Fort Campbell
JOINT LAND USE STUDY

FORT CAMPBELL
Joint Land Use Study Update

OCTOBER 2009 - FINAL REPORT

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Acknowledgements

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The Fort Campbell Joint Land Use Study (JLUS) is a cooperative land use planning initiative between the U.S. Army and surrounding cities and counties of the region.

Partners in the JLUS study include: Montgomery County, Tennessee; Christian County, Kentucky; Trigg County, Kentucky; Stewart County, Tennessee; Clarksville, Tennessee; Hopkinsville, Kentucky; Oak Grove, Kentucky; Cadiz, Kentucky; Dover, Tennessee; Cumberland City, Tennessee; Pembroke, Kentucky; Lafayette, Kentucky and Fort Campbell.

This document serves as an ongoing guide to local government and Army actions to enhance compatibility around Fort Campbell and strengthen the civilian-military relationship.

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Executive Summary

Fort Campbell straddles the state line in north-middle Tennessee and southwestern Kentucky. Four counties surround the 105,000-acre installation: Montgomery County to the southeast; Christian County to the northeast; Trigg County on the northwest; and Stewart County on the southwest. Over the years, the cities and counties around Fort Campbell have grown along with the military, reinforcing a close economic and social relationship. This interdependence raises the central challenge of the Joint Land Use Study (JLUS).

In 1985, the Department of Defense's Office of Economic Adjustment (OEA) initiated the Joint Land Use Study (JLUS) program to create a participatory, community-based framework for addressing land use issues around military installations. The objectives of the JLUS are two-fold: to encourage cooperative land use planning between military installations and the surrounding communities; and to seek ways to reduce the operational impacts of military installations on adjacent land.

The Fort Campbell region was an early adopter of this coordinated approach to planning around military installations. In 1996, the Army and participating local governments completed a JLUS for the surrounding four-county area of Montgomery, Stewart, Christian and Trigg Counties.

Members of the Fort Campbell JLUS Partnership joined in initiating this effort to build on the 1996 study by revisiting current development issues, growth trends, and evolving mission needs and strengthening planning practices at the military/civilian interface.

While encroachment (incompatible land use) is currently not severe around Fort Campbell, changing market conditions, population growth, and increasing commercial activity are quickly reshaping development patterns near critical training operations. The JLUS is at its most effective as a proactive process for identifying and minimizing these foreseeable threats to military readiness, public safety, and regional quality of life.

Fort Campbell serves as a Power Projection Platform (PPP) and a major maneuver installation for the Army/Department of Defense. The post supports the training and deployment of over 30,000 assigned Soldiers and is one of the largest installations in the Army.

Fort Campbell occupies approximately 105,347 acres of land and is home to three of the U.S. Army's premier combat units (the 101st Airborne Division, the 160th Special Operations Regiment, and the 5th Special Forces Group), which includes a substantial portion of the Army's aviation assets. The post's tenant units operate at one of the highest tempos in the Army, and are among the first units deployed to theaters throughout the world. To maintain unit combat readiness, the installation must accommodate realistic and intense training exercises. Fort Campbell is also a significant economic engine for the region and the largest single (mobile) employer in Kentucky and Tennessee. According to statistics for Fiscal Year 2008, the installation circulated more than $3.5 billion throughout the area.

The community of Clarksville, Tennessee to the east of the post is the fastest growing of the region's population centers. The communities north of the post, Hopkinsville and Oak Grove, Kentucky, are also expanding. The most significant trend shaping compatibility issues near the installation

is the demand for residential housing that is increasing pressure to develop the remaining farms and wooded areas on the urban edge. U.S. Highway 41A and the recently expanded U.S. Highway 79 are also emerging as commercial corridors that could facilitate more intense development and produce light intrusion impacts affecting aviation operations at Fort Campbell, particularly around Campbell Army Airfield and Sabre Army Heliport.

As with all active military installations, routine training and readiness activities at Fort Campbell produce various impacts that can affect the quality of life in surrounding communities. Based upon stakeholder feedback and a review of existing conditions and key documents, the planning team identified the following issues as the primary threats to mission viability and regional quality of life:

- exposure of residents to noise associated with aviation operations
- exposure of residents and businesses to the risk of an aircraft accident
- visual interference with the night vision training environment associated with exterior lighting

Partner entities, including Fort Campbell and local jurisdictions, have taken a variety of steps to mitigate the operational impacts of training activity on the post. The purpose of this JLUS effort is to build on previous measures and to develop additional strategies to promote land use compatibility around the installation. A particular emphasis of this document is on sustainability, which seeks to meet current and future mission requirements, while safeguarding human health, improving quality of life, and enhancing the natural environment.

