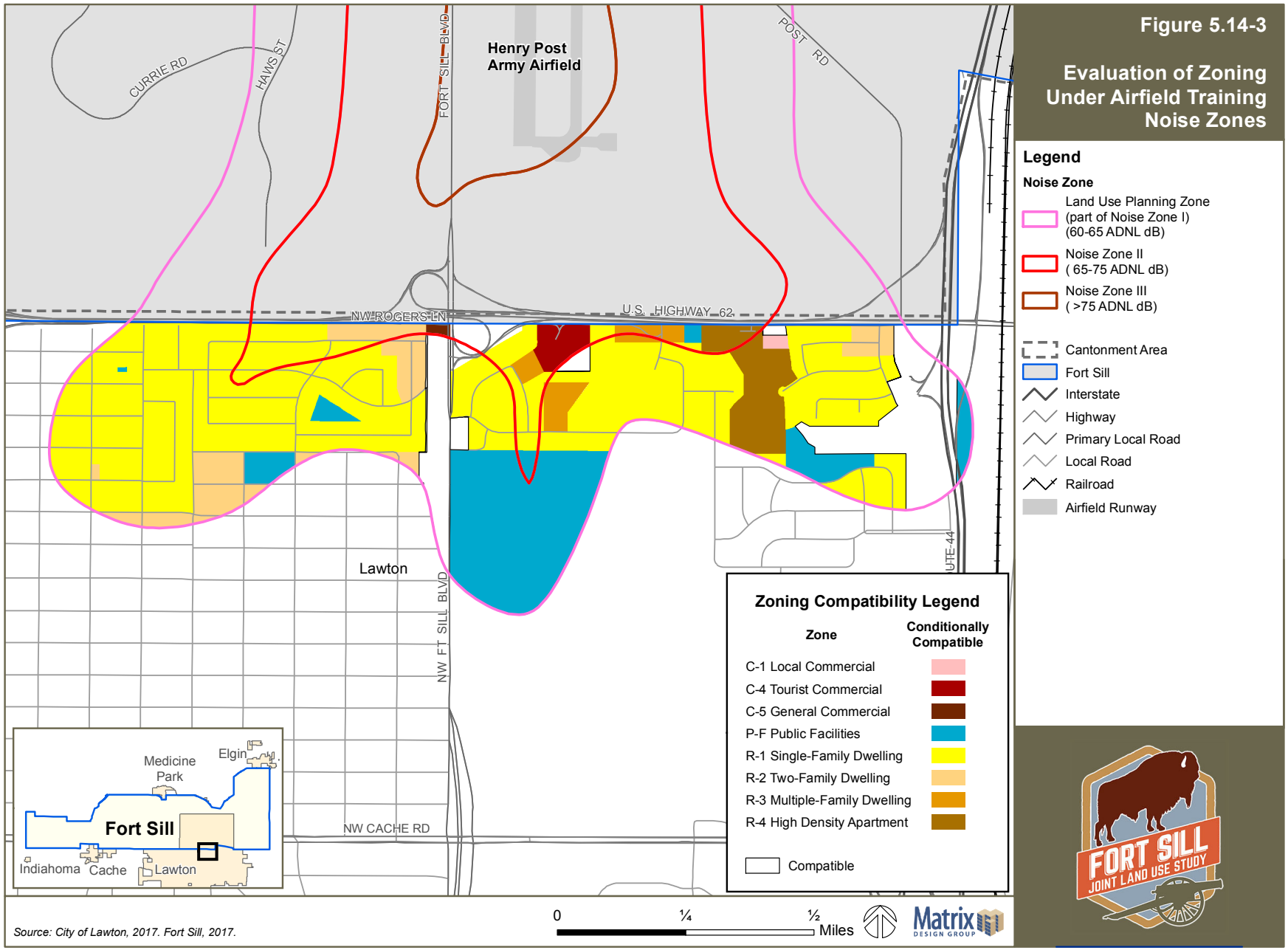


Figure 5.14-3
Evaluation of Zoning Under Airfield Training Noise Zones
Legend
Noise Zone
Land Use Planning Zone (part of Noise Zone I) (60-65 ADNL dB)
Noise Zone II (65-75 ADNL dB)
Noise Zone III (>75 ADNL dB)
Cantonment Area
Fort Sill
Interstate
Highway
Primary Local Road
Local Road
Railroad
Airfield Runway
Zoning Compatibility Legend
Zone
Conditionally Compatible
C-1 Local Commercial
C-4 Tourist Commercial
C-5 General Commercial
P-F Public Facilities
R-1 Single-Family Dwelling
R-2 Two-Family Dwelling
R-3 Multiple-Family Dwelling
R-4 High Density Apartment
Compatible
Henry Post Army Airfield
CURRIE RD
HAWS ST
FORT SILL BLVD
POST RD
NW ROGERS LN
U.S. HIGHWAY 62
Lawton
NW FT SILL BLVD
UTE 44
NW CACHE RD
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
Source: City of Lawton, 2017. Fort Sill, 2017.
0
¼
½
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

Table 5.14-2 FICUN Guidelines for Land Uses in Aviation Noise Zones

SLUCM No.	Land Use	Noise Zones and ADNL Levels (dBA)						
		Noise Zone I		Noise Zone II		Noise Zone III		
		0-55	55-65	65-70	70-75	75-80	80-85	85+
10	**Residential**							
11	Household Units	Yes	Yes*	25[1]	30[1]	No	No	No
12	Group Quarters	Yes	Yes*	25[1]	30[1]	No	No	No
13	Residential Hotels	Yes	Yes*	25[1]	30[1]	No	No	No
14	Mobile Home Parks or Courts	Yes	Yes*	No	No	No	No	No
15	Transient Lodgings	Yes	Yes*	25[1]	30[1]	35[1]	No	No
16	Other Residential	Yes	Yes*	25[1]	30[1]	No	No	No
20, 30	**Manufacturing**							
21	Food & Kindred Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
22	Textile Mill Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
23	Apparel/Other Finished Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
24	Lumber & Wood Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
25	Furniture & Fixtures	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
26	Paper & Allied Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
27	Printing, Publishing & Allied Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
28	Chemicals & Allied Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
29	Petroleum Refining & Related Industries	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
31	Rubber & Misc Plastic Products - Manufacturing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
32	Stone, Clay & Glass Products Manufacturing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
33	Primary Metal Industries	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
34	Fabricated Metal Products - Manufacturing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
35	Professional, Scientific & Controls	Yes	Yes	Yes	25	30	No	No
39	Miscellaneous Manufacturing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No

SLUCM No.	Land Use	Noise Zones and ADNL Levels (dBA)						
		Noise Zone I		Noise Zone II		Noise Zone III		
		0-55	55-65	65-70	70-75	75-80	80-85	85+
40	**Transportation Communication & Utilities**							
41	Railroad, Rapid Rail Transit & Street Rail	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
42	Motor Vehicle Transportation	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
43	Aircraft Transportation	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
44	Marine Craft Transportation	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
45	Highway & Street Right-of-Way	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
46	Automobile Parking	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
47	Communications	Yes	Yes	Yes	25[5]	30[5]	No	No
48	Utilities	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
49	Other Transportation, Communication & Utilities	Yes	Yes	Yes	25[5]	30[5]	No	No
50	**Trade**							
51	Wholesale Trade	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
52	Retail - Building Materials, Hardware/Farm	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
53	Retail - General Merchandise	Yes	Yes	Yes	25	30	No	No
54	Retail - Food	Yes	Yes	Yes	25	30	No	No
55	Retail - Auto, Marine, Aircraft & Parts	Yes	Yes	Yes	25	30	No	No
56	Retail - Apparel & Accessories	Yes	Yes	Yes	25	30	No	No
57	Retail - Furniture, Furnishings & Equipment	Yes	Yes	Yes	25	30	No	No
58	Retail - Eating & Drinking Facilities	Yes	Yes	Yes	25	30	No	No
59	Other Retail Trade	Yes	Yes	Yes	25	30	No	No
60	**Services**							
61	Finance, Insurance & Real Estate Services	Yes	Yes	Yes	25	30	No	No
62	Personal Services	Yes	Yes	Yes	25	30	No	No
62.4	Cemeteries	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[6]
63	Business Services	Yes	Yes	Yes	25	30	No	No

SLUCM No.	Land Use	Noise Zones and ADNL Levels (dBA)						
		Noise Zone I		Noise Zone II		Noise Zone III		
		0-55	55-65	65-70	70-75	75-80	80-85	85+
64	Repair Services	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
65	Professional Services	Yes	Yes	Yes	25	30	No	No
65.1	Hospitals, Nursing Homes	Yes	Yes*	25*	30*	No	No	No
65.1	Other Medical Facilities	Yes	Yes	Yes	25	30	No	No
66	Contract Construction Services	Yes	Yes	Yes	25	30	No	No
67	Government Services	Yes	Yes*	Yes*	25*	30*	No	No
68	Educational Services	Yes	Yes*	25*	30*	No	No	No
69	Miscellaneous Services	Yes	Yes	Yes	25	30	No	No
70	**Cultural Entertainment & Recreational**							
71	Cultural Activities, Including Churches	Yes	Yes*	25*	30*	No	No	No
71.2	Nature Exhibits	Yes	Yes*	Yes*	No	No	No	No
72	Public Assembly	Yes	Yes	Yes	No	No	No	No
72.1	Auditoriums, Concert Halls	Yes	Yes	25	30	No	No	No
72.11	Outdoor Music Shells, Amphitheaters	Yes	Yes*	No	No	No	No	No
72.2	Outdoor Sports Arenas, Spectator Sports	Yes	Yes	Yes7	Yes7	No	No	No
73	Amusements	Yes	Yes	Yes	Yes	No	No	No
74	Recreational Activities	Yes	Yes*	Yes*	25*	30*	No	No
75	Resorts, Groups & Camps	Yes	Yes*	Yes*	Yes*	No	No	No
76	Parks	Yes	Yes*	Yes*	Yes*	No	No	No
79	Other Cultural, Entertainment & Recreation	Yes	Yes*	Yes*	Yes*	No	No	No
80	**Resource Product & Extract**							
81	Agriculture (Except Livestock)[11]	Yes	Yes	Yes[8]	Yes[9]	Yes[10]	Yes[10]	Yes[10]
81.5 to 81.7	Livestock Framing & Animal Breeding	Yes	Yes	Yes[8]	Yes[9]	No	No	No
82	Agricultural Related Activities	Yes	Yes	Yes[8]	Yes[9]	Yes[10]	Yes[10]	Yes[10]
83	Forestry Activities & Related Services	Yes	Yes	Yes[8]	Yes[9]	Yes[10]	Yes[10]	Yes[10]

SLUCM No.	Land Use	Noise Zones and ADNL Levels (dBA)						
		Noise Zone I		Noise Zone II		Noise Zone III		
		0-55	55-65	65-70	70-75	75-80	80-85	85+
84	Fishing Activities & Related Services	Yes	Yes	Yes	Yes	Yes	Yes	Yes
85	Mining Activities & Related Services	Yes	Yes	Yes	Yes	Yes	Yes	Yes
89	Other Resource Production & Extraction	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Fort Sill Installation Compatible Use Zone Study, 2015

Table 5.14-2 FICUN Guidelines for Land Uses in Aviation Noise Zones Notes:

SLCUM = Standard Land Use Coding Manual

Yes Land use and related structures compatible without restrictions.

No Land use and related structures are not compatible and should be prohibited.

ADNL A-weighted day-night sound level

Yes[x] "Yes" but with restrictions. Land use and related structures generally compatible; see footnotes.

25, 30, 35 Land use and related structures generally compatible; measures to achieve noise level reduction (NLR) of 25, 30 or 35 must be incorporated into design and construction of structure.

25*, 30*, 35* Land use generally compatible with NLR; however, measures to achieve an overall NLR do not necessarily solve noise difficulties and additional evaluation is warranted.

NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

Footnotes:

* The designation of these uses as "compatible" in this zone reflects individual Federal agencies' consideration of general cost and feasibility factors as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

a) Although local conditions may require residential use, it is discouraged in 65-70 ADNL and strongly discouraged in 70-75 ADNL. The absence of viable alternative development options should be determined and an evaluation indicating that a demonstrated community need for residential use would not be met if development were prohibited in these zones should be conducted prior to approval.

b) Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 dB (65-70 ADNL) and 30 dB (70-75 ADNL) should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a 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 and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels.

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

x[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.

x[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.

x[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.

x[5] If noise-sensitive, use indicated NLR; if not, use is compatible.

x[6] No buildings.

x[7] Land use compatible provided special sound reinforcement systems are installed.

x[8] Residential buildings require a NLR of 25.

x[9] Residential buildings require a NLR of 30.

x[10] Residential buildings not permitted.

x[11] In areas with ADNL greater than 80, land use not recommended, but if community decides use is necessary, hearing protection devices should be worn by personnel.

Per the FICUN guidelines, commercial applications are generally compatible in the LUPZ and Zone II, however the Lawton zoning ordinance allows for residential, school and daycare land uses in the city commercial zones. These types of uses would be considered conditionally compatible subject to required noise attenuation above 65 dBA.

The Lawton public facilities area impacted by the LUPZ and Zone II is classified as conditionally compatible as well due to hospitals and parks being an approved use in the ordinance. Noise attenuation would be potentially required where noise levels exceed 65 dBA as identified in the FICUN.

Findings

- Portions of northern Lawton are impacted by noise generated by the HPAAF on Fort Sill. The noise contours that extend beyond the Fort Sill boundary are the LUPZ and Zone II areas.
- The areas of Lawton impacted are currently zoned for residential, commercial and public facilities.
- Lawton planning and zoning ordinances have no provisions for noise aspects related to airport / aircraft operations and processes for managing any potential incompatible development.
- The Fort Sill ICUZ applies the FICUN guidelines for recommended zoning provisions including residential, commercial and public use.
- Several of the zoning areas of Lawton that underlie the LUPZ and Zone noise contours are considered conditionally compatible subject to proper noise attenuation to reduce levels to below 65 dBA.

ISSUE NOI-2	**Range Operations Generate Noise that Extends Off-Installation** *Small arms, field artillery, and aerial bombing training generate an abundance of noise for Fort Sill. These activities occur in all parts of the installation resulting in noise impacting noise sensitive land uses in every direction.*

From training with small arms, e.g. rifle marksmanship to large arms, e.g. 105 millimeter Howitzer, Fort Sill enables training with numerous weapons. Fort Sill is located in south-central Oklahoma situated in a mostly rural area. Fort Sill training activities occur throughout the installation creating a noise footprint that extends beyond the installation boundary.

The primary concern is the noise generated from the various weapons used for training can impact off-installation land uses in in the surrounding communities. This impact potential extends to the evening and nighttime hours, which can impact sleep patterns of residents of incompatibly sited residential uses.

In addition, there are only two jurisdictions that have adopted and enforce land use planning tools such as a Land Use Plan and Zoning Ordinances to protect their residents from impacts associated with the noise generated by the military training activity and operations that occur at Fort Sill. Too many noise complaints and / or work-arounds by the military can have an adverse impact on the installation's mission.

Compatibility Assessment

There is land immediately outside the installation in all directions that is impacted by noise. To assist in providing a buffer for the installation and the public, the Army has applied for funding for the following programs:

- Army Compatible Use Buffer (ACUB) to collaborate with willing landowners to place the land identified by the Army into easements.
- Readiness Environmental Protection Integration (REPI) to collaborate with willing landowners and / or third-party organizations, e.g. Land Trusts or the Nature Conservancy, to place the land identified by the Army into easements.

Fort Sill has used the ACUB Program to protect over 3,380 acres around the installation from future development. The Army has also identified another 9,300 acres of potential ACUB land to place in easement for protection against future development. This is an effective tool that the Army and willing landowners or organizations can use to place land in easements removing the land from development for a set number of years depending on the transaction. The easement can be for 10 years, 20 years, or in perpetuity. The concern with only utilizing this ACUB tool is that the partnerships require willing landowners, and at times, the transaction can be lengthy delaying the protection of the land to an indefinite time in the future. Fort Sill has identified that approximately another 5,700 acres of land is potentially incompatible designated as school, city, or Native American land.

The REPI program is another tool the Army can use to purchase development rights of land from willing landowners. Through Fiscal Year 2016 (FY16), the Army has used REPI funds to protect 3,595 acres around Fort Sill. Similar to the ACUB, this program requires a partnership between the Army and willing landowners. This process can also be lengthy, which could result in missed opportunities with other partners.

According to the Oklahoma Statute §11-43-101.1, jurisdictions in Oklahoma have the authority to enact an ordinance that is designed to prevent future noise sensitive land uses from being located in high noise zones, a high noise zone refers to an area that has a noise level measuring 65 dB and greater. In addition, if the jurisdictions enact an ordinance, the State requires the ordinance comply with the recommended land use guidelines as reported in the AICUZ Report area, JLUS Study area, or the ACUB priority areas. The concern with this law is that it does not require jurisdictions to enact an ordinance.