The resulting document is a series of tools that the Army and the local governments can choose to adopt during the implementation phase of the JLUS process. The JLUS emphasizes a prioritized list of land use compatibility strategies for local jurisdictions and Fort Campbell including:

- Adopting outdoor lighting standards to protect the Fort Campbell night vision device environment from light intrusion
- Controlling Development Density in the public safety buffer area at Campbell Army Airfield
- Controlling Development Density in the Rural Planning Area west of Sabre Army Heliport
- Conducting corridor management studies along U.S. Highway 41A and U.S. Highway 79
- Expand coordination and communication policies for development within the JLUS Area of Concern
- Continuing and expanding regional coordination
- Continuing to improve overall communication
- Strengthen and expand Memoranda of Understanding with regional stakeholders
- Exploring state compatibility measures
- Exploring use of state conservation programs
- Develop regional sustainability partnerships

1.0 Introduction / Study Purpose

FORT CAMPBELL
Joint Land Use Study Update

INTRODUCTION

Fort Campbell straddles the state line in north-middle Tennessee and southwestern Kentucky. Four counties surround the 105,000-acre installation: Montgomery County to the southeast; Christian County to the northeast; Trigg County on the northwest; and Stewart County on the southwest (See **Figure 1**). The communities of this region form the rapidly growing Clarksville, TN-KY Metropolitan Statistical Area.

The Army first activated Camp Campbell during World War II to train and mobilize armored divisions. Designated as a permanent installation in 1950, Fort Campbell's mission has continued to evolve in response to America's changing defense needs. Today the installation is home to three of the U.S. Army's premier combat units (the 101st Airborne Division, the 160th Special Operations Regiment, and the 5th Special Forces Group), as well as a substantial portion of the Army's aviation assets. The post's tenant units operate at one of the highest tempos in the Army, and are among the first units deployed to theaters throughout the world.

Over the years, the cities and counties around Fort Campbell have grown along with the military, reinforcing a close economic and social relationship. This interdependence raises the central challenge of the Joint Land Use Study.

As military installations expand, they bring new people and economic activity to an area. Communities build houses, schools and infrastructure, and create new jobs to support soldiers, civilian workers, and their families. More people begin to live and work in proximity to the noise and safety risks generated by military training. The presence of these civilian uses can in turn place pressure on installations to modify their operations, possibly compromising mission viability. This land use conflict, referred to as encroachment, threatens the ability of the U.S. military to conduct the realistic training activities necessary for combat readiness. Conversely, military training impacts such as noise from aircraft or weapons firing can diminish quality of life for affected local residents.

STUDY PURPOSE

In 1985, the Department of Defense's Office of Economic Adjustment (OEA) initiated the Joint Land Use Study (JLUS) program to create a participatory, community-based framework for addressing land use issues around military installations.

The objectives of the JLUS are two-fold:

1. to encourage cooperative land use planning between military installations and the surrounding communities; and
2. to seek ways to reduce the operational impacts of military installations on adjacent land.

The JLUS is as much about the process as it is the final document. It creates a public dialogue around the complex issues of land use, economic and population growth, infrastructure delivery, environmental sustainability, and mission change. The intent of the study is to highlight common interests—attractive development, healthier environments, more efficient infrastructure, economic prosperity, and better quality of life—and to protect the military mission, while sustaining local growth. The resulting report is not a binding document, but a dynamic blueprint of best practices and ideas to guide military and community policy actions in the years ahead.

The Fort Campbell region was an early adopter of this coordinated approach to planning around military installations. In 1996, the Army and participating local governments completed a JLUS for the surrounding four-county area of Montgomery, Stewart, Christian and Trigg Counties. The study articulated the following mission statement:

> *Recognizing the vital role of Fort Campbell and related facilities for the Kentucky and Tennessee communities and recognizing the vital role of Kentucky and Tennessee communities on the region, it is important that a military and community partnership is developed, which encourages balanced growth and development.*

Members of the Fort Campbell JLUS Partnership joined in initiating this effort to build on the 1996 study by revisiting current development issues, growth trends, and evolving mission needs and strengthening planning practices at the military/civilian interface. The JLUS Partnership is an ongoing regionally-based organizational framework that consists of city and county officials and Fort Campbell Garrison leadership.

The primary objectives of the JLUS Partnership are to:

- Enhance existing cooperative land use and infrastructure planning between Fort Campbell and surrounding communities.
- Develop a comprehensive land use strategy to preserve installation training capabilities and ensure the long-term viability of Fort Campbell Military Installation
- Refine current strategies to anticipate and minimize military operational impacts on adjacent lands and surrounding communities.

While encroachment is currently not severe around Fort Campbell, changing market conditions, population growth, and increasing commercial activity are quickly reshaping development patterns near critical training operations. The JLUS is at its most effective as a proactive process for identifying and minimizing these foreseeable threats to military readiness, public safety, and regional quality of life.

STAKEHOLDER AND PUBLIC PARTICIPATION EFFORTS

COMMITTEES

A successful JLUS requires active and broad participation to ensure that strategies reflect the diversity of the region and to build support for ongoing implementation. The JLUS planning team led by the project contractor EDAW worked closely with two committees throughout the planning process. The Executive Committee, consisting of local officials and Fort Campbell Garrison leadership, oversaw study efforts and accepted the final recommendations identified in this document.

Members of the Technical Coordinating Committee (TCC) assisted in developing practical encroachment reduction tools and delivering study recommendations to the Executive Committee for their evaluation. The TCC members are also the key military and community professionals who will implement strategies as part of daily decision-making on the installation and in the community. The planning team conducted the following committee meetings as shown in **Table 1**.

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Figure 1
Regional Context

October 2009

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STAKEHOLDER INPUT

The planning team also conducted a series of face-to-face interviews with members of the TCC to identify recent compatibility actions adopted by local communities, assess development trends, and establish priorities to guide policy development. The respondents also identified several existing challenges to implementing an effective land use compatibility plan around Fort Campbell, including the lack of planning capacity in local communities, rapid population growth and a lack of political support. Appendix I contains a summary of stakeholder feedback.

TABLE 1

Committee Meeting Dates

Meeting	Date
TCC Kick Off Meeting #1	March 6, 2007
TCC Meeting #2	May 1, 2007
Executive Committee #1	May 15, 2007
TCC Meeting #3	June 21, 2007
Public Meetings Round #1	July 16 through July 23, 2007
Night Vision Device Workshop	August 22, 2007
Executive Committee #2	September 5, 2007
Public Meetings Round #2	October 4 through October 10, 2007
TCC Meeting #4	December 11, 2007
TCC Meeting #5	August 19, 2008
Executive Committee #3	October 31, 2008
Public Meetings Round #3	March and April 2009
Public Review Period	May 2009
TCC Meeting #6	June 12,2009
Executive Committee	September 21, 2009

PUBLIC MEETINGS AND COMMUNITY OUTREACH

Active community involvement is a critical component of the JLUS. Public forums create a valuable opportunity to educate residents about training operations and the economic impact of the mission and to build trust between the military and community. Since study recommendations can affect nearby property owners, these sessions are also essential for conveying information about conservation or development options that maintain compatibility with adjacent training activities. The planning team hosted three rounds of public meetings in July and October of 2007 and March and April of 2009. The public forums consisted of a series of four evening sessions in Clarksville, Oak Grove or Hopkinsville, Dover and Cadiz. To continue engaging the public, the planning team has also produced a JLUS brochure that summarizes major study findings, recommendations, and maps.

OVERVIEW OF DOCUMENT

The remainder of the document consists of the following sections:

MILITARY MISSION

This section gives an overview of the installation's history, mission and economic impact.

REGIONAL DEMOGRAPHICS AND GROWTH TRENDS

This section profiles the partner jurisdictions and summarizes growth trends and recent development activity around the installation.

OPERATIONAL IMPACTS AND HAZARDS

This section identifies the impacts of the military mission on nearby civilian land and potential hazards to training activities caused by proximate off-post development.

COMPATIBILITY ANALYSIS

This section defines land use compatibility and highlights current or foreseeable land use conflicts in the communities surrounding Fort Campbell based on zoning and land use plans. This section also assesses threats to the night vision training environment.