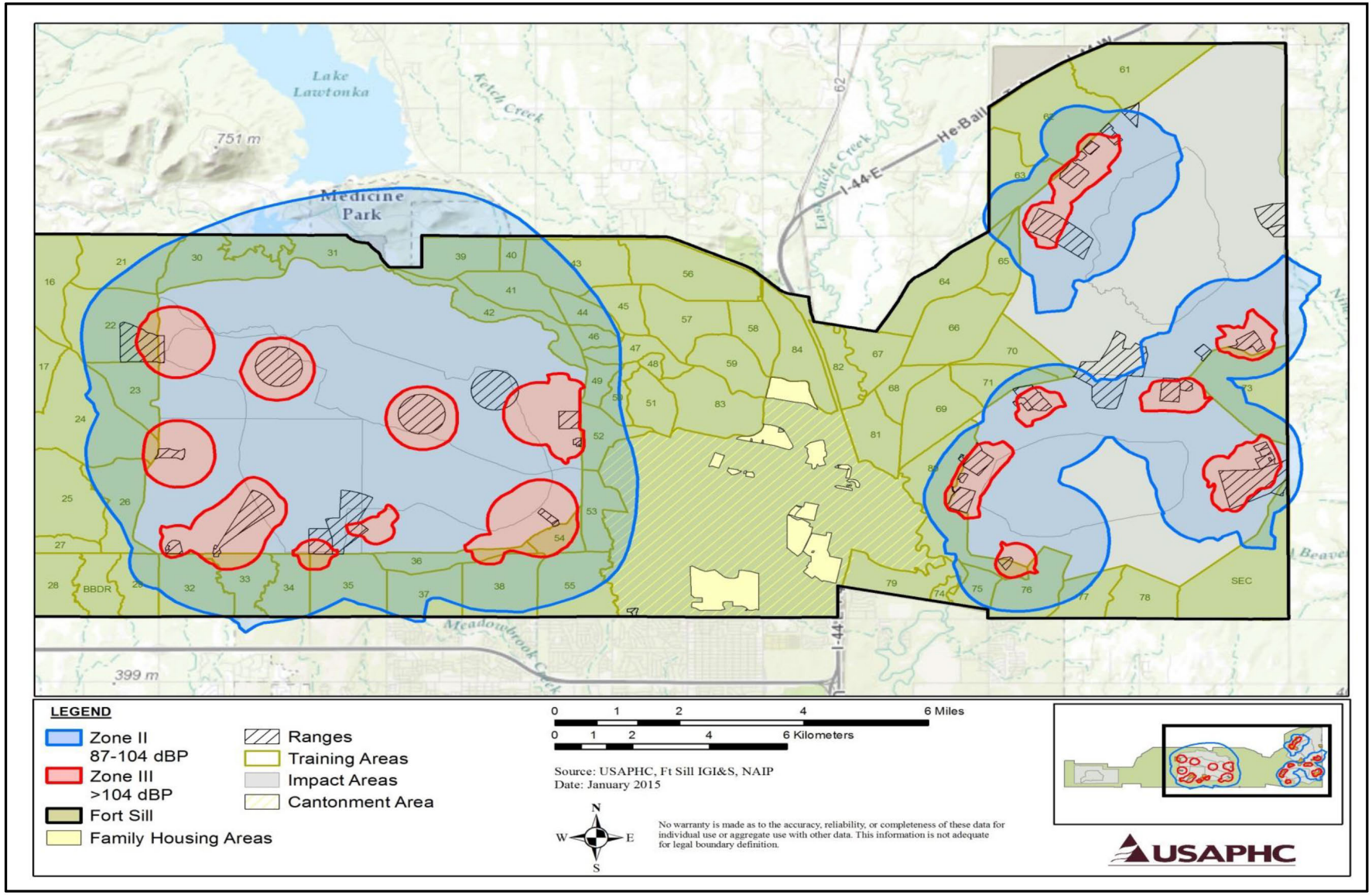
Addressing this issue on a local level includes the use of land use planning tools such as Land Use Plans and Zoning Ordinances. The City of Lawton has implemented both tools, which are used in this assessment for the evaluation of future land uses and zoning illustrated on the following maps for the various range noise zones.

Small Arms Range Noise

Noise zones for small arms includes weapons of .50 caliber or less and are developed using SARNAM to calculate and plot the peak noise levels based on the loudest weapon at each fixed firing point. Weapons firing from non-fixed firing points are not calculated into the noise contours but are addressed through predicted peak noise levels. Noise contours represent a maximum small caliber training scenario in which weapons firing occurs simultaneously at all ranges. While this scenario is unlikely or rare, it provides the greatest extent of noise levels for normal operations. At the time of this report, the small arms range noise data was not available. However, the noise contours are mapped in Fort Sill's 2015 ICUZ and indicate all Noise Zone III contours (>104 dBP) are contained on the installation. There are small portions of Noise Zone II that extend off-installation, primarily impacting the Town of Medicine Park to the north.

Land use and zoning compatibility analysis is not available for small arms range noise at the time of this report. Figure 5.14-4 depicts the small arms range noise contours from Fort Sill's 2015 ICUZ.

Figure 5.14-4. Small Arms Range Noise



Source: Fort Sill Installation Compatible Use Zone Study 2015

Medium to Large Arms Range Noise

The Army used the FICUN guidance and the National Academy of Sciences Committee on Hearing, Bioacoustics and Biomechanics, 1981 to develop the Medium to Large Arms Range Noise Recommended Land Uses that was used in another JLUS with similar operations and activities as Fort Sill. Matrix is recommending using this table in the Fort Sill JLUS as a best practice. Table 5.14-3 outlines the recommended land uses for medium to large arms for range noise. Figure 5.14-5 illustrates the future land uses in the city of Lawton that have been assessed for compatibility based on the Army guidance and best practices.

Future Land Uses

The Land Use Planning Zone (LUPZ) or, a subdivision of Noise Zone I, extends off-installation in all directions excluding the west side of the installation. The LUPZ has the greatest impact on off-installation land uses than the other noise zones; however, the LUPZ is measured at decibel range between 57 dB to 62 dB, which is generally compatible for most land uses.

The entire city of Lawton is included in the LUPZ. There are 1,246 acres of high-density residential and 4,895 acres of low density residential future land uses located in the LUPZ that are conditionally compatible. Residential uses have been recommended as conditional land uses in the LUPZ due to the decibel range of approximately 57-62 dB. This decibel range of noise can impact noise sensitive land uses such as residential uses. The FICUN guidelines indicate that residential uses in the LUPZ are acceptable with conditions, which means the governing authorities should consider these land uses being located in this zone and should potentially consider noise attenuation or sound mitigation measures if residential is planned for this area. In addition to the residential land uses, there are 607 acres of Tribal Trust Land and 357 acres of Urban Renewal Plan Area in the LUPZ zone. As there are no specific permitted land uses in the 2030 Land Use Plan that have been delineated for the Tribal Trust Land or Urban Renewal Plan Area; therefore, these land use categories, for the purposes of this study, are designated as conditional as there may be future land uses planned for these areas that would be impacted by noise.

Relative to Noise Zone II, there are approximately 439 acres designated as Parks and Opens Space in the city of Lawton that are designated as incompatible according to the recommended guidance parks and open space are incompatible if located in Noise Zone II areas due to the impact and frequency of high impact noise.

There are incompatible in the Noise Zone II extends off-installation to the east and to the north. Due to lack of data, a detailed land use assessment of the land uses to the east and to the north was not evaluated at the time of the development of this JLUS.

For Noise Zone III, there are approximately 25 acres of Parks and Open Space and 2 acres of commercial future land uses in the city of Lawton located just south of the installation boundary and west of 52nd Street. These land uses are recommended as incompatible due to the high noise impacts that the public would be subject to in this area. This is the only area in which the Noise Zone III footprint extends off-installation.

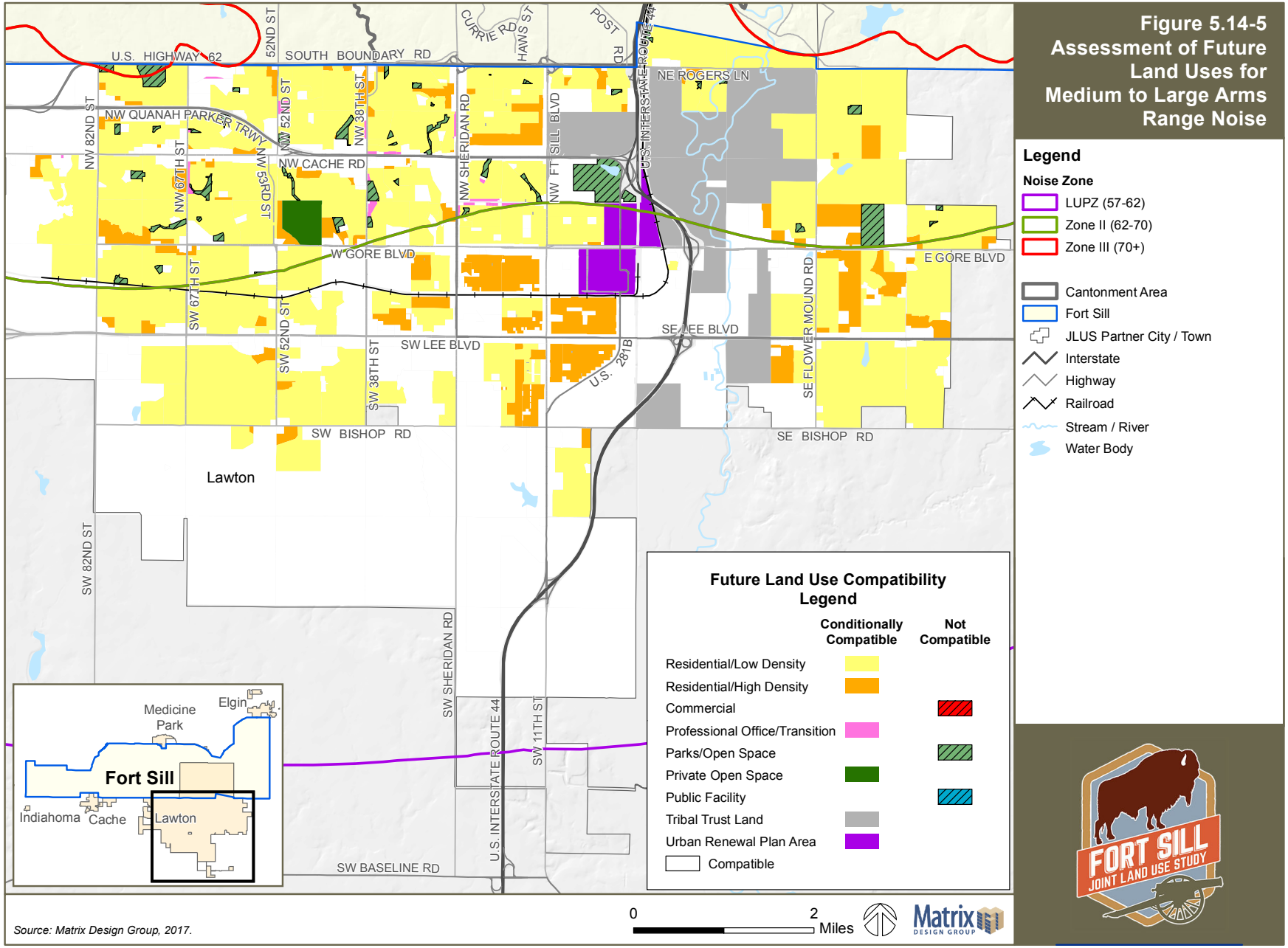


Figure 5.14-5 Assessment of Future Land Uses for Medium to Large Arms Range Noise

Legend

Noise Zone

- LUPZ (57-62)
- Zone II (62-70)
- Zone III (70+)

- Cantonment Area
- Fort Sill
- JLUS Partner City / Town
- Interstate
- Highway
- Railroad
- Stream / River
- Water Body

FORT SILL JOINT LAND USE STUDY

Table 5.14-3. Medium to Large Arms Recommended Land Uses

Land Use		*Suggested Land Use Compatibility*		
SLUCM No.	Land Use Name	LUPZ CDNL or CNEL 57-62	Noise Zone II CDNL or CNEL 62-70	Noise Zone III CDNL or CNEL 70+
10	**Residential**	**Y[1]**	**N[2,3]**	**N[3]**
11	Household units	Y[1]	N[2,3]	N[3]
11.11	Single units: detached	Y[1]	N[2,3]	N[3]
11.12	Single units: semi-detached	Y[1]	N[2,3]	N[3]
11.13	Single units: attached row	Y[1+]	N[2,3]	N[3]
11.21	Two units: side-by-side	Y[1]	N[2,3]	N[3]
11.22	Two units: one above the other	Y[1]	N[2,3]	N[3]
11.31	Apartments: walk-up	Y[1]	N[2,3]	N[3]
11.32	Apartments: elevator	Y[1]	N[2,3]	N[3]
12	Group quarters	Y[1]	N[2,3]	N[3]
13	Residential hotels	Y[1]	N[2,3]	N[3]
14	Mobile home parks or courts	Y[1]	N[2,3]	N[3]
15	Transient lodgings	Y	Y	N
16	Other residential	Y[1]	N[2,3]	N[3]
20	**Manufacturing**			
21	Food and kindred products; manufacturing	Y	Y[4]	Y[4]
22	Textile mill products; manufacturing	Y	Y[4]	Y[4]
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y[4]	Y[4]
24	Lumber and wood products (except furniture); manufacturing	Y	Y[4]	Y[4]
25	Furniture and fixtures; manufacturing	Y	Y[4]	Y[4]
26	Paper and allied products; manufacturing	Y	Y[4]	Y[4]
27	Printing, publishing, and allied industries	Y	Y[4]	Y[4]
28	Chemicals and allied products; manufacturing	Y	Y[4]	Y[4]

Land Use		*Suggested Land Use Compatibility*		
SLUCM No.	**Land Use Name**	**LUPZ CDNL or CNEL 57-62**	**Noise Zone II CDNL or CNEL 62-70**	**Noise Zone III CDNL or CNEL 70+**
29	Petroleum refining and related industries	Y	Y[4]	Y[4]
30	**Manufacturing (continued)**			
31	Rubber and misc. plastic products; manufacturing	Y	Y[4]	Y[4]
32	Stone, clay and glass products; manufacturing	Y	Y[4]	Y[4]
33	Primary metal products; manufacturing	Y	Y[4]	Y[4]
34	Fabricated metal products; manufacturing	Y	Y[4]	Y[4]
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	N	N
39	Miscellaneous manufacturing	Y	Y[4]	Y[4]
40	**Transportation, communication, utilities**			
41	Railroad, rapid rail transit, and street railway transportation	Y	Y	Y
42	Motor vehicle transportation	Y	Y	Y
43	Aircraft transportation	Y	Y	Y
44	Marine craft transportation	Y	Y	Y
45	Highway and street right-of-way	Y	Y	Y
46	Automobile parking	Y	Y	Y
47	Communication	Y	N	N
48	Utilities	Y	Y	Y
49	Other transportation, communication and utilities	Y	Y	N
50	**Trade**			
51	Wholesale trade	Y	Y	N
52	Retail trade – building materials, hardware and farm equipment	Y	Y	N

Land Use		*Suggested Land Use Compatibility*		
SLUCM No.	**Land Use Name**	**LUPZ CDNL or CNEL 57-62**	**Noise Zone II CDNL or CNEL 62-70**	**Noise Zone III CDNL or CNEL 70+**
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	Y	N
54	Retail trade – food	Y	Y	N
55	Retail trade – automotive, marine craft, aircraft and accessories	Y	Y	N
56	Retail trade – apparel and accessories	Y	Y	N
57	Retail trade – furniture, home, furnishings and equipment	Y	Y	N
58	Retail trade – eating and drinking establishments	Y	Y	N
59	Other retail trade	Y	Y	N
60	**Services**			
61	Finance, insurance and real estate services	Y	Y	N
62	Personal services	Y	Y	N
62.4	Cemeteries	Y	Y	Y
63	Business services	Y	Y	N
63.7	Warehousing and storage	Y	Y[4]	Y[4]
64	Repair services	Y	Y	N
65	Professional services	Y	Y	N
65.1	Hospitals, other medical facilities	Y[1]	N	N
65.16	Nursing homes	Y[1]	N	N
66	Contract construction services	Y	Y	N
67	Government services	Y	Y	N
68	Educational services	Y[1]	N	N
68.1	Child care services, child development centers, and nurseries	Y[1]	N	N
69	**Miscellaneous**			

Land Use		*Suggested Land Use Compatibility*		
SLUCM No.	**Land Use Name**	**LUPZ CDNL or CNEL 57-62**	**Noise Zone II CDNL or CNEL 62-70**	**Noise Zone III CDNL or CNEL 70+**
69.1	Religious activities	Y[1]	N	N
70	**Cultural, entertainment and recreational**			
71	Cultural activities (& churches)	Y[1]	N	N
71.2	Nature exhibits	Y[1]	N	N
72	Public assembly	Y1	N	N
72.1	Auditoriums, concert halls	Y1	N	N
72.11	Outdoor music shells, amphitheaters	Y1	N	N
72.2	Outdoor sports arenas, spectator sports	Y	N	N
73	Amusements	Y	Y	N
74	Recreational activities (including gold courses, riding stables, water recreation)	Y	N	N
75	Resorts and group camps	Y	N	N
76	Parks	Y	N	N
79	Other cultural, entertainment and recreation	Y	N	N
80	**Resource production and extraction**			
81	Agriculture (except live- stock)	Y	Y	Y
81.5	Livestock farming	Y	N	N
81.7	Animal breeding	Y	N	N
82	Agriculture related activities	Y	Y	Y
83	Forestry activities	Y	Y	Y
84	Fishing activities	Y	Y	Y
85	Mining activities	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y

Source: FICUN guidelines, 1980. National Academy of Sciences Committee on Hearing, Bioacoustics and Biomechanics, 1981

Note 1: LUPZ- Land Use Planning Zone is a subdivision of Land Use Zone I and functions as a buffer for Noise Zone II. Communities and individuals often have different views regarding acceptable or desirable levels of noise. To address this, some local governments have implemented land use planning measures beyond Noise Zone II limits. In addition to mitigating current noise impacts, implementing such controls within the LUPZ can create a buffer to prevent the possibility of future noise conflicts.

Land Use		*Suggested Land Use Compatibility*		
SLUCM No.	Land Use Name	LUPZ CDNL or CNEL 57-62	Noise Zone II CDNL or CNEL 62-70	Noise Zone III CDNL or CNEL 70+

Note 2: Although local requirements for on- or off-base housing may require noise-sensitive land uses within Noise Zone II, such land use is generally not compatible within Noise Zone II. Measures to achieve overall noise level reduction inside structures do not solve noise difficulties outside the structure. Barriers are not effective reducing the noise from artillery and armor, the detonation of either large caliber military munitions or a large quantity of explosives. Additionally, noise level reduction inside structures does not mitigate the vibration generated by the low-frequency energy of large caliber weapons firing and detonations.

Note 3: Within Zones, existing "noise sensitive land uses are considered as pre-existing incompatible land uses. In most cases these uses are not a risk to either mission sustainment or a community's quality of life. Most long-term members near Army installations or activities acknowledge hearing military operations and activities but they are usually not alarmed or bothered by the noise.

Note 4: Although noise levels may be compatible, caution should be exercised in siting any activity which may be sensitive to vibration.

Zoning

Figure 5.14-6 illustrates the compatibility assessment of zoning in the JLUS Study Area. The Town of Medicine Park and City of Lawton provided data for the purposes of this assessment, therefore, the assessment is limited to those jurisdictions.

The Land Use Planning Zone (LUPZ) or, a subdivision of Noise Zone I, extends off-installation in all directions excluding the west side of the installation. The entire city of Lawton is included in the LUPZ. There are 3,353 acres zoned for R-1, Single-family Dwelling District in the LUPZ that are conditionally compatible. This is due to this zoning district permitting noise sensitive land uses in this district including residential, churches, and libraries and schools. The FICUN guidance indicates these uses if located in the LUPZ would most likely be compatible; however, measures to mitigate sound and noise from the external environment to inside these buildings should be considered. In addition to the R-1 zoning district, the other residential zoning districts that are also recommended as conditionally compatible are identified in Table 5.14-4.

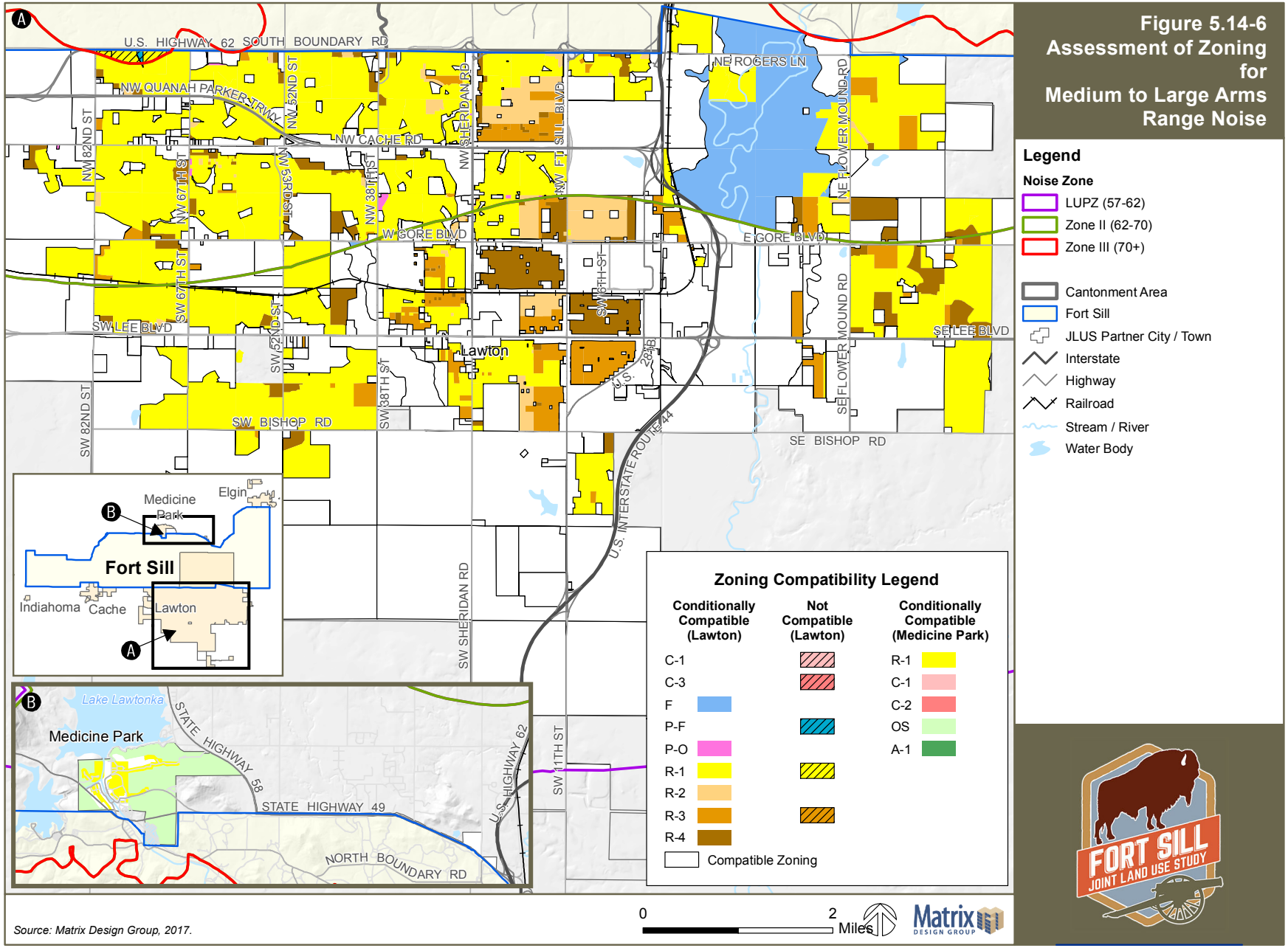
Table 5.14-4. Zoning Districts with Conditional Compatibility in LUPZ

Zoning District	Zoning District Description	Acres	Compatibility Assessment
R-2	Two-Family Dwelling District	357	Conditional
R-3	Multiple-Family Dwelling District	729	Conditional
R-4	High-Density Apartment District	825	Conditional

Source: City of Lawton Code of Ordinances, amended 2000

These are all recommended as conditionally compatible due to the uses permitted in these zoning districts including noise sensitive land uses, e.g. libraries and homes for the aged.

There are approximately 215 acres zoned for R-1, Single-family Residential in the Town of Medicine Park located in Noise Zone II, which is located immediately north of Fort Sill. This type of land use is recommended as conditional in this area due to the land use being a noise sensitive land use.


U.S. HIGHWAY 62 SOUTH BOUNDARY RD
NW QUANAH PARKER TRWY
NW 82ND ST
NW 67TH ST
NW 52ND ST
NW CACHE RD
NW 38TH ST
NW SHERIDAN RD
NW FT SILL BLVD
NE ROGERS LN
NE FLOWER MOUND RD
W GORE BLVD
E GORE BLVD
SW LEE BLVD
SE LEE BLVD
SW 67TH ST
SW 52ND ST
SW 38TH ST
SW 26TH ST
SW 82ND ST
SW BISHOP RD
SE BISHOP RD
SE FLOWER MOUND RD
Lawton
U.S. INTERSTATE ROUTE 44
U.S. 281
SW SHERIDAN RD
SW 11TH ST
U.S. HIGHWAY 62
STATE HIGHWAY 58
STATE HIGHWAY 49
NORTH BOUNDARY RD
Lake Lawtonka
Medicine Park
Elgin
Fort Sill
Indiahoma
Cache
Lawton
A
B
Zoning Compatibility Legend
Conditionally Compatible (Lawton)
Not Compatible (Lawton)
Conditionally Compatible (Medicine Park)
C-1
C-3
F
P-F
P-O
R-1
R-2
R-3
R-4
Compatible Zoning
R-1
C-1
C-2
OS
A-1
Source: Matrix Design Group, 2017.
0
2
Miles
Matrix DESIGN GROUP
Figure 5.14-6
Assessment of Zoning for
Medium to Large Arms Range Noise
Legend
Noise Zone
LUPZ (57-62)
Zone II (62-70)
Zone III (70+)
Cantonment Area
Fort Sill
JLUS Partner City / Town
Interstate
Highway
Railroad
Stream / River
Water Body
FORT SILL
JOINT LAND USE STUDY

While this is recommended as a conditional use in the Noise Zone II area, the DoD understands the community needs to provide housing and other similar types of land uses and services for their community. In this circumstance, it is recommended that certain considerations be made during the planning and construction phase.

The Town of Medicine Park also has 815 acres zoned Open Space located in Noise Zone II north of Fort Sill. This land use is also recommended as conditional in this area due to the types of land uses it can bring including large groups of people—they could be impacted by high noise activities.

There are a number of zoning districts located in the city of Lawton that are situated in Noise Zone II. Table 5.14-5 identifies the zoning districts within the city of Lawton that are located in Noise Zone II and provides a brief compatibility assessment and reason for the designated assessment.

Table 5.14-5. City of Lawton Zoning Districts within Noise Zone II

Zoning District	Zoning District Description	Acres	Compatibility Assessment
F	Floodplain District	1,444	Conditional
P-O	Professional and Office District	18	Conditional
R-1	Single-Family Dwelling District	5,273	Conditional
R-2	Two-Family Dwelling District	260	Conditional
R-3	Multiple-Family Dwelling District	351	Conditional
R-4	High-Density Apartment District	452	Conditional

Source: Source: City of Lawton Code of Ordinances, amended 2000

While it is unlikely that development would occur in the Floodplain District, the permitted uses include public recreation and some riding stables. These types of uses can be impacted by high noise from military artillery training.

Professional and Office and Residential uses are recommended as conditional in Noise Zone II due to these uses considered as noise sensitive land uses.

In addition, if the demand requires Professional and Office and Residential land uses in the Noise Zone II, then considerations should occur with these types of land uses in this area of the city and the noise zone.

There are several acres and zoning districts that are located in Noise Zone III in the city of Lawton. Table 5.14-6 identifies all the zoning districts and associated acres that are located in Noise Zone III. These are all incompatible due to the noise sensitivity and the high noise, which ranges from over 70 dB CDNL. As a reminder, 70 dB CDNL is roughly the noise a vacuum cleaner makes, however consider this noise all the time or during crucial times such as nap time for children.

Table 5.14-6. City of Lawton Zoning Districts within Noise Zone III

Zoning District	Zoning District Description	Acres	Compatibility Assessment
C-1	Local Commercial District	1.3	Incompatible
C-3	Planned Community Shopping Center District	1.6	Incompatible
P-F	Public Facilities District	4.5	Incompatible
R-1	Single-Family Dwelling District	46.4	Incompatible

Source: Source: City of Lawton Code of Ordinances, amended 2000

Aerial Bombing Range Noise

Aerial bombing range noise includes aircraft bombing training at Fort Sill consisting of 500-, 1,000-, and 2,000-pound bombs at West Range and Quanah Range. The noise levels emanating from the detonation of these bombs are modeled using peak level measurement and a risk of noise complaints level of noise. A peak decibel is used to measure the highest sound at an instantaneous moment.

Using peak decibel level measurements for aircraft bombing activities, the peak level model generates moderate risk and high-risk noise complaint areas. A high risk of noise complaint area is where the noise limits range from 130 dBP to 140 dBP. A moderate risk of noise complaints area is where noise limits range from 115 dBP to 130 dBP.

As mentioned in Chapter 3, Military Profile, there is a high risk of noise complaints outside for Fort Sill slightly north and south of Quanah Range under unfavorable weather conditions. However, there is a moderate risk of noise complaints that extends several miles outside of Fort Sill, impacting the cities of Cahe and Lawton, as well as the Towns of Indiahoma and Medicine Park.

Land use and zoning compatibility analysis is not available for aerial bombing range noise at the time of this report. Figure 5.14-7 depicts the aerial bombing range noise contours from Fort Sill's 2015 ICUZ.

Findings

- There are incompatible land uses in Noise Zone III in the city of Lawton.
- The City of Lawton has not implemented controls to address compatibility as it relates to noise.

ISSUE NOI-3	**Noise from MLRS Rocket Firing Extends Off Fort Sill Impacts the City of Eglin** *The firing of MLRS rockets are loud and generate noise levels that impact the City of Elgin primarily during daytime, however there are occasions when firings occur at night. While there are only about 56 rockets fired annually it does result in off base noise impacts.*

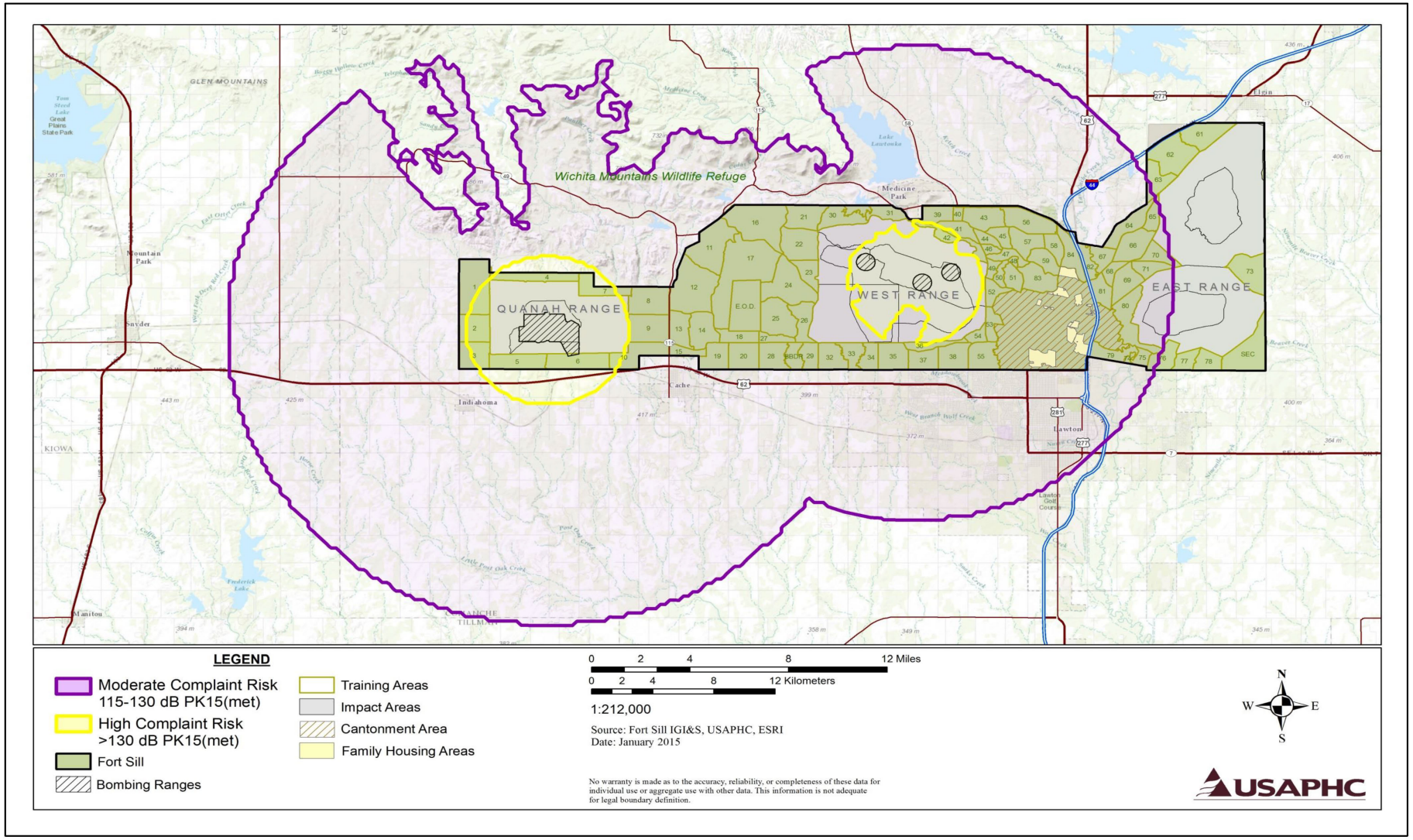
Compatibility Assessment

The Fort Sill 75th Field Artillery Brigade conducts training / testing on large weapons including the Multiple Launch Rockets System (MLRS). The MLRS is an artillery system that is highly mobile and fires surface-to-surface rockets. MLRS training occurs both day and night to prepare military personnel for all real-time situations.

Although the MLRS produces a considerable amount of noise, the noise levels are within the acceptable decibel levels as set by the United States Army Public Health Command. According to Fort Sill Range Control personnel, the City of Eglin submits the most noise complaints during both daytime and nighttime MLRS training / testing activities. The City of Eglin is located on the installation's northeast boundary and one of the faster growing communities in the JLUS Study Area.

The 2015 ICUZ does not specifically call out the noise data for the MLRS but captures it as part of the medium to large weapons noise analysis. The BNOISE2 modeling program is used to calculate noise levels generated by firing medium / large arms (including MLRS) and high-explosive charges.

Figure 5.14-7. Aerial Bombing Noise



Source: Fort Sill Installation Compatible Use Zone Study 2015

The noise model was used to develop the C-weighted Day-Night average sound Level (CDNL) contours based on an assessment period of 250 days.

The City of Eglin is enveloped by the LUPZ noise area of 57-62 dB CDNL. The Zone II noise area of 62-70 dB CDNL is barely contained within the base perimeter in the northeast near the City of Eglin. The ICUZ also provides data on peak noise events for medium to large weapons. The [PK15 (met)] noise contours are plotted for both weather neutral and unfavorable weather conditions. During weather neutral conditions the high complaint risk >130 dB PK15 (met) noise areas are contained on base while the moderate complaint risk 115-130 dB PK15 (met) noise area extend slightly off base to the east which is south of the City of Eglin. During unfavorable weather conditions the high complaint risk >130 dB PK15 (met) noise area extends off base slightly to the east, but south of the City of Eglin. The moderate complaint risk 115-130 dB PK15 (met) noise area encompasses a large portion of the City of Eglin on the south and east.

The MLRS in action at Fort Sill – nicknamed "steel rain"

The City of Eglin has no land use planning tools such as comprehensive plans or land use controls such as zoning ordinances to manage and guide development in a manner that avoids incompatible land uses. Army Regulation 200-1 provides compatibility use criteria for weapons and explosives noise that were developed using the FICUN guidelines. For large weapons noise the Army considers the LUPZ 57-62 dB CDNL as generally compatible with noise sensitive land uses such as residential. For Zone II 62-70 dB CDNL sensitive land uses are considered generally incompatible.

Findings

- Fort Sill conducts periodic MLRS training / testing operations which results in noise complaints primarily from residents in the City of Eglin.
- The City of Eglin is entirely within the LUPZ noise area of 57-62 dB CDNL and just to the north of the Zone II noise area of 62-70 dB CDNL.
- During unfavorable weather conditions the City of Eglin is exposed to peak noise events, primarily the moderate complaint risk 115-130 dB PK15 (met) noise areas.
- The City of Eglin has no land use plans or land use ordinances to guide current land use and future land development.
- The U.S. Army guidelines show noise levels in the LUPZ as generally compatible with sensitive land uses such as residential. Peak noise levels may be a better indicator of when / where noise complaints are likely.

ISSUE NOI-4	**There is No Formal Process for Reporting Noise Complaints to Fort Sill** *Fort Sill does not have a clearly identified process by which the community can report noise complaints.*

US Army Regulation 200-1 requires installations to monitor, record, address and archive operational noise complaints. U.S. Army policy includes direction to manage operational noise issues and community relations to maintain sustainable testing and training capabilities and prevent encroachment. A major goal of the Operational Noise Management Program as outlined in Regulation 200-1 is to:

> *"Reduce community annoyance from operational noise to the extent feasible, consistent with Army training and materiel testing mission requirements."*

Managing noise complaints is a critical component of a successful noise management program and is to key maintaining a positive relationship with communities surrounding an installation. The U.S. Army Operational Noise Program, Directorate of Environmental Health Engineering Division, produced a guide, *Suggested Procedures for Handling and Recording Noise Complaints at Military Installations,* to assist installations with the process of managing noise complaints. As the guide notes, few installations have a systematic process for effectively collecting noise complaint information.

The guide provides four primary steps:

- **Step 1:** Let the area residents know that the Installation / Garrison Commander is concerned with their environment and wants to hear their concerns.
- **Step 2:** Make sure that noise complaints are always routed to the proper office to prevent confusion on how to properly handle the complaint.
- **Step 3:** Make sure that the proper forms are locally developed, made available, and that the people responsible for completing them are trained.
- **Step 4:** Complete the follow-up through the appropriate offices. This requires good coordination and communication among all involved offices.