OVERVIEW OF COMPATIBILITY EFFORTS

This section gives an overview of compatibility actions taken at the local, state, and federal levels of government. It also assesses the progress of partner governments in implementing the 1996 JLUS recommendations and explores the sustainable use of resources and protection of the environment.

COMPATIBILITY TOOLS

This section identifies general strategies to promote land use compatibility around Fort Campbell and a set of prioritized key actions to reduce the risk of encroachment in the most vulnerable areas.

IMPLEMENTATION PLAN

This section organizes recommended actions by partner.

TECHNICAL APPENDICES

The appendices contain guidelines and a series of sample or model tools for promoting land use compatibility around the installation.

2.0 Military Mission

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DESCRIPTION OF INSTALLATION/GENERAL OVERVIEW

Fort Campbell occupies approximately 105,000 acres of land. (See **Table 2** for a description of the physical features on post). Most of the post's major facilities cluster in a 15,000-acre area along the eastern boundary of the installation within the main cantonment area. The Army dedicates the remaining 90,000 acres of the post, including ranges, impact areas, and maneuver areas to training activities.

Fort Campbell serves as a premier Power Projection Platform (PPP) and major maneuver installation for the Army / Department of Defense. The post supports the training and rapid deployment of over 30,000 assigned soldiers and is one of the largest installations in the Army. Fort Campbell is the home of the only Air Assault Division in the world, the 101st Airborne Division (Air Assault). The installation is also the home of two prestigious Special Operations Command units, the 5th Special Forces Group (Airborne) and the 160th Special Operations Aviation Regiment (Airborne), and other important military units. The post's tenant units operate at a very high operational tempo and are among the most-deployed contingency forces in the Army.

To maintain unit combat readiness, the installation must accommodate realistic and intense training exercises. In addition to preparing its assigned tenant units, Fort Campbell provides training and mobilization support for numerous Army National Guard and Army Reserve units. Training facilities are also utilized by the other military services. Over 50,000 personnel train at the post each year.

TABLE 2

Physical Characteristics of Fort Campbell	
Total size	105,000 acres
Acreage in KY	37,000 acres
Acreage in TN	68,000 acres
Width	20.5 miles
Length	11.7 miles

HISTORY

Fort Campbell traces its roots to just before World War II. It is the only war-time camp that was planned and surveyed before Pearl Harbor. Following the Japanese attack in 1941, the U.S. Army Corps of Engineers acquired land between Hopkinsville, KY and Clarksville, TN and within a few months the War Department opened a war-time post called Camp Campbell. An initial cadre of one officer and 19 enlisted men arrived at Camp Campbell from Fort Knox in June of 1942.

During World War II, Camp Campbell was a major training and mobilization center for a new type of Army organization known as the armored division. Camp Campbell trained and deployed more than one-quarter of all soldiers who fought in the Army's armored divisions in World War II. The post also served as a prisoner-of-war camp for some 4,000 German soldiers. The vestiges of the fort's early history can be seen in a number of the 1940s era wooden facilities that are still in use today.

Camp Campbell remained operational after World War II and on April 14, 1950, the post became a permanent installation under the designation of Fort Campbell. During the 1950s, the installation grew and the Air Force relinquished control of Campbell Airfield to the U.S. Army. Construction of a control tower, crash fire station, Hangar 1, and two 25,000-square-foot barracks in 1959 elevated Campbell Army Airfield to the status of the U.S. Army's single largest airfield. The 11th Airborne Division was also assigned to Fort Campbell for several years (1949-1956) during this period.

The Cold War ushered in an era of change for the post. The Army fenced off 2,500 acres in the southeast corner of Fort Campbell for use as a top-secret nuclear weapons storage and modification facility. The military Armed Forces Special Weapons Project and the civilian Atomic Energy Commission jointly operated the facility named Clarksville Base. This facility was closed in the mid 1960s and the land was transferred to the Army.

In 1956, the 101st Airborne Division relocated to Fort Campbell from Fort Jackson in South Carolina. Nicknamed the "Screaming Eagles," the Division is well-known for leading the Allied assault prior to the D-Day invasion of Normandy.

During the absence of the 101st Airborne Division (Vietnam War) from 1967 to 1972, Fort Campbell became the home of the United States Army Training Center. More than 240,000 entry-level Soldiers received basic and advanced infantry training at Fort Campbell before receiving assignments around the world as individual replacements. Additionally, the 6th Infantry Division—a specially trained unit formed to provide assistance with civil disturbances—was also

activated and stationed at Fort Campbell during these years.