The suggested forms to fill out to document a complaint are detailed to ensure all pertinent information is collected. The follow up documentation is intended to ensure any necessary action is taken by the appropriate organization. The guide provides useful templates for both collecting the right information from the complainant and for capturing the follow up actions.

Compatibility Assessment

Fort Sill, although situated in a relatively rural area, has several communities on or adjacent to its border, all of which are impacted by noise to one extent or another. Chapter 2 of this JLUS provides additional information on these communities.

Fort Sill has various training / testing activities that generate noise. The primary sources being from range operations including small arms, larger artillery weapons, explosives, and also from aircraft operations (fixed wing and helicopter) including bombing activities. These operations occur across Fort Sill on the East, West, and Quanah ranges. Chapter 3 of this JLUS provides additional detail on the Fort Sill mission footprint and operations.

As documented in the Fort Sill 2015 ICUZ Study, the high level areas, Zone III are contained on Fort Sill, however both Zone II and Zone I noise contours extend off base. The ICUZ Study also provides an analysis of noise complaint areas for medium / large weapons and aircraft bombing attributable to peak noise events [PK15 (met)] during unfavorable and neutral weather conditions. Because weather can affect how sound travels, during unfavorable weather conditions, the moderate complaint risk 115-130 dB PK15 (met) from large weapons firing increases over a wider area off base, however high complaint risk >130 dB PK15 (met) areas are mostly contained the installation with a few small exceptions. For peak noise events from aircraft bombing operations during unfavorable weather conditions the area of moderate complaint risk 115-130 dB PK15 (met) is significantly larger and the high complaint risk >130 dB PK15 (met) area extends slightly off base. These instances of peak noise attributable to specific events are more likely to generate noise complaints.

According to Fort Sill personnel, the Public Affairs Office (PAO) is responsible for managing the noise complaint process. As documented in the 2015 ICUZ PAO is responsible for receiving, recording (TRADOC FORM 592-R) and coordinating complaint investigations with Directorate of Plans, Training, Mobilization and Security Range Control. In addition, PAO staff indicate they provide notices of unusual training activities to the community via local media and social media outlets.

The Fort Sill website provides a link to the PAO, however there is no information specific to noise complaints including who to contact to register a complaint. Other U.S. Army installation web sites including Fort Drum, Fort Carson, and Fort Stewart provide information for making noise complaints.

Findings

- Army Regulation 200-1 requires installations to reduce operational noise annoyance to the community to the extent possible and the U.S. Army has provided guidance on now to ensure a systematic process for managing noise complaints.
- Fort Sill range operations create noise that impacts local communities.
- Peak noise events, especially during unfavorable weather conditions have the potential for moderate to high noise complaint risk in areas off the installation.
- According to Fort Sill staff and the 2015 ICUZ, PAO manages the noise complaint process.
- The Fort Sill web site including the PAO link, has no specific information on noise complaints or who to contact. Other U.S. Army installations provide this information on their web site.

Please see the next page.

5.15 Public Services (PS)

Public services include police, fire, emergency services, parks and recreation, and water / wastewater / storm water infrastructure are of good quality and available for use by the installation and surrounding communities as the area develops. The supply and demand of these public services in the event of emergency situations is also considered.

Key Terms

Acre-foot. An acre-foot refers to a unit of volume of a sheet of water that is one acre in width and one foot in depth.

Jurisdiction-Size Dam. A jurisdiction size dam is a dam in the state of Oklahoma that has a measured height of greater than 25 feet and a capacity of greater than 50 acre-feet.

Issue Assessment

ISSUE PS-1	**Flooding Due to the Release of Water Overages from Nearby Dams Impacts Fort Sill's Training Areas** *The Lake George, Lake Lawtonka, and Lake Elmer Thomas dams occasionally release water to reduce water overages in the lakes. This release of water can flood Fort Sill Training Areas in the northern and southeastern portion of the installation as well as many off-post areas in northern Lawton.*

Fort Sill is located near three dams that provide water to the surrounding jurisdictions—Lake Lawtonka Dam, Lake Elmer Thomas Dam, and Lake George Dam.

The Lake Lawtonka Dam is a gravity dam located north-northwest of Fort Sill in the Town of Medicine Park. The City of Lawton owns and operates the Lake Lawtonka Dam. The Town of Medicine Park is adjacent to the Lake. Lake Lawtonka encompasses an area that is two square miles (i.e. approximately 2,400 acres in surface area) formed by a Dam constructed over Medicine Bluff Creek. The Dam is approximately 60 feet high and 375 feet across the creek. According to the Oklahoma Water Resources Board, the Lake has a capacity of 56,764 acre-feet of water. Generally, flood gates have to be opened when the lake's capacity is near full capacity to ensure dam safety. This Lake feeds into Medicine Bluff Creek, which runs adjacent to the City of Lawton's Water Treatment Plant in the Town of Medicine Park. This creek runs through the installation as well.

The Lake Elmer Thomas Dam is a gravity dam near the Lake Lawtonka Dam. It is located on the border between the Wichita Mountain Wildlife Refuge and Fort Sill and is owned by the U.S. Fish and Wildlife Service. The Dam is 105 feet high runs a length of 400 feet. Lake Elmer Thomas covers about 334 acres in surface area and has a capacity of 12,000 acre-feet of water. Lake Elmer Thomas has a water source from Little Medicine Creek, and the Dam was constructed in 1939. The lake primarily serves as a recreation area. The Lake feeds into Medicine Creek, which traverses the installation.

The City of Lawton has conducted flood studies considering many scenarios including the extent of flooding if the dams were not constructed and as a result has developed a dam gate release policy, the incorporated strategy has shown to cause the least amount of impact. The City does have to operate the gates to keep the water from overtopping the dam. The City of Lawton is committed will continue with providing Ft Sill with information regarding gate operation.

The Lake George Dam is an embankment dam located in the southeastern portion of the installation and has an area of approximately 75 acres in surface area. The Lake George Dam is owned by Fort Sill and was constructed in 1950. The Dam is about 25 feet tall and runs 1,030 feet in length. The Lake and Dam has a capacity of about 1,340 acre-feet of water with a normal storage range of approximately 720 acre-feet of water. This Dam recently had a failure and caused flooding south of the Dam in the city of Lawton.

The concern with these lakes and their respective dams are two-fold— when water must be released to manage the volume of the lake, and if one of the dam fails. Either of these two events can cause flooding on Fort Sill training areas and ranges or in the city of Lawton. Flooding can cause delays and lost hours of valuable training time as well as infrastructure destruction. The infrastructure destruction can occur not only on-Post but also in the nearby communities. This can cause concerns for both the military and communities.

There have been two major flooding events in the past few years, a 100-year flood event in May 2015 and a 500-year flood event in June 2016. These flood events required both Lake Lawtonka and Lake Elmer Thomas to release water through their spillways. The May 2015 flood resulted in the death of a Fort Sill soldier.

Compatibility Assessment

The Oklahoma Water Resources Board (OWRB) coordinates the dam safety program to ensure the safety of 4,700 dams in the state. According to the OWRB, inspections are required for all jurisdictional size dams, especially those that have downstream development. Jurisdictional size means the dam has a height greater than 25 feet and has a storage capacity greater than 50 acre-feet. High hazard potential dams are inspected annually by licensed professional engineer.

There is a formal agreement between the City of Lawton and Fort Sill that establishes responsibility for both the City and Fort Sill regarding the operation of Lake Lawtonka Dam. The agreement stipulates the following:

> *1. The City of Lawton will release, until such time that both parties mutually agree to a change, 455,000 gallons of raw water per day from Lake Lawtonka into Medicine Creek to aid in maintaining the elevation of the water level at White Wolf dam, Medicine Creek, on Fort Sill at 1,131.3 feet mean sea level.*
>
> *2. The release of the 455,000 gallons of raw water per day will begin when the water level falls to said elevation, and upon telephonic request from the Environmental Division, Directorate of Engineering and Housing, Fort Sill to the Water Treatment Plant, City of Lawton. Release of this quantity of raw water will continue until such time as the Water Treatment Plant, City of Lawton, receives the telephonic request to terminate from the Environmental*

Division, Directorate of Engineering and Housing, because the water level has risen above the said elevation. Termination of raw water release will continue until such time as the Water Treatment Plant, City of Lawton, receives additional request s for raw water release from the Environmental Division, Directorate of Engineering and Housing.

3. Department of the Army, Fort Sill, will request that the City of Lawton temporarily reduce, by a certain amount, the release of 455,000 gallons of water per day from Lake Lawtonka into Medicine Creek in the event that the Water Treatment Plant, City of Lawton, is unable to meet the Municipal water needs of Fort Sill and the City of Lawton due to drought conditions.

Regarding Lake Elmer Thomas Dam, there is a formal agreement for the maintenance and operation of the Dam. The agreement does not specify responsibilities about water releases.

Findings

- There is a formalized agreement between the City of Lawton and Fort Sill for the release of water from Lake Lawtonka Dam.
- There are no formal coordination procedures for the release of water coming from Lake Elmer Thomas and Dam.
- Water released out of the Dams' spillways can cause mass flooding at Fort Sill at throughout the surrounding communities

Please see the next page.

5.16 Roadway Capacity (RC)

Roadway capacity relates to the ability of existing freeways, highways, arterials, and other local roads to provide adequate mobility and access between military installations and their surrounding communities.

As urban development expands into rural areas, roads once used primarily to provide access for agricultural uses and limited local traffic begin to function as urban major arterial roadways. These once rural roads often become the main transportation corridors for all types of traffic—from residential to commercial trucking—and can assist or impede access to military installations. As transportation systems grow and provide more capacity, these facilities induce and encourage growth as rural areas become more accessible.

ISSUE RC-1	**Key Gate East Does Not Have a Queuing Area** *The Fort Sill Key Gate East provides access to the Warrior Training Campus area on Fort Sill. Key Gate East does not have a vehicle queuing area during times of heavy use. This lack of queuing area can cause traffic congestion and other related traffic impacts that can affect traffic flow and mobility on local roadways.*

Compatibility Assessment

Fort Sill has a total of seven gates that access the installation, however only one gate, Key Gate East provides access to the Warrior Training Campus used for Basic Combat Training. Key Gate East provides access directly off Interstate 44 at exit 41. The gate entrance is on Sheridan Road which runs east onto Fort Sill and is just north of U.S. Highway 62. Key Gate West provides all hours' access to the main area of Fort Sill seven days a week and is directly opposite Key Gate East on the opposite side of Interstate 44. According to the Oklahoma Department of Transportation 2015 Annual Average Daily Traffic surveys, this area along Interstate 44 averages approximately 28,000 vehicles per day. This area has the highest average daily traffic count in Comanche County.

Photo of traffic stacked up at a Fort Sill gate

The distance from the intersection at Sheridan Road / Interstate 44 exit 41 north off ramp (traveling north; while Interstate 44 is an east / west roadway this section of the highway is situated in a north / south direction) and the Fort Sill Key East Gate is approximately 300 feet. There is a railroad crossing approximately half way between this off ramp intersection and the guard building. This off-ramp intersection has both stop and yield signs to control traffic flow. Speed limits on this portion of Sheridan Road is between 15 and 25 mph. Interstate 44 exit 41 south off ramp (traveling south) is approximately 700 feet west of the Key Gate East guard building. This off-ramp intersection has both stop and yield signs to manage traffic flow.

During heavy traffic periods when personnel are accessing the gate the queue to enter the Warrior Training Campus could easily back up with these relatively short roadway distances for vehicles to wait. While there are two lanes available to access the gate, there are no additional queueing areas available. If enough vehicles are in the waiting in the queue, it would be possible for the traffic to back up beyond the north exit ramp intersection, and possibly beyond the south exit ramp intersection as well. If traffic were to back up and block these exit ramp intersections it would impede traffic flow and potentially pose a safety hazard along Interstate 44.

Findings

- Fort Sill Key Gate East is the only gate available to access the Warrior Training Campus on the east portion of installation.
- The Key Gate East is accessed directly from Interstate 44 at exit 41.
- The roadway distances between the exit ramp intersections and the Key Gate East guard building are relatively short with no additional queuing area available for traffic exiting Interstate 44 and heading east on Sheridan Road towards the Key Gate East.
- During periods of heavy use, it would be possible for traffic waiting to access the Key Gate East to back up beyond the off-ramp intersections creating potential safety hazards.

5.17 Safety Zones (SA)

Safety zones are areas in which development should be more restrictive, in terms of use and concentrations of people, due to the higher risks to public safety. Issues to consider include aircraft accident potential zones, weapons firing range safety zones, and explosive safety zones.

Military installations often engage in activities or contain facilities that, due to public safety concerns, require special consideration by local jurisdictions when evaluating compatibility. It is important to regulate land use near military airfields in order to minimize damage from potential aircraft accidents and to reduce air navigation hazards. To help mitigate potential issues, the Department of Defense (DOD) has delineated Clear Zones (CZ) and Accident Potential Zones (APZ) in the vicinity of airfield runways. APZs are usually divided into APZ I and APZ II. Each zone was developed based on the statistical review of aircraft accidents. Studies show that most aircraft mishaps occur on or near the runway, predominately along its extended centerline.

Key Terms

Airport Operations Area (AOA). The Airport Operations Area (AOA) is an area that encompasses the entire airfield's approach or departure airspace including the circling space.

Accident Potential Zone I (APZ I). APZ I is an area beginning at the end of each clear zone and continuing out to a length of 2,500 feet by 1,000 feet wide. This area has a lower potential for accidents and therefore has less restrictive development restrictions recommended.

Accident Potential Zone II (APZ II). APZ II is an area that begins at the end of each APZ I and extends an additional 2,500 feet in length by 1,000 feet wide. Again, the accident potential in this area reduces further, and with this, some additional development types are allowed.

Bird / Wildlife Aircraft Strike Hazard (WASH). WASH refers to the likely occurrence for a collision between an airborne animal (usually a bird) or an animal on the ground on the runway and a man-made vehicle, particularly aircraft.

BASH Relevancy Area. The BASH Relevancy Area is a five-statute mile area from the AOA, including the runway. This area has been determined by the FAA as an area where BASH incidences are likely to occur due to the types of flying operations that occur near the airfield. Such operations are typically at slower speeds and lower altitudes resulting in a greater chance for a BASH incident.

Clear Zone (CZ). The CZ begins at the end of each runway measuring 1,000 feet wide and extending outward to a length of 3,000 feet from the end of each runway. This area has the highest potential of an aircraft mishap. This area should be kept clear of all structures, including fences.

ISSUE SA-1	**There is Moderate to High Potential for Wildland Fires in the JLUS Study Area** *Topography, types of vegetation, and climate conditions within the region are conducive to wildland fires. The high risk for such fires during the year, particularly during fire season within the JLUS Study Area presents a threat to human safety and could cause damage to personal property, personal injury, or death.*

Compatibility Assessment

A safety risk associated with use of the live fire ranges at Fort Sill is the potential for wildfire ignition. As demonstrated by the June 2011 wildfire that started on the West Range impact area and spread north off base to the Medicine Park area. Several thousand acres burned and both public and private property was damaged before the fire was brought under control. The use of the live fire training ranges on Fort Sill can ignite fires that have the potential to impact both on base and off base areas. Regardless of the source, at a minimum, wildfires can disrupt Fort Sill training / testing operations and in worst case scenarios can destroy public / private property and cause injury to personnel.

Conditions such as dry vegetation, low humidity and high winds easily ignite fires and allow them to move to surrounding areas quickly. Vegetation on and around Fort Sill constitutes an ecological transition area where tall grass prairie merges with short grass prairie. Mesquite and oak thickets occur on much of the western two-thirds of the installation. Native grassland communities comprise over 70 percent of Fort Sill. Non-native species such as Johnson grass is a prolific invader of disturbed grounds (*e.g.*, old agricultural fields and food plots, former occupied military troop locations, firing range berms). These grasslands are sources of fuel and increase wildfire risks, especially near roads and firebreaks.

US Army Regulations 200-1 *Environmental Protection and Enhancement*, addresses wildfire management and highlights following requirements:

- Reduce wildfire potential using appropriate management practices, such as prescribed burning, firebreak maintenance/construction, etc.
- Installations with wildfire hazards and/or utilize prescribed burns as a land management tool will develop and implement an Integrated Wildlife Fire Management Plan that is compliant and integral with the INRMP.
- Assure that all civilian, contractor, and emergency services personnel involved in wildland fire management possess the level of training and physical fitness needed for their expected level of involvement.
- Ensure that only qualified personnel conduct prescribed burns.

Fort Sill has a Wildland Fire and Prescribed Burn Plan that includes responsibilities for prevention and suppression of wildland fires and prescribed burning. The Garrison Commander is responsible for wildland fire protection and prescribed fire projects on all lands within the boundaries of Fort Sill. Fort Sill Fire and Emergency Services is the authority having jurisdiction on all wildland fire and prescribed fire incidents within the boundaries of Fort Sill.

Fort Sill area has a temperate, dry climate with relatively wet spring weather (the Lawton area averages about 27 inches of rain per year) and hot summers. The strongest winds generally occur from late winter through early summer. Figure 5.17-1 provides a historical perspective of wildfires in the JLUS Study Area, and Figure 5.17-2 provides an overview of the JLUS Study Area fire potential.

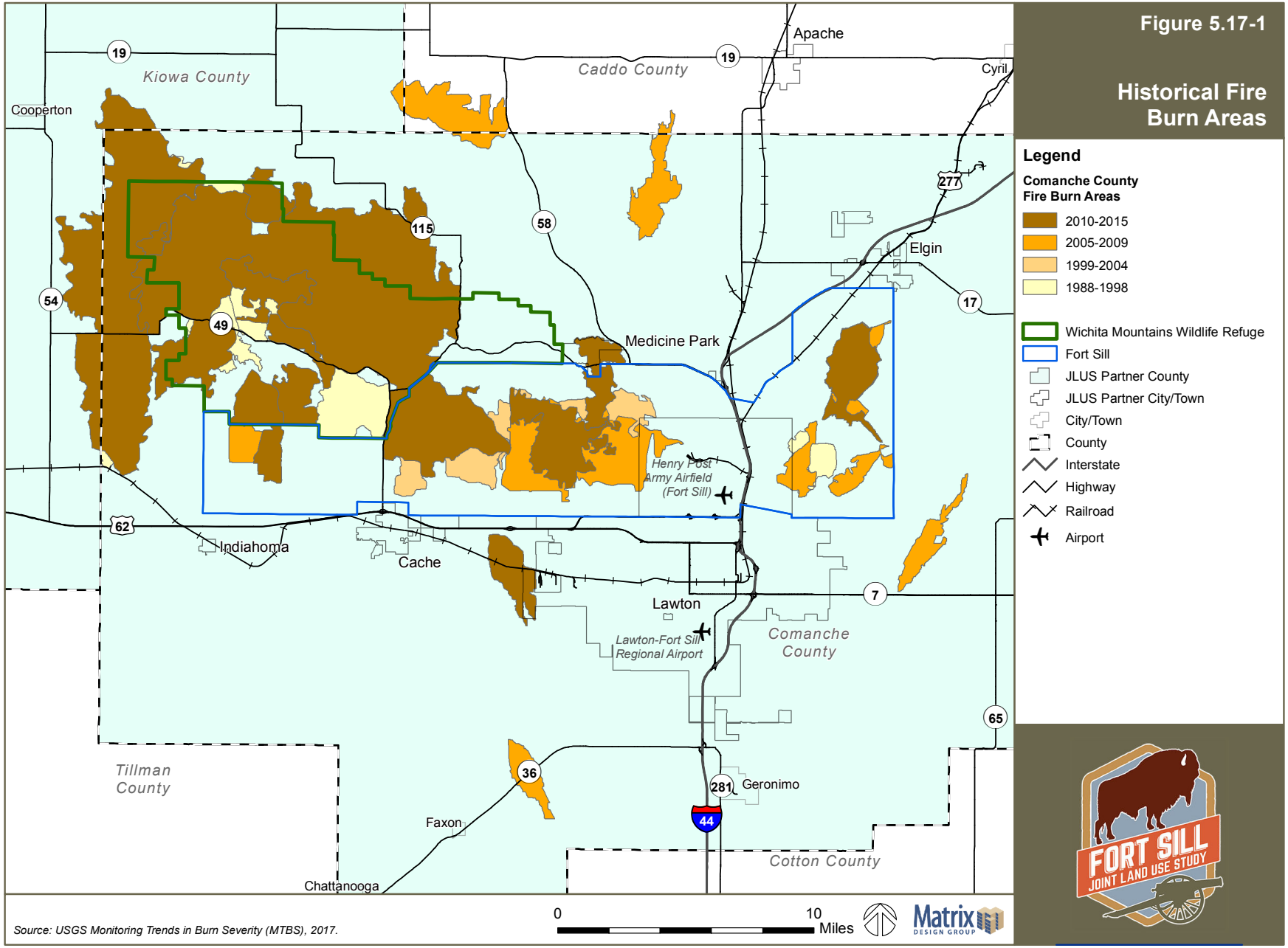


Figure 5.17-1
Historical Fire Burn Areas
Legend
Comanche County Fire Burn Areas
2010-2015
2005-2009
1999-2004
1988-1998
Wichita Mountains Wildlife Refuge
Fort Sill
JLUS Partner County
JLUS Partner City/Town
City/Town
County
Interstate
Highway
Railroad
Airport
Kiowa County
Caddo County
Apache
Cyril
Cooperton
Elgin
Medicine Park
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Lawton-Fort Sill Regional Airport
Comanche County
Tillman County
Geronimo
Faxon
Chattanooga
Cotton County
19
58
115
54
49
277
17
62
7
65
36
281
44
Source: USGS Monitoring Trends in Burn Severity (MTBS), 2017.
0
10
Miles
Matrix DESIGN GROUP
FORT SILL JOINT LAND USE STUDY

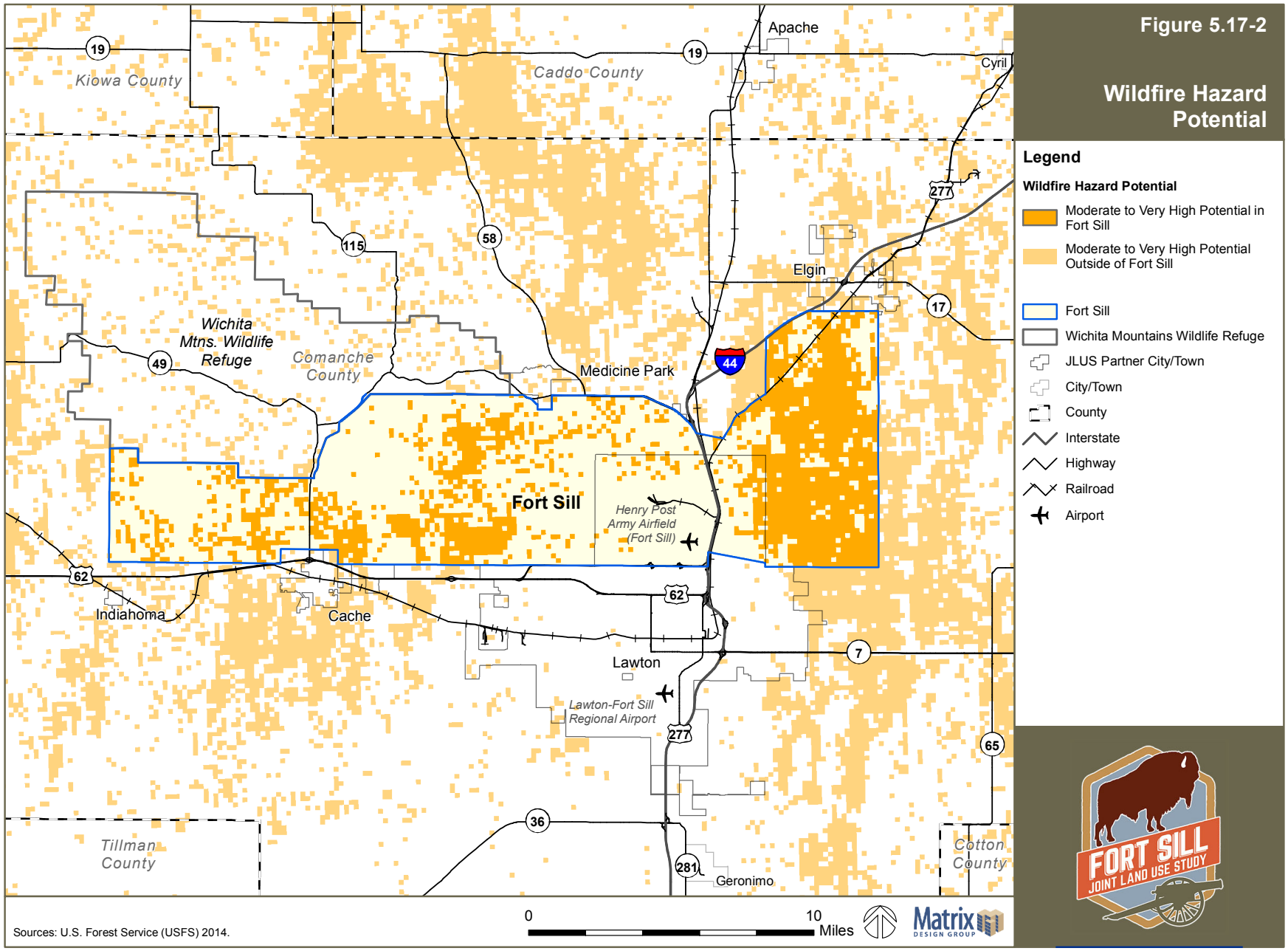


Figure 5.17-2
Wildfire Hazard Potential
Legend
Wildfire Hazard Potential
Moderate to Very High Potential in Fort Sill
Moderate to Very High Potential Outside of Fort Sill
Fort Sill
Wichita Mountains Wildlife Refuge
JLUS Partner City/Town
City/Town
County
Interstate
Highway
Railroad
Airport
Kiowa County
Caddo County
Apache
Cyril
Elgin
Wichita Mtns. Wildlife Refuge
Comanche County
Medicine Park
Fort Sill
Henry Post Army Airfield (Fort Sill)
Indiahoma
Cache
Lawton
Lawton-Fort Sill Regional Airport
Tillman County
Cotton County
Geronimo
19
58
115
49
44
17
277
62
7
65
36
281
0
10
Miles
Sources: U.S. Forest Service (USFS) 2014.
Matrix DESIGN GROUP

Fort Sill maintains a network of firebreaks to help control wildfires, especially in areas where access is difficult. There are about 246 miles of boundary and interior firebreaks, generally 60 and 40 feet wide, respectively. Boundary firebreaks are wider to ensure fires are contained within the installation. The firebreaks are disked or bladed, generally three times annually. There are also 27 miles of firebreaks that are no longer maintained but are potentially available for use during wildfires. Fort Sill conducts prescribed burns for various purposes including managing fuel loads. Prescribed burns are categorized as:

- Natural Resources and Enforcement prescribed burns,
- Range Control Integrated Training Area Management (ITAM) program prescribed burns, and
- Fire & Emergency Services control burns.

Impact area fires present specific dangers where there is either a high density of duds or where anti-personnel duds (mortar, grenade, M-79, etc.) exist. Some unexploded ordnance, or duds, are susceptible to react to heat. Personal safety is a major consideration before fighting an impact area fire. Knowledge of impact areas and types of duds is essential.

Fort Sill Regulation 385-1 Safety Post Range Regulation addresses requirements related to wildfires that occur on the ranges as a result of live weapons firing activities. It directs specific actions by personnel in the event of wildfires from live firing operations, as well as firebreak construction and maintenance on the range areas. Personnel safety and protection of property is a priority.

The Wichita Mountain Wildlife Refuge (WMWR) located northwest of Fort Sill has a fire management program designed to enhance wildlife habitat on the refuge while reducing the possibility of damaging wildfires. Professional wildland firefighters from the Oklahoma and North Texas Fire Management Program are stationed at the refuge. These firefighters respond to wildfires on the refuge and elsewhere in the country. Fort Sill and WMWR fire personnel have worked together when required to manage wildfires. A 2015 wildfire on the Fort Sill West Range was contained on base as a result of the cooperative firefighting efforts by the two organizations

Comanche County has prepared a 2008 Natural Hazard Mitigation Plan that includes provisions related to wildfires. The Plan highlights the vulnerability of the area to wildfires:

- Periods of drought, dry conditions, high temperatures, wind and low humidity set the stage for wildfires in Comanche County.
- Areas along railroads and people whose homes are in woodland settings (especially Eastern Red Cedar woodlands) in rural areas have an increased risk of wildfire.
- The sparsely populated tall grass rangelands are capable of experiencing large sweeping fires. Ironically, fire suppression can create larger fire hazards, because live and dead vegetation is allowed to accumulate in areas where fire has been excluded.

The Plan also notes there are seasonal maximums of wildfires during late winter and late summer when fuel and weather conditions are ideal for fire propagation. Based on data collected by the state fire marshal, rural and small-town fire departments average approximately 312 fire runs to suppress wildland fires per year. The highest risk of wildland fires is in northern and southwest portions of Comanche County.

The mitigation measures proposed by the Comanche County 2008 Natural Hazard Mitigation Plan are:

- Educating the public about wildland fires and hazards.
- Purchase firefighting equipment for wildland fires including “dry hydrants” for use in fighting wildfires.
- Implement a “Fire Wise” program to clear areas around structures.

The City of Lawton operates a Water Treatment Plants called the Medicine Park Water Treatment Plant (MPWTP) which supplies safe drinking water to the City of Lawton. The plant is governed by the EPA in conjunction with ODEQ by setting federal and state guidelines for the plant operations and conducts by frequent water testing and analysis. The MPWTP is a surface water treatment plant. There is a concern that a wildfire can affect operations at this critical asset by limiting access to the plant or other devastating effects if the plant is in the path of a wildfire.

Findings

- Fort Sill and the surrounding area is susceptible to wildfires due to a combination of a dry climate, regular winds and types of ground vegetation.
- Fort Sill conducts live fire training / testing on its range areas which have the increased potential to start wildfires.
- U.S. Army Regulation 200-1 requires plans and procedures to help manage wildfire programs. Fort Sill abides by these regulations through its Wildland Fire and Prescribed Burn Plan and the implementation of measures including establishing firebreaks and conducting prescribed burns.
- The WMWR has fire professionals on location to support wildfire management. Fort Sill and WMWR have worked cooperatively to combat wildfires when needed.
- Critical assets are identified with respect to fire mitigation plans.
- Comanche County has adopted a Natural Hazard Mitigation Plan that includes provisions for implementing actions to reduce the risk posed by wildfires.

ISSUE SA-2	**Stray Ordnance Associated with Falcon Range** *There is risk for stray ordnance landing off-post on land subject to local jurisdiction land use controls. While there have been few incidents of this occurring, the risk is still a concern for the military and communities surrounding Fort Sill, especially if development continues in the JLUS Study Area.*

Fort Sill has three primary range areas used to support military training;

- Quanah Range (including Falcon Range)
- West Range
- East Range

Within these three ranges, there are multiple firing areas, maneuver areas and impact areas used regularly (see chapter 3 for details on mission activities) to support military readiness.

The U.S. Army has issued range safety guidance through Pamphlet (PAM) 385-63, which provides standards and procedures for the safe firing of munitions and demolition for training and target practice.

Included within PAM 385-63 guidance are requirements for Safety Danger Zones (SDZs) to minimize the inherent risk of ammunition from landing in areas that could cause harm to life or property.

The SDZs for a specific range include safety buffer areas to reduce the risk potential for stray ammunition from impacting operations at other range areas or landing outside the installation fence line and compromising the safety of the surrounding community. For this purpose, PAM 385-63 specifies that no part of an SDZ may leave the installation property. Fort Sill is compliant with the SDZ requirements per the Army guidance – all SDZs are currently contained within the installation.

The US Army employs an active science and technology program to provide better battlefield performance of platforms, weapons, and people. High combat readiness requires modern equipment and realistic training to meet strategic and sustained capability into the future. Changes to the types of weapons, ammunition, and target engagement scenarios drive a continuous review of current SDZs and consideration of expanded safety buffers to ensure that safety risks continue to be minimized outside the fence line.

Compatibility Assessment

The Falcon Range, a USAF Reserve facility for training air to ground engagements, is the only training site in the Quanah Training Area. The 301st Fighter Wing (FW), based at Naval Air Station Joint Reserve Base Fort Worth at Carswell Field, Texas, is equipped with the F-16C aircraft and uses the Falcon Range for training operations. The 301st FW has operational control of the Falcon Range while Fort Sill maintains control and scheduling of the ground space and is the scheduling and controlling agency for the R-5601 air space.

Fort Sill Regulation (FSR) 385-1 Safety Post Range provides direction for safe operations and conduct of training / testing operations on Fort Sill ranges. FSR 385-1 includes procedures for fixed wing and non-Army air operations and specifies air operation using the Falcon Range exclusively must also comply with the 301st FW Instruction (FWI) 13-212 Range Planning and Operations. FWI 13-212 is thorough and precise regarding the types of air to ground activities that are authorized including target types and locations on the range and munitions approved for use. Range entry, hold, departure procedures as well as overflight limitations are clearly spelled out. Weather conditions, including visibility and wind speeds that would limit or cause suspension of air to ground operations are specified. Weapons Danger Zones (WPZ), similar to SDZs, are established and procedures are in place to minimize risk munitions falling outside the WPZs.

In any live fire event, there is the possibility of stray ordnance, however, changes in the run-in heading and procedures as a proactive measure stemming from a previous incident has further reduced this possibility. Additionally, “dry run-in: procedures to identify target and approaches prior to “live fire” increase safety and should alleviate any off-installation incidents.

Findings

- Fort Sill uses three primary range areas to support live fire training / testing including the Falcon Range located over the Quanah Range located on the western portion of the installation.
- The 301st Fighter Wing from NAS Joint Reserve Base Fort Worth uses the Falcon Range for air to ground weapons training / testing.
- FSR 385-1 Safety Post Range complies with U.S Army requirements for range operations including the criteria for establishing SDZs.
- FWI 13-212 Range Planning and Operations provides specific procedures for operating on the Falcon Range and to minimize risk of munitions falling outside the approved WPZs.

ISSUE SA-3	**Future Concern Regarding Fire Hazards and Incompatible Development Adjacent to Falcon Range** *There is existing infrastructure west of Indiahoma Road, just past Falcon Range in an area that is not currently developed. If this area attracts future incompatible development in the future, there may be greater risk of potential damage to the both on and off-post development if there is a large wildfire.*

According to the US Forest Service, there are a few areas west of Quanah and Falcon Ranges outside the installation that have a moderate potential for wildfires. These areas are surround by other areas that are designated as a low potential for wildfires; however, within these low potential areas there are some small dotted areas that are designed as high potential.

Fort Sill has the capability for training in aerial bombing and aviation maneuvering tactics. The aerial bombing and maneuvering occurs at Falcon Air Range, which is located above the Quanah Range at the far west portion of the installation. Quanah Range has an impact area that is centrally-located, which is where ordnance are expected to impact. There are training areas surrounding the impact area as well. The concern is that military training operations that occur at Quanah and Falcon ranges could ignite a fire compounded by the dry environment in proximity to the ranges. The result in destruction of the ecology in this area of Oklahoma, damages to the property to the western portion of the installation and to the Town of Indiahoma, as well as delays and lost hours of training time.

Future development that is incompatible could also pose a source of future wildfires that can encroach on the installation and impact the mission at Fort Sill.

Compatibility Assessment

Fort Sill has a process for fire prevention for all its ranges including firebreak construction and maintenance. On a daily basis, the Fort Sill Fire Department (FSFD) Chief and the Range Officer confer on the conditions of the range, whether they are suitable for training on all ordnance, training on partial ordnance, or completely restricted to all ordnance types. The FSFD Chief and Range Officer designate the range with a color, which means the conditions are right for certain types of training with certain ordnance. Table 5.17-1 identifies the colors (levels) for the range and what ordnance is suitable to train in for that day.

Table 5.17-1 Fort Sill Firing Restriction Status Standards

Restriction Level	Ordnance / Activities Restricted
Green – no restrictions	All authorized ammunition, projectiles, pyrotechnics/simulators, and explosives may be used in training activities approved by Range Operations.
Amber – partial restrictions apply	All white phosphorus, illumination, smoke, and tracer ammunition/projectiles; pyrotechnics/simulators, and explosives expended must stay in the impact area.
Red – partial restrictions apply	Only ball, inert, and point-detonating high-explosive projectiles may be used. All projectiles expended must stay in the impact area. No MLRS or HIMARS firing. Artillery rounds will be visually observed. Use of stoves must be approved by the FSFD Fire Prevention.
Black – all restrictions apply	No live or blank fire to include the use of pyrotechnics as well as privately-owned weapons.

Source: Fort Sill Regulation 385-1, Post Range Regulation-Safety, 2015

According to Fort Sill Regulation 385-1, Post Range Regulation – Safety, 2015, unit commanders are expected to comply with the standards set forth in the regulation. Not only are these levels of restrictions expressly stated in the regulation, but there is also a reporting process established by the regulation. Other rules the unit commanders and units must comply with include: no careless discarding of matches, cigarettes, and combustible materials; no open fires permitted on the range complex at any time; and Hot Work Permit is required to be issued by the FSFD if there will be activities that will generate a spark, fire, or heat. In addition, smoking is prohibited in Army vehicles and within 100 feet of petroleum materials.

This regulation also stipulates the standards for the construction and maintenance of firebreaks in preventing wildland fires and fires caused by training operations. It should be noted fires caused by training operations and ordnance firing is not a frequent event. Fort Sill regularly maintains the firebreaks, about three times per year, to protect the ranges.

Additionally, Fort Sill recently updated their Fire Mitigation Plan, which requires an increased width for firebreaks and vegetation clearing along the installation boundary. These new measures will help contain wildland fires on installation in the future.

Findings

- Fort Sill's Regulation 385-1 establishes standards for the FSFD Chief and Range Officer to determine the conditions of the ranges relevant to suitable conditions for wildfires, including prevailing winds and dry climate, and conducting training with fires (ordnance).
- Unauthorized open flame is prohibited from the range complex.
- Fort Sill has appropriate standards and regulations that address the concern for wildfires or for fires caused by training operations.

ISSUE SA-4	**Incompatible Land Uses in Aircraft Safety Zones** *There are existing incompatible land uses in the aircraft safety zones of Henry Post Army Airfield that impact military aviation operations.*

There incompatible land uses in the aircraft safety zones of HPAAF, which results in an increased risk profile for the aircraft safety zones. This area is at high risk as it is an area that is statistically likely to be an area for aircraft mishaps due to aircraft ascending at an increased speed or descending at a decreased speed depending upon the operation the pilot is performing. Incompatible development can increase the risk potential to both, the pilot, federal property, and the general public and private property. If an aircraft mishap occurs, there is a higher risk potential to people and property in these areas when land uses are not compatible with aviation operations.

Compatibility Assessment

The DOD Air Installation Compatible Use Zone (AICUZ) program identifies land uses that are compatible and incompatible with active military airfields to encourage sustainable, compatible land use planning around military operational facilities. The AICUZ program uses historic data and scientific modeling based on various factors including geography, elevation of runways, aircraft type, aircraft operations, wind, and others to develop the various modeling and zones that are presented in the AICUZ reports. This information is designed for military and community planners to make informed decisions about land uses and land use planning around military airports.

Table 5.17-2. Recommended Land Uses for Airfield Safety Zones

Land Use		Suggested Land Use Compatibility[1]			
SLUCM No.	Land Use Name	Clear Zone	APZ I	APZ II	Density
10	**Residential**				
11	Household units				
11.11	Single units: detached	N	N	Y[2]	Maximum density of 2 Du/Ac
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 & 0.56 in APZ II
25	Furniture and fixtures; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
26	Paper and allied products; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
27	Printing, publishing, and allied industries	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
28	Chemicals and allied products; manufacturing	N	N	N	
29	Petroleum refining and related industries	N	N	N	
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

Land Use		Suggested Land Use Compatibility[1]			
SLUCM No.	Land Use Name	Clear Zone	APZ I	APZ II	Density
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 & 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 & 0.56 in APZ II
42	Motor vehicle transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
43	Aircraft transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
44	Marine craft transportation	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I & 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 & 0.56 in APZ II
46	Automobile parking	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
47	Communication	N	Y[6]	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
48	Utilities[7]	N	Y[6]	Y[6]	Maximum FAR of 0.28 in APZ I & 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 & 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 0.16 in APZ II
53.	Shopping centers-Neighborhood, Community, Regional, Super-regional[9]	N	N	N	

Land Use		Suggested Land Use Compatibility[1]			
SLUCM No.	Land Use Name	Clear Zone	APZ I	APZ II	Density
54	Retail trade - food	N	N	Y	Maximum FAR 0.24 in APZ II
55	Retail trade – automotive, marine craft, aircraft, and accessories	N	Y	Y	Maximum FAR 0.14 in APZ I & 0.28 in APZ II
56	Retail trade – apparel and accessories	N	N	Y	Maximum FAR 0.28 in APZ II
57	Retail trade – furniture, home furnishings and equipment	N	N	Y	Maximum FAR 0.28 in APZ II
58	Retail trade – eating and drinking establishments	N	N	N	
59	Other retail trade	N	N	Y	Maximum FAR 0.16 in APZ II
60	**Services[10]**				
61	Finance, insurance and real estate services	N	N	Y	Maximum FAR 0.22 in APZ II
62	Personal services	N	N	Y	Office uses only. Maximum FAR 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 0.22 in APZ II
63.7	Warehousing and storage services[12]	N	Y	Y	Maximum FAR 1.0 in APZ I; 2.0 in APZ II
64	Repair services	N	Y	Y	Maximum FAR 0.11 in APZ I; 0.22 in APZ II
65	Professional services	N	N	Y	Maximum FAR 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 0.11 in APZ I; 0.22 in APZ II
67	Government services	N	N	Y	Maximum FAR 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 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	

Land Use		Suggested Land Use Compatibility[1]			
SLUCM No.	Land Use Name	Clear Zone	APZ I	APZ II	Density
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 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 0.11 in APZ I; 0.22 in APZ II
79	Other cultural, entertainment and recreation	N	Y[11]	Y[11]	Maximum FAR 0.11 in APZ I & 0.22 in APZ II
80	**Resource production and extraction**				
81	Agriculture (except livestock)	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 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 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 0.28 in APZ I; 0.56 in APZ II; no activity which produces smoke, glare, or involves explosives

Land Use		Suggested Land Use Compatibility[1]			
SLUCM No.	Land Use Name	Clear Zone	APZ I	APZ II	Density
85	Mining activities[18]	N	Y[18]	Y[18]	Maximum FAR 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 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]	

Source: Air Force Instruction AFI 32-7063, Rev. December 2015

Key to Table:
SLUCM - Standard Land Use Coding Manual, US Department of Transportation.

Table Notes:
1. A "Yes": (Y) or a "No" (N) 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 the densities of people and structures. In order 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 an acre in APZ I and 50 an acre in APZ II are considered to be low density. Outside events should normally be limited to assemblies of not more than 25 people an acre in APZ I and 50 people an acre in APZ II. Recommended FARs are calculated using standard parking generation rates for various land uses, vehicle occupancy rates, and desired density in APZ I and II. For APZ I, the formula is FAR = 25 people an acre / (Average Vehicle Occupancy x Average Parking Rate x (43560/1000)). The formula for APZ II is FAR = 50/ (Average Vehicle Occupancy x Average Parking Rate x (43560/1000)).
2. The suggested maximum density for detached single-family housing is two Du / Ac. In a planned unit development (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 within 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 above ground passenger terminals and no above ground 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 impact military operations through hazards to flight or electromagnetic interference. Each new development should to 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-11; 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, auditoriums, etc. 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, large classes, etc., 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 bird/wildlife aircraft strike hazards (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, 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.

The Army has not established a recommended land use table for airfield safety zones, so as a best practice, the December 2015 Air Force Instruction 32-7063 (AFI 32-7063), Table 5.17-2 identifies the most current land use recommendations for the airfield safety zones. The AFI 32-7063 is based off the DOD Instruction 4165.57 and is used in this compatibility assessment as a best practices tool in effort provide guidance to mitigate incompatible development to the extent practical.

Based on the information provided in the table and the City of Lawton planning tools, the following paragraphs describe the incompatible land uses in the aircraft safety zones. It should be noted, the only jurisdiction affected by the recommended land uses per the AFI 32-7063 in this report is the City of Lawton as the aircraft safety zones only extend off-installation in the southern portion of the installation. These land uses are subject to local land use controls, while the safety zones that are located on-Post are governed by Federal land use plans.

Future Land Uses

Figure 5.17-3 illustrates the future land uses that have been designated in the aircraft safety zones. There are 17 acres of land uses designated as low density residential, 3 acres of land uses designated as high density residential, and approximately 4 acres of land uses designated as commercial land use located in the CZ.

These are all incompatible as the clear zone is designed and recommended to be clear of all types of development including agricultural uses that require earth movement or stacking of hay bales would also be recommended as incompatible land uses with the CZ. There are 31 acres of land uses designated as public facilities and approximately 3 acres of land uses designated as low density residential, which are also recommended as incompatible in accident potential zone I (APZ I). This area, does not have as high a risk profile associated with it like the CZ does, this area should still be very limited when it comes to land uses that encourage the congregation of large groups of people.

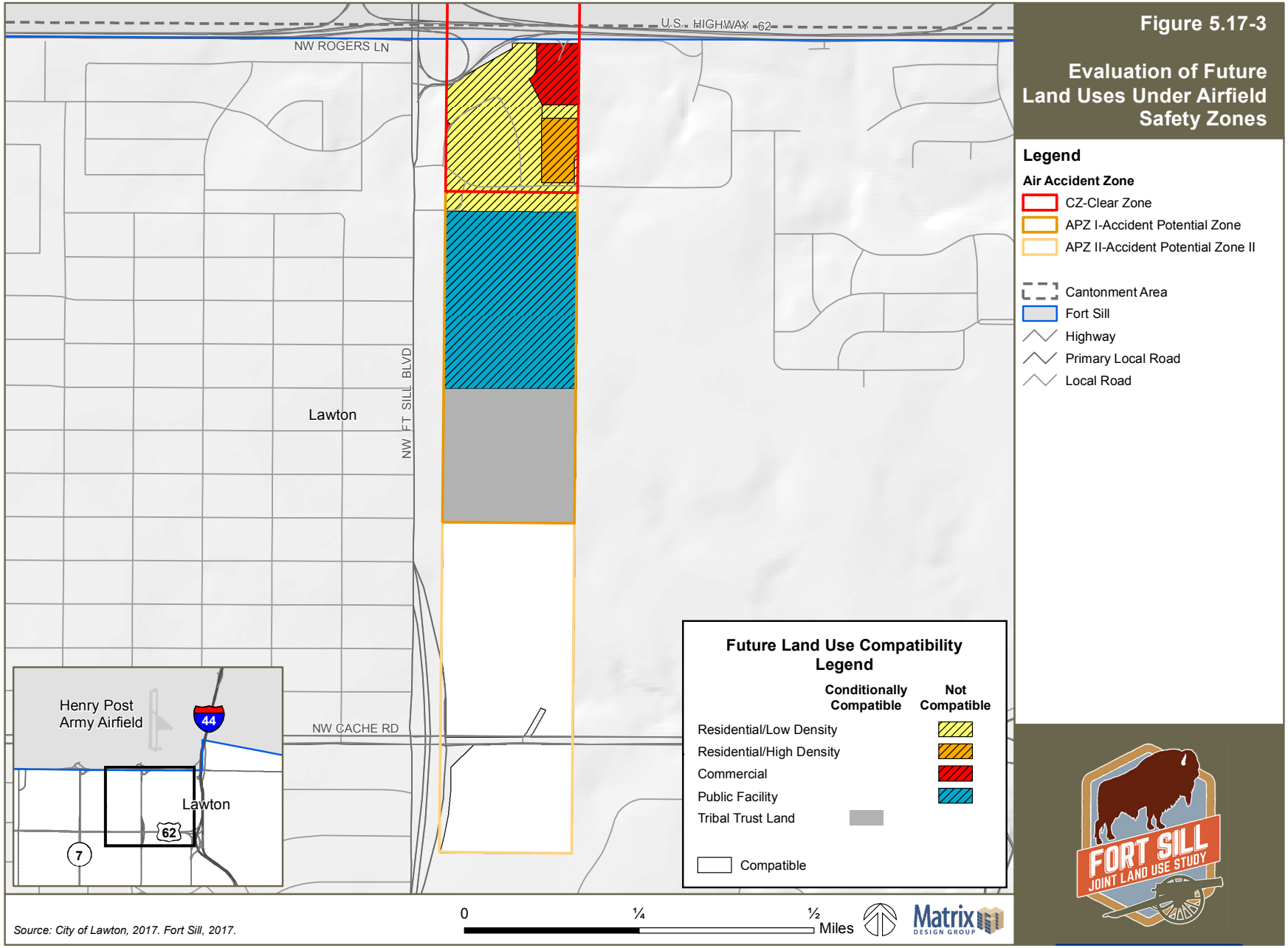
There are also about 23 acres designated as Tribal Trust Land located in APZ I. This is a conditional land use as there is no definition of this type of land use that describes allowable land uses, therefore, it is recommended to be a conditional land use to trigger coordination and communication with the City and Fort Sill. The future land uses designated in accident potential zone II (APZ II) are all compatible. No further assessment is needed for the APZ II.

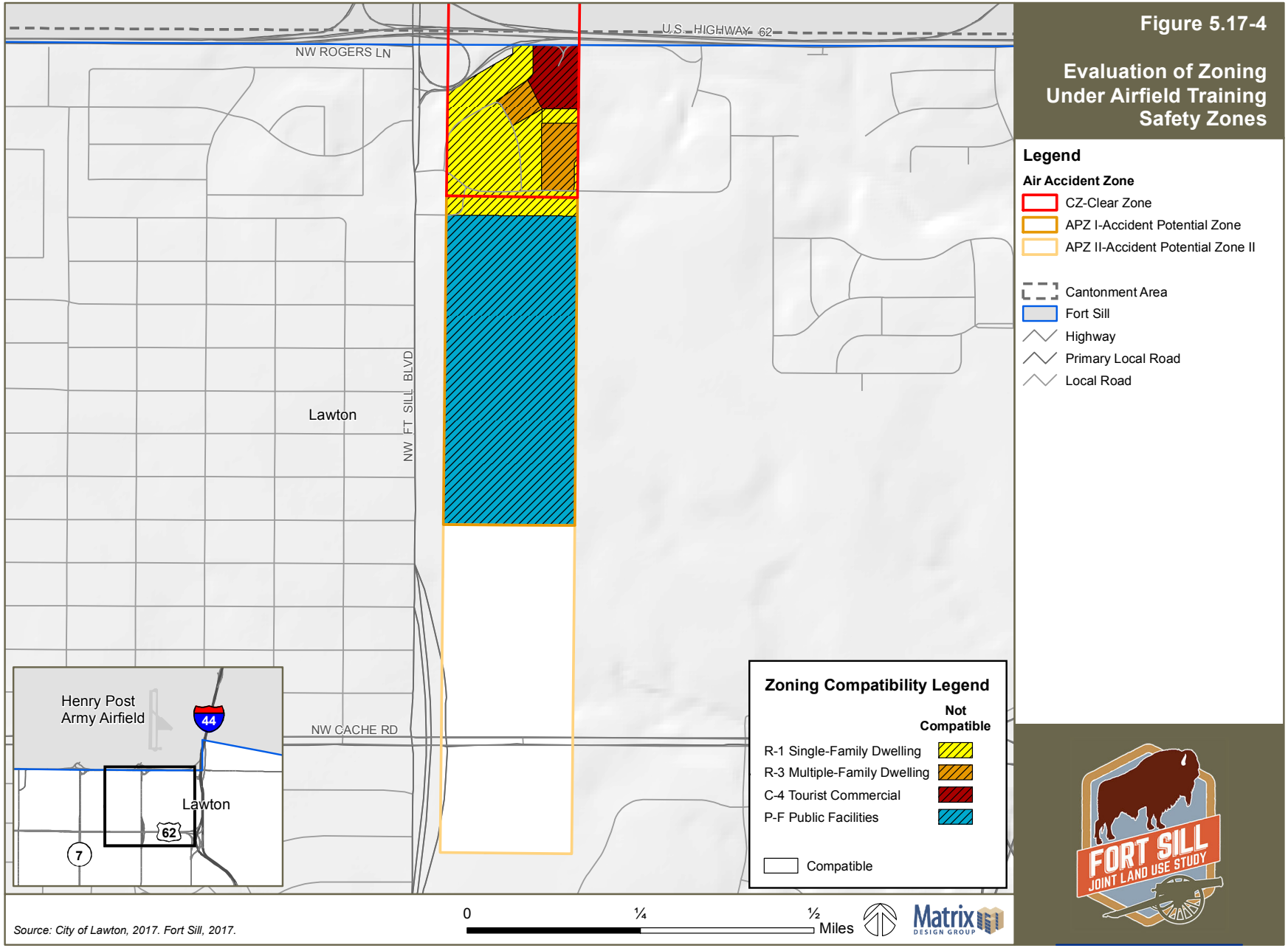
Zoning

There is approximately 16 acres of land zoned for R-1, Single-family dwelling; about 5 acres are zoned for R-3, Multi-family dwelling; and about 4 acres are zoned for C-4, Tourist commercial in the Clear Cone (CZ) that are recommended as incompatible as illustrated on Figure 5.17-4. By definition, the CZ is recommended to be free and clear of all types of development as this is the area with the highest risk profile for aircraft mishaps. In addition, there are approximately 3 acres zoned R-1, Single-family residential and about 54 acres zoned P-F, Public Facilities located in the APZ I.

These zoning districts are recommended as incompatible land uses in the APZ I due to the high risk associated with this area. In addition, the City of Lawton permits by right public schools, higher education institutions, and playgrounds and parks in R-1, Single-family residential zoning district, which are uses that encourage the congregation of large numbers of people. In addition, the city permits seven dwelling units per acre in the R-1, Single-family residential zoning district, which exceeds the recommendations in the recommended land use table. This would create a higher risk profile associated with the APZ I.

The Public Facilities (P-F) zoning district permits by right auditoriums, exhibition halls, fairgrounds, airports, and other land uses that encourage a large number of people to congregate. This increases the risk associated with APZ I, and thus makes this zoning district incompatible in this area.


U.S. HIGHWAY 62
NW ROGERS LN
NW FT SILL BLVD
Lawton
NW CACHE RD
Henry Post Army Airfield
44
Lawton
62
7
Future Land Use Compatibility Legend
Conditionally Compatible
Not Compatible
Residential/Low Density
Residential/High Density
Commercial
Public Facility
Tribal Trust Land
Compatible
Source: City of Lawton, 2017. Fort Sill, 2017.
0
¼
½
Miles
Figure 5.17-3
Evaluation of Future Land Uses Under Airfield Safety Zones
Legend
Air Accident Zone
CZ-Clear Zone
APZ I-Accident Potential Zone
APZ II-Accident Potential Zone II
Cantonment Area
Fort Sill
Highway
Primary Local Road
Local Road
FORT SILL
JOINT LAND USE STUDY


U.S. HIGHWAY 62
NW ROGERS LN
NW FT SILL BLVD
Lawton
NW CACHE RD
Henry Post Army Airfield
44
Lawton
62
7
Zoning Compatibility Legend
Not Compatible
R-1 Single-Family Dwelling
R-3 Multiple-Family Dwelling
C-4 Tourist Commercial
P-F Public Facilities
Compatible
0
¼
½
Miles
Source: City of Lawton, 2017. Fort Sill, 2017.
Figure 5.17-4
Evaluation of Zoning Under Airfield Training Safety Zones
Legend
Air Accident Zone
CZ-Clear Zone
APZ I-Accident Potential Zone
APZ II-Accident Potential Zone II
Cantonment Area
Fort Sill
Highway
Primary Local Road
Local Road
FORT SILL
JOINT LAND USE STUDY
Matrix DESIGN GROUP

The zoning districts that are located within APZ II are all compatible. No further assessment is needed for APZ II regarding zoning.

The ACUB program has not been identified as a possible tool by the Army to utilize in this area located within the city of Lawton.

Findings

- There are future land uses designated as residential and commercial land uses located in the Clear Zone (CZ).
- There are 16 acres zoned for R-1, Single-family residential; 5 acres zoned for R-3, Multi-family residential; and 4 acres zoned for C-4, Tourist commercial, that are incompatible and located in the CZ.
- The ACUB Program has not been identified by the Army to address the land uses in the CZ.

ISSUE SA-5	**Concern About Lack of Local Regulations for Drones** *There is a concern about the lack of enforcement of the use of drones around Fort Sill due to a lack of local regulations controlling of drone use and operations in the JLUS Study Area.*

Compatibility Assessment

The use of unmanned aerial systems (UASs), commonly called drones, has increased dramatically as they have become cheaper, smaller, more accessible, and easier to use. According to the FAA as of March 2017, nearly 800,000 drones have been registered in the U.S., with a higher estimate of more than 1.1 million drones currently in use. The FAA has a ban on drones flying over areas such as national parks, major sporting events, military installations, and within a five-mile radius of airports. However, the FAA has seen a large increase in the number of drones flying too close to airports and aircraft. According to the FAA there were approximately 1,800 instances of drones operating near aircraft in 2016. These drones pose a hazard to aircraft safety, creating potential mid-air collision scenarios.

As of April 14, 2017, the FAA and the Department of Defense agreed to restrict drone flights up to 400 feet within the lateral boundaries of 133 military facilities in the U.S. including Fort Sill. Operators who violate the airspace restrictions may be subject to enforcement action, including potential civil penalties and criminal charges. The military recently adopted policies allowing drones trespassing on military installations to be destroyed under certain circumstances.

In December 2015, the FAA established a UAS registry, requiring anyone who owns a small unmanned aircraft more than 0.55 pounds to register it before flying it outdoors. People who do not register could face civil and criminal penalties. The maximum civil penalty is a fine of up to $27,500, with criminal penalties reaching $250,000 or three years in prison. The FAA released a law enforcement guide, "*Law Enforcement Guidance for Suspected Unauthorized UAS Operations*," in January 2015 to explain how first responders and others can provide assistance to the FAA by:

- Identifying potential witnesses and conducting initial interviews;
- Contacting the suspected operators of the UAS or model aircraft;
- Viewing and recording the location of the event;
- Collecting evidence;
- Identifying if the UAS operation was in a sensitive location, event or activity; and
- Notifying one of the FAA's Regional Operation Centers about the operation as soon as possible.

In more rural parts of the US, UASs are becoming increasingly used for agricultural purposes to monitor crops and livestock. As the number of UASs increases, there will be the increased risk of UASs flying too close to military installations without prior coordination. Citizens may also be unaware of FAA regulations of UASs.

The FAA finalized the operational rules for use of commercial drones in June 2016. The new rule, Federal Aviation Regulations Part 107, provides operating requirements, including maintaining a view of the drone and getting approval before operating in Class B, C, D, and E airspace from the air traffic control tower. It sets a weight limit of 55 pounds, speed limit of 100 miles per hour, and height limit of 400 feet.

The proximity of drones being flown near the base also raises security concerns as many UASs are equipped with camera equipment. A drone could provide a line-of-sight into the base. The FAA does not restrict the use of camera equipment on UASs. A drone following the regulations outlined by the FAA could still create an issue if the drone can record activities taking place on the base.

Fort Sill has had several instances of unauthorized drones operating over the installation. In one recent incident, an unauthorized drone was located after crashing on the Henry Post Army Airfield located on Fort Sill. Fort Sill security indicated the operator appeared to be unfamiliar with applicable rules and regulations regarding drone operation. The use of drones on or around airports / airfields is of particular concern due to the potential hazards to aircraft operations. In addition, due to the nature of range operations training / testing on Fort Sill, drones pose a significant hazard to military activities and personnel.

Oklahoma State Statute 3-332 prohibits unauthorized drone operation around critical infrastructure facilities. The law does not specify military installations but includes infrastructure facilities that may be located on Fort Sill (e.g., electrical substations, cell towers, etc.).

The City of Lawton has an ordinance on drones that focuses on drone activities on and around the Lawton-Fort Sill Regional Airport and critical infrastructure. No other local jurisdictions in the JLUS Study Area have regulations regarding drone operations.

The National League of Cities has developed a document "Ordinance for the Promotion of Drone Innovation & Accountability" to assist jurisdictions with a balanced approach to managing drone use.

Findings

- Drone activity continues to increase across the U.S. and Fort Sill has had several incidents of unauthorized drone activity on and around the installation including on the Henry Post Army Airfield.
- Unauthorized drone operation on or around Fort Sill pose a threat to training and testing activities, military and civilian personnel, and national security.
- Legal operation of drones is regulated by FAA, and recent regulations specifically prohibit unauthorized drone operation on or near Fort Sill.
- The FAA requires drone registration and operation in accordance with very specific requirements.
- Oklahoma and the City of Lawton have drone laws specific to critical infrastructure and airports respectively. Military installations are not identified in these laws.

5.18 Vertical Obstruction (VO)

Vertical obstructions are described as by manmade (buildings, telephone poles, radio antennae or other structures), or natural (trees) objects or other features that may encroach into the navigable airspace or line of sight radar signal transmission pathways used by the military. These obstructions can be a safety hazard to both the public and military personnel and potentially impact military readiness.

Vertical obstructions can compromise the value of low-level flight training by limiting the areas where such training can occur, this includes not only ranges, but the entire military operational footprint encompassing military training activities. These obstructions can include a range of items from man-made, such as telephone poles, utility transmission towers, and radio antennas, to natural, such as tall trees and land features. Vertical obstructions can also interfere with radar transmissions, compromising the integrity of data transmission between the transmitter and receiver. Though most critical near the transmitter, the geographic area impacting the transmissions, or radar viewshed, can be broad depending on the distance between the transmitter and receivers.

Key Terms

Imaginary Surfaces. The term imaginary surface refers to the areas surrounding a heliport or airfield that must be kept clear of objects that might pose a safety threat to aviation activities.

Vertical Obstructions (VO). A man-made or natural object that projects above an imaginary surface is a vertical obstruction. Vertical obstructions are objects or structures that exceed a specified height above ground level and extend into airspace. Vertical obstructions may be described as manmade (buildings, telephone poles, radio antennae or other structures) or natural (trees) objects or other features that are of greater height than, and encroach into, the navigable airspace used for military operations (aircraft approach-departure surfaces, transitional surfaces, as well as military training or flight routes for example). These can present a safety hazard to both the public and military personnel and potentially impact military readiness.

Technical Background

In relation to flight operations from an airport (military or civilian), vertical obstructions are addressed through compliance with FAA Code of Federal Regulation (CFR) Title 14, Chapter 1, Subchapter E, Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace, commonly referred to as Part 77 Compliance. Part 77 Compliance establishes standards and notification requirements for objects affecting navigable airspace. Part 77 Compliance provides details to evaluate the potential for a vertical obstruction based on the elevation of the airfield, the height and resulting elevation of the new structure or facility, and the location of the structure or facility in relation to the airfield in question.

To determine when structures or facilities should be evaluated for vertical obstruction, Part 77 Compliance states the following requirements for notifying the FAA:

> *§77.9 - Any person/organization who intends to sponsor any of the following construction or alterations must notify the Administrator of the FAA:*

– Any construction or alteration exceeding 200 feet above ground level.

Any construction or alteration:

–within 20,000 feet of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with at least one runway more than 3,200 feet.

–within 10,000 feet of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 feet.

–within 5,000 feet of a public use heliport which exceeds a 25:1 surface.

Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards.

When requested by the FAA:

–Any construction or alteration located on a public use airport or heliport regardless of height or location.

Part 77 also identifies the height at which an object may be considered an obstruction at a designated distance:

§77.17 - Obstruction standards.

(a) An existing object, including a mobile object, is, and a future object would be an obstruction to air navigation if it is of greater height than any of the following heights or surfaces:

(1) A height of 499 feet above ground level at the site of the object.

(2) A height that is 200 feet above ground level or above the established airport elevation, whichever is higher, within three nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length, and that height increases in the proportion of 100 feet for each additional nautical mile from the airport up to a maximum of 499 feet.

(3) A height within a terminal obstacle clearance area, including an initial approach segment, a departure area, and a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required obstacle clearance.

(4) A height within an en route obstacle clearance area, including turn and termination areas, of a Federal Airway or approved off-airway route, that would increase the minimum obstacle clearance altitude.

(5) The surface of a takeoff and landing area of an airport or any imaginary surface established under § 77.19, 77.21, or 77.23. However, no part of the takeoff or landing area itself will be considered an obstruction.

(b) Except for traverse ways on or near an airport with an operative ground traffic control service furnished by an airport traffic control tower or by the airport management and coordinated with the air traffic control service, the standards of paragraph (a) of this section apply to traverse ways used or to be used for the passage of mobile objects only after the heights of these traverse ways are increased by:

(1) 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance.

(2) 15 feet for any other public roadway.

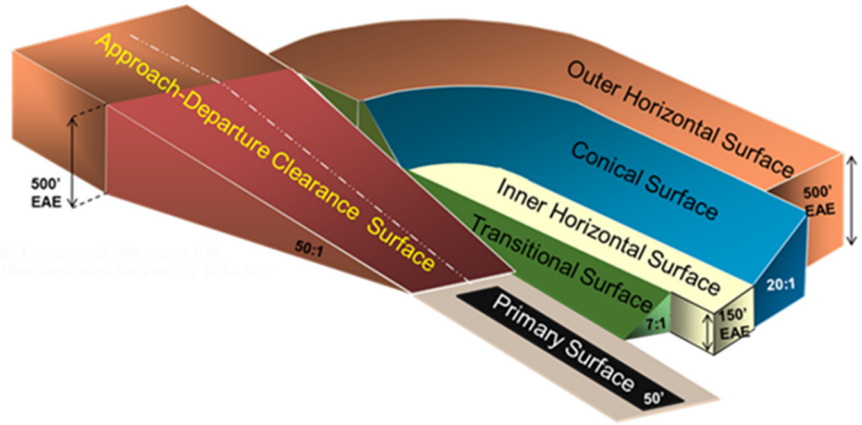
(3) 10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road.

(4) 23 feet for a railroad.

(5) For a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it.

Apart from the Part 77 Compliance, the FAA has developed Imaginary Surfaces (IS) around runways to determine how structures and facilities are evaluated as to whether they pose a vertical obstruction relative to the surrounding airspace. The levels of Imaginary Surfaces build upon one another and are designed to eliminate vertical obstructions to air navigation and operations, either natural or man-made. The dimension or size of an Imaginary Surface depends on the runway classification. For the purposes of illustrating all the imaginary surfaces, Figure 5.18-1 is provided to show the heights and ratios of the imaginary surfaces of a runway that buildings and structures are evaluated for vertical obstructions.

Figure 5.18-1. Example Imaginary Surfaces Cross-Section



Issue Assessment

ISSUE VO-1	**Uncoordinated Siting of Tall Structures May Impact Low-Level Military Aviation Operations** The military has a concern about tall structures including microwave towers and energy development facilities impacting low-level military aviation operations. An uncoordinated microwave tower has already been installed that impacted low-altitude flying north of the installation. This is an area where low-level flights are performed to execute aerial bombing and other military aviation training.

The construction of tall structures in the vicinity of Fort Sill's Falcon Range in the western portion of the installation, and the HPAAF in the southeastern portion is of concern to the military and its capability of continuing certain aviation training missions. Fort Sill conducts low level aerial maneuvering and bombing to which occurs around and at Falcon Range. This protected airspace is important to the mission capability of Fort Sill and other regional military installations including Altus AFB, OK; Vance AFB, OK; and Sheppard AFB, TX.

Blue Canyon Wind Farm is located approximately five miles north of Fort Sill in unincorporated Comanche County. The Blue Canyon Wind Farm consists of 250 wind turbines with a total output of approximately 423 megawatts of energy. These types of development not only pose potential vertical obstruction incompatibility, but require transmission lines that may also impact military training if siting is not coordinated with the military. In addition to the wind farms, microwave towers are constructed in this area as microwave towers are easier to construct in hilly and mountainous terrain as opposed to large wind towers and transmission lines. Microwave towers can transmit data long distances without the use of physical wires—utility companies can use these towers to manage the power grid and public safety agencies (e.g. local, state law enforcement and fire responders) can use these towers to monitor and manage situations remotely.

The area north of Fort Sill is prime land for energy development and there has already been an impact to aviation training due to the Blue Canyon Wind Farm and a microwave tower being constructed in the area. Increasing these types of structures in the area around Fort Sill can impact the aviation training by increasing the height of flights because pilots have to avoid tall structures. When a flight altitude is increased to avoid development, then the training environment is not as realistic as it could be if tall structures were not affecting the flight altitudes. The more increases and adjustments in altitudes the pilots have to make to avoid development, the less effective the training environment is for the aviation training and aerial bombing missions. This would not only impact Fort Sill but it would also impact other nearby military installations' missions that jointly use Fort Sill's ranges. The issue is not alternative energy development, but uncoordinated development that does not take unknown military training needs into account. The DOD supports economic development, but in a coordinated, compatible way.

Compatibility Assessment

According to Oklahoma Statutes Title 17, Corporation Commission (Commission) has the responsibility at the state for regulating communications towers including microwave towers and energy development facilities. The state regulations do not preclude any local regulations that jurisdictions may have adopted. Regarding communications, the Commission requires notification to the Commission in order to do the appropriate research to determine impact of new tower construction. However, this coordination and research does not indicate that the Commission is required to coordinate with the state's military, or even the Oklahoma Strategic Military Planning Commission to ensure safe navigable airspace for military training.

In addition, the Commission requires six-month written notification of intent to construction an energy development facility to ensure the Commission has the appropriate time to research and determine impacts of wind energy facilities. In addition, the Commission requires the energy developer to initially file Form 7460-1, the Obstruction Evaluation Form, with the Federal Aviation Administration's (FAA). Filing this form could trigger review by the DoD Siting Clearinghouse but that connection is not codified. In addition, developers are required to submit copies of the intent to construct energy development facilities package to all the County Boards of Commissioners and municipality leadership (if affected) in which all or portions of the energy facility will be located within 24 hours of filing with the Commission. The Commission requires the energy developer to publish intent to construct in a paper of general circulation within six months of the notification to the Commission as well. Within 60 days of publishing the intent to construct in a newspaper of general circulation, the developer is required to hold a public meeting. The public meeting announcements are required to follow the local public process. Not one of these notification requirements indicates a direct coordination and communication effort with the military at the installation level. While the FAA is aware of airspace related matters on a macro-level, the FAA may not be fully aware of the micro-level impact of construction of new towers—communications and / or energy development towers, especially in the vicinity of Fort Sill.

None of the jurisdictions in the JLUS Study Area have local regulations that control the construction of energy development facilities.

The City of Lawton is the only jurisdiction in the JLUS Study Area that has adopted a Telecommunications and Towers Infrastructure Ordinance. According to Chapter 6 of the City's Ordinance Article 6-8, the city only requires coordination with the City's Airport Zoning Ordinance as well as the FAA. There is no indication in the City's Zoning Ordinance that any person or company desiring to construct a communications tower or related infrastructure towers must coordinate with the military to ensure there are no frequency interference or other impacts to military training in the JLUS Study Area. The City's Ordinance expressly states that the height of the tower shall not exceed 20 feet beyond the zoning districts height restrictions, and such towers are not permitted in residential zoning districts. The majority of the city's zoning districts height restrictions are at 35 feet or 2.5 stories, which is compatible with low-level flying. However, the city's Industrial Zoning District permits uses to a height of 100 feet. This could result in a compatibility concern should a tower be constructed in location that has a high ground level elevation and is in a military flight path.

Findings

- The Corporation Commission is not required to coordinate with military installations that could be impacted by the locating, permitting, and construction of communications towers and energy development facilities.
- The DoD Siting Clearinghouse is not formally coordinated with on the development of new energy development facilities for a compatibility review in conjunction with FAA Form 7460-1 submittal.
- None of the jurisdictions in the JLUS Study Area have local regulations that control the construction of energy development facilities.
- The City of Lawton is the only jurisdiction that has adopted a telecommunications ordinance; however, it is not required to coordinate with the military for siting and construction of communications towers in the JLUS Study Area.
- The Oklahoma Strategic Military Planning Commission is designed to protect the state's military assets from mission impacts; however, this Commission has not been given the authority to determine impact of certain types of development such as communications towers and energy development facilities on military training in the state.

Please see the next page.

5.19 Vibration (V)

Vibration is the oscillation or motion that alternates in opposite directions and may occur as a result of an impact, explosion, noise, mechanical operation, or other change in the environment and is expressed as a pressure wave when impacting a solid surface. There are two types of vibration associated with these types of sources. Ground-borne vibration travels through the ground and is more likely to cause structural shaking. Airborne vibration refers to vibration patterns that travel and are felt through the air. These vibrations travel further, have a stronger "feel" at greater distances than ground-borne vibration. Airborne vibration is influenced by environmental factors including topography and atmospheric conditions such as wind speed and direction, humidity levels, and temperature. Vibrations from the firing of ballistics and their associated impacts can produce a vibration effect. Vibrations can cause structural shaking and rattling of windows that can annoy or concern property owners and, in some cases, cause structural damage. Vibrations from low frequency pressure waves can also have an adverse impact on people. Vibration may be caused by military and/ or civilian activities.

Key Terms

There are no unique terms in this section.

ISSUE V-1	**Vibration from Military Training Exercises is Experienced Throughout the Study Area, and Has the Potential to Cause Physical Property Damage** *Many of the communities along the north-northeastern boundary of Fort Sill experience vibration during heavy artillery training. This vibration has potential to cause damage to private property, as well as critical infrastructure. There is concern that the vibration is causing damage to Lawton's Water Treatment Plant, Lake Lawtonka Dam, and Lake Elmer Thomas Dam.*

Artillery fire and other training operations at Fort Sill create wide-spread ground-borne vibration throughout the JLUS Study Area, particularly along the northern border of the installation. These vibrations are generally the result of heavy weapons and explosive detonations, which take place in the East and West Range of the installation and can be strong enough to cause property damage off-installation. Under most circumstances, the vibration intensity decreases with distance from the source as the waves meet resistance from materials present in the ground. The distance between the point source of the vibration and the affected structures that are off-installation would dampen due to reduction of the force generated by the vibration in relation to both distance from the source and the types of materials travelled through so that it would typically not cause any structural damage among communities surrounding Fort Sill.

Vibration studies have shown that residents begin having concern for structural damage caused by rattling when the peak decibel (dBP) exceeds 120 dBP; however, actual damage is not likely to occur until a level of 150 dBP (a level far exceeding those typically modeled for Fort Sill) is attained.

Compatibility Assessment

Some critical infrastructure north of Fort Sill's border has been damaged due to vibrations in the past. The City of Lawton's Water Treatment Plant, Lake Lawtonka Dam, and Lake Elmer Thomas Dam are all within Medicine Park, and have experienced some damage from vibration emanating from Fort Sill's training operations. Both Fort Sill and the surrounding communities rely on the Lake Lawtonka Dam and Lake Elmer Thomas Dam, as well as the Lawton Water Treatment Plant as a source of water and flood control. Continued damage to these assets could become costly if it persists.

Findings

- Fort Sill's operations typically do not produce noise / vibration models that result in peak sound level of 150 dBP.
- Critical infrastructure has been damaged in the past from vibrations caused by ordnance detonation at Fort Sill.

5.20 Water Quality / Quantity (WQQ)

Water quality / quantity concerns include the assurance that adequate water supplies of good quality are available for use by the installation and surrounding communities as the area develops. Water supply for agriculture and industrial use is also considered.

Key Terms

Acre-foot. An acre-foot is a measure of the volume of one acre of surface area to a depth of one foot. It is equal to approximately 325,853 gallons.

Aquifer. An aquifer consists of a layer of porous substrate that contains and transmits groundwater where water can flow directly between the surface and the saturated zone.

Groundwater. Water held underground in soil or in rock pores and crevices.

Safe Yield. The safe yield (or perennial yield) of a groundwater basin is the rate at which water can be pumped from wells year after year without decreasing the groundwater in storage.

Surface Water. Surface water is derived from waters that flow continuously over land surfaces in a defined channel or bed, such as streams and rivers; standing water in basins such as lakes, wetlands, marshes, swamps, ponds, sinkholes, impoundments, and reservoirs either natural or man-made; and all waters flowing over the land as runoff, or as runoff confined to channels with intermittent flow.

Water Security. The reliable availability of an acceptable quantity and quality of water for mission, health, livelihoods and production, coupled with an acceptable level of water-related risks.

Technical Background

In 2012 Oklahoma lawmakers passed Oklahoma's Water for 2060 Act which set an ambitious statewide goal of consuming no more fresh water between now and 2060 than was consumed in 2012, while continuing to grow the state's population and economy. Toward this goal, the Oklahoma Water Resources Board (OWRB) is promoting water efficiency in partnership with the U.S. Army Corps of Engineers (USACE) through a series of Water for 2060 activities, with an emphasis on potential means of alleviating the water shortages projected in the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP). Water efficiency, conservation, recycling, and reuse – the cornerstones of Water for 2060 – were among the Priority Recommendations of the OCWP.

In the State of Oklahoma total withdrawals from surface-water and groundwater sources during 2005 were about 1,559 Million gallons per day (Mgal / day); 63 percent (989 Mgal / day) from surface-water sources and 37 percent (570 Mgal / day) from groundwater sources. The three largest water withdrawal use categories were public supply (41 percent); irrigation, (32 percent); and livestock and aquaculture (12 percent).

Comanche County was among the top 10 Oklahoma counties for surface-water withdrawals at approximately 20 Mgal / day in 2005. Comanche County was also in the top 10 Oklahoma counties for total public system supply withdrawals at approximately 18 Mgal / day in 2005. The largest surface-

water public supply system in southwest Oklahoma was the City of Lawton averaging about 16 Mgal/d or 3 percent of Oklahoma total public supply surface-water withdrawals in 2005.

The sources of potable water supply for the City of Lawton / Fort Sill is primarily from surface supplies from Lake Lawtonka with secondary sources being Lake Ellsworth and Lake Waurika. The water supply is part of the Lawtonka Watershed Basin with the watershed for Lake Lawtonka covering an area of roughly 92 square miles. Much of the watershed is mountain ranges and some agricultural lands. Lake Lawtonka is a multipurpose waterbody with the designated beneficial uses of public and private water supply, warm water aquatic community, and water recreation. These beneficial uses are promulgated through Oklahoma's Water Quality Standards which limit how much of specific contaminants can be in the water for the water to support these designated uses. Lake Lawtonka has the additional limitation of being designated as a Sensitive Water Supply. Due to this additional limitation, no new loads or increased loads from existing point sources shall be allowed unless those new or increased loads can be shown to maintain or improve existing water quality. The City of Lawton owns and operates the lake as its primary water supply. Lake Lawtonka has a yield of 23,500 acre feet per year (AFY). The City of Lawton also owns the water rights for Lake Ellsworth which approximately 10 miles northeast of Lake Lawtonka. A high pressure water line connects Lake Ellsworth to Lake Lawtonka allowing water to be treated at the Lawton Water Treatment Facility. Lake Ellsworth has a yield of 23,500 AFY.

ISSUE WQQ-1	**Long Term Water Availability / Security for Fort Sill** *Fort Sill currently does not own any water rights. Fort Sill and the City of Lawton have an existing agreement where the City sells water to Fort Sill. Because the pipeline that carries the water goes through Fort Sill, the agreement provides for lower water rates. However, there have been efforts to increase the water rates charged to Fort Sill. To date there has been little interest to establish a regional plan for water to jointly support water needs.*

Compatibility Assessment

The City of Lawton operates a water treatment facility in the Town of Medicine Park south of Lake Lawtonka and adjacent to Medicine Creek. The plant is gravity fed water from Lake Lawtonka and has a 40 Mgal / day design treatment capacity. The plant provides water via two 24-inch water supply lines to approximately 100,000 customers in the area. Fort Sill receives treated water via one of the 24 water supply lines. Fort Sill owns no water rights, but has an agreement with City of Lawton for treated drinking water. However, Fort Sill does not have guaranteed water security in the long term. Potable water infrastructure on Fort Sill has been privatized and is owned and operated by the American Water Enterprises, Inc. The 2016 Annual Water Quality Report indicates that the water delivered by American Water's Military Services Group met or exceeded all applicable state and federal drinking water standards.

The City of Lawton is making substantial investments in developing new water strategies to define existing and future requirements and preserve long term access to Ft. Sill. This effort could lead to long term water security if Ft sill could commit to the amount of water that they would purchase from Lawton. This information would provide Lawton with a viable plan to pursue strategies and seek funding sources by providing needs justification from a business case perspective.

The state of Oklahoma is pursuing an aggressive approach to managing water resources through conservation, recycling and reuse efforts via the Oklahoma's Water for 2060 Act. Fort Sill has stepped up to this challenge by repurposing treated wastewater for reuse in a water recycling distribution network. The Fort Sill wastewater treatment plant produces the high-quality effluent which is sent through the distribution network giving Fort Sill the ability to use the treated wastewater in its energy plant's cooling towers and for geothermal heat pumps to condition buildings. This allows the installation to use the treated wastewater for purposes that previously required the use of potable water. The system currently operates at approximately 50,000 gallons per day and a potential capacity of 700,000 gallons per day. This current and future reduction in potable water use by Fort Sill provides the installation reduced water costs while giving the other users of water from the City of Lawton Water Treatment Plant the beneficial use of water that is no longer needed by the installation.

Findings

- If Fort Sill could commit to minimum water requirements on a long-term basis, the City of Lawton would have a better opportunity to secure resources to enact water security plans.
- Fort Sill owns no water rights and has an agreement with the City of Lawton for providing potable water supplies.
- Fort Sill receives potable water from the Lawton Medicine Park Water Treatment plant. The City of Lawton owns and operates the treatment plant and obtains water primarily from Lake Lawtonka.
- The water Fort Sill receives is provided by the American Water Enterprise's distribution system meets or exceeds all state and federal requirements.
- Fort Sill has been aggressive in pursuing water reuse / recycling initiatives including a wastewater effluent treatment / distribution system for cooling and geothermal water requirements.

SSUE WQQ-2	**Water Supply Interruptions at Fort Sill** *Fort Sill lost water supply for approximately 38 hours following a 2010 ice storm that impacted the City of Lawton Medicine Park Water Treatment Plant. Fort Sill obtains water from this facility and is concerned that service interruptions may occur again in the future. As a result, Fort Sill and the City of Lawton are conducting ground water studies to investigate potential backup sources of water.*

Compatibility Assessment

From a water security perspective, in the event of a disaster or drought, communities must plan for emergency water sources to ensure a reliable water supply. Cooperative efforts such as emergency inter-ties between systems, jointly developed facilities, water exchanges, and other methods will help enhance water reliability for all water users in the JLUS Study Area.

As noted above Fort Sill receives treated water from one of the 24-inch water supply lines from the Lawton Water Treatment Facility. Fort Sill owns no water rights, but has an agreement with City of Lawton for treated drinking water. Fort Sill has no other source of potable water currently available.

In 2010 a severe ice storm resulted in the temporary shutdown of the Lawton Medicine Park Water Treatment Facility highlighting concerns about potable water supplies during natural disasters and similar events. Fort Sill and local communities were without water for 38 hours.

In 2015 Fort Sill hosted a regional roundtable to discuss southwest Oklahoma's future water needs. Among those participating were legislators; state, county, municipal, rural, academia and private water conservationists; and Army engineers and leaders. The purpose of the collaborative event

was to discuss ways to solve water and drought issues in the region. It was noted the water challenges were not unique to Fort Sill and is a challenge facing all communities in the region. Participants were encouraged to identify water shortage problems and to work together in existing and new groups to come up with solutions and resources to meet the current and future water objectives in the Beaver-Cache watershed. The executive director for the Oklahoma State Water Resources Board (OWRB) discussed the hydrological cycle where communities should:

- Plan ahead and plan for the worst drought;
- Conserve as if they are always in drought;
- Reuse/recycle as much water as possible; and
- Look for innovative alternatives to freshwater for meeting water needs.

In 2016 Fort Sill awarded a contract for a water feasibility study to include alternative sources of potable water. As of the preparation of this JLUS the final report was not available.

Findings

- Fort Sill receives all of it potable water from the Lawton Water Treatment Facility in Medicine Park.
- Fort Sill and the surrounding local communities need to be prepared for emergencies including severe droughts, weather events, etc. where normal water supplies may not be available for periods of time.
- In 2010 Fort Sill and some surrounding communities were without water from the Lawton Water Treatment Facility for 38 hours as a result of severe weather which temporarily shut down the Lawton Water Treatment Facility.
- In 2015 Fort Sill hosted a roundtable to discuss future water needs. The OWRB Executive Director noted that innovative water need alternatives are important for communities to pursue.
- In 2016 Fort Sill awarded a contract to for a water feasibility study.

ISSUE WQQ-3	**Cumulative Effect of Jurisdictional and Private Wells Pulling from Same Groundwater Source** *A general concern was expressed about the number of wells in the JLUS Study Area and its unregulated impact on the overall water resources in this area. The concern also stems from the lack of regional water resources planning and coordination. This can impact all jurisdictions, Fort Sill, and the public.*

Compatibility Assessment

Most of Comanche County, the City of Lawton and Fort Sill are in the Beaver-Cache Water Planning Region. Within this planning region are several water basins used for planning purposes in assessing water resources by the OWRB. Two major bedrock aquifers, the Arbuckle-Timbered Hills and Rush Springs, are present in the northern portion of the Beaver-Cache Region, and two major alluvial aquifers, the Tillman Terrace and Red River, are located in the southern portion of the region. Minor bedrock aquifers in the region include the El Reno, Hennessey-Garber, Post Oak, and Southwestern Oklahoma. Minor alluvial aquifers include Beaver Creek and Cache-Creek. Table 5.20-1 provides a summary of groundwater resources in the planning region. The data show availability of some capacity for new groundwater permits, however these are estimates and in some cases the available permit estimates may exceed the actual aquifer storage capacity.

The Beaver-Cache Region's water needs account for about 2 percent of the total statewide demand. Regional demand is projected to increase by 27 percent (12,000 AFY) from 2010 to 2060. The majority of demand and largest growth in demand over this period will be in the Municipal and Industrial, and Crop Irrigation sectors.

Municipal and Industrial (M&I) demand is projected to account for approximately 51 percent of the region's 2060 demand. Currently, M&I demand is supplied by

- 89 percent surface water,
- 3 percent alluvial groundwater,
- 8 percent bedrock groundwater.

Crop Irrigation demand is projected to account for 28 percent of the 2060 demand. Currently, Crop Irrigation demand is supplied by:

- 25 percent surface water,
- 48 percent alluvial groundwater,
- 27 percent bedrock groundwater.

Livestock use in the region is predominantly cattle for cow-calf production. Livestock demand is projected to account for 7 percent of the 2060 demand. Currently, Livestock demand is supplied by:

- 35 percent surface water,
- 29 percent alluvial groundwater,
- 36 percent bedrock groundwater.

Oil and Gas (O&G) demand is projected to account for 4 percent of the 2060 demand. Currently, O&G demand is supplied by:

- 78 percent surface water,
- 5 percent alluvial groundwater,
- 17 percent bedrock groundwater.

Alluvial groundwater is currently used to meet 19 percent of the demand in the region. If alluvial groundwater is used to supply a similar portion of demand in the future, depletions from these aquifers are likely to occur in summer months, although projected depletions will be small relative to the amount of water in storage and permit availability. Water quality issues will remain a concern for the region and may constrain some uses of alluvial groundwater. The availability of water rights is not expected to constrain the use of alluvial groundwater supplies to meet local demand through 2060.

Bedrock groundwater is currently used to meet 17 percent of the demand in the region. Aquifer storage depletions are likely to occur during summer months. These depletions are small relative to the amount of water in storage and maximum annual yields of the aquifers. Water quality issues may constrain future Municipal and Industrial use (due to high fluoride levels) and Crop Irrigation use (due to high chloride levels) from portions of the Arbuckle-Timbered Hills aquifer. The availability of water rights is not expected to constrain the use of bedrock groundwater supplies to meet local demand through 2060.

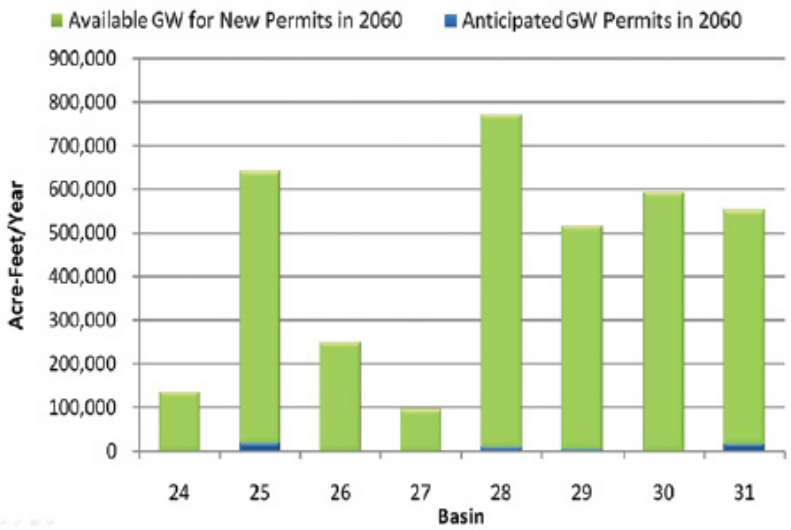
Table 5.20-1 Beaver-Cache Water Planning Region Groundwater Resources

Aquifer			Portion of Region Overlaying Aquifer	Recharge Rate	Current Groundwater Rights	Aquifer Storage in Region	Equal Proportionate Share	Groundwater Available for New Permits
Name	Type	Class[1]	Percent	Inch/Year	AFY	AF	AFY/Acre	AFY
Arbuckle-Timbered Hills	Bedrock	Major	10%	0.30-0.60	5,300	883,000	Temporary 2.0	429,800
Red River	Alluvial	Major	6%	2.50	6,900	287,000	Temporary 2.0	254,100
Rush Springs	Bedrock	Major	3%	1.80	17,500	1,558,000	Temporary 2.0	103,900
Tillman Terrace	Alluvial	Major	4%	2.90	11,900	598,000	1.0	68,200
Beaver Creek	Alluvial	Minor	2%	3.60	0	151,000	1.0	38,300
Cache Creek	Alluvial	Minor	9%	3.60	6,300	746,000	1.0	180,600
El Reno	Bedrock	Minor	2%	0.75	2,700	166,000	Temporary 2.0	62,600
Hennessey-Garber	Bedrock	Minor	61%	2.70	3,500	5,579,000	1.6	2,024,000
Post Oak	Bedrock	Minor	5%	3.60	1,600	2,500,000	2.0	190,000
Southwestern Oklahoma	Bedrock	Minor	5%	2.25	0	293,000	Temporary 2.0	217,100
Non-Delineated Groundwater Source	Alluvial	Minor			2,200			
Non-Delineated Groundwater Source	Bedrock	Minor			3,800			

[1] Bedrock aquifers with typical yields greater than 50 gallons per minute (gpm) and alluvial aquifers with typical yields greater than 150 gpm are considered major.
Source: https://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/WaterPlanUpdate/regionalreports/OCWP_BeaverCache_Region_Report.pdf

Figure 5.20-1 shows OWRB projections for groundwater permit availability in the Beaver-Cache Water Planning Region. According to OWRB, there is sufficient groundwater to supply potable water through 2060.

Figure 5.20-1. OWRB Groundwater Permit Availability Through 2060 in the Beaver-Cache Region



Source: https://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/WaterPlanUpdate/regionalreports/OCWP_BeaverCache_Region_Report.pdf

Findings

- The region around Fort Sill is within the Beaver-Cache Water Planning Region.
- The majority of potable water needs in this planning region is supplied by surface water resources and the remainder is supplied by groundwater resources.
- The OWRB projects the availability of groundwater permit capacity through 2060 in the planning region, however in some cases these planning estimates may be affected by actual aquifer storage capacities particularly where aquifers have not been fully delineated.

Please see the next page.

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