After the Vietnam War, the division switched its designation from "Airmobile" to "Air Assault." This change reflected the changing mission of the division, from guerrilla war in Southeast Asia to high intensity combat on the battlefields of Europe, or elsewhere.

Throughout the 1970s and 1980s, Fort Campbell kept up with the demanding changes and support requirements of the air assault division, and in the process, became home to two other highly specialized and strategically deployable units: the 5th Special Forces Group (Airborne) and the 160th Special Operations Aviation Regiment (Airborne).

The installation experienced another spurt of construction in the 1980s, adding a total of 1,418,371 square feet of facilities, a 241-bed hospital, an aviation maintenance hanger at Sabre Heliport, and an AH-64 Apache flight simulator.

Fort Campbell proved throughout the 1990s to be an exceptional installation, capable of supporting the training, deployment and family needs of the finest and most elite contingency forces in the U.S. Army. In 1991, the 101st and other Fort Campbell units deployed in support of Operation Desert Shield/Desert Storm. In addition to major operations, Fort Campbell Soldiers also supported humanitarian relief efforts in Rwanda and Somalia, and supplied peacekeepers to Bosnia, Haiti and Kosovo in the decade that followed Operation Desert Storm.

The United States was again called to war after the Sept. 11, 2001 terrorist attacks on the World Trade Center and the Pentagon. Since that time, Fort Campbell units have been on multiple deployments to Afghanistan and Iraq in support of Operation Enduring Freedom and Operation Iraqi Freedom.

CURRENT MISSION

The primary mission of Fort Campbell is to advance the combat readiness of the 101st Airborne Division (Air Assault) and the other non-divisional units posted at the installation through training, mobilization and deployment. The Commanding General of the 101st Airborne Division serves as the Installation Commander (and Senior Mission Commander) for the post.

Fort Campbell is a U.S. Army Installation Management Command (IMCOM) installation and its garrison staff supports the 101st Airborne Division and other assigned units. The garrison mission is to support expeditionary forces and power projection capabilities; to sustain, transform, and modernize the installation; to enhance well-being for the military community; to transform business processes to become effective, efficient, and equitable; and to develop and sustain an innovative, highly capable, mission focused workforce.

POST DEMOGRAPHICS

Fort Campbell supports a total population of 180,786, including a military component of 30,000. **Table 3** shows the total population profile of the installation and includes active military, family members, civilian employees, contractors, reserve component and military retirees. The post accommodates more than 60,000 people each day.

Soldiers assigned to Fort Campbell, along with visiting Army units, U.S. Army Reserve, National Guard, U.S. Air Force and Marine units use the installation's airfield facilities, training areas, and firing ranges 365 days a year. The installation serves as a Premier Power Projection Platform that can deploy combat equipped soldiers, tactical vehicles, weapons and ammunition, and logistical equipment by air, rail, water, or land. To fulfill this mission and to support current military operations in Afghanistan, Iraq and other locations, the post maintains a very high operational intensity.

TABLE 3

Population Profile at Fort Campbell	
Military	30,537
Family Members	45,806
Civilians	4,649
Contract Employees	3,815
Retirees & Family Members	95,521
Reserve Component	755
Total Supported	180,786

MAJOR TENANT UNITS

Fort Campbell's major units include the 101st Airborne Division (Air Assault), 160th Special Operations Aviation Regiment (Airborne), 5th Special Forces Group (Airborne), 86th Combat Support Hospital, 52nd Ordnance Group (EOD), U.S. Army Medical Activity Blanchfield Army Hospital, and the U.S. Army Garrison Fort Campbell (See **Table 4**).

TABLE 4

Major Units at Fort Campbell	
UNIT	SOLDIERS/EMPLOYEES
101st Airborne Division (Air Assault)	20,539
160th Special Operations Aviation Regiment (Airborne)	1,381
5th Special Forces Group (Airborne)	2,191
86th Combat Support Hospital	438
52nd Ordnance Group (EOD)	202
Blanchfield Army Hospital	1,189*
U.S. Army Garrison Fort Campbell	7,030*
* indicates totals that include military and civilian personnel	

101st Airborne Division (Air Assault)

"The 101st Airborne Division is the world's only Air Assault Division"

The 101st Airborne Division is the largest operational unit stationed at Fort Campbell. Nicknamed the "Screaming Eagles," the 101st is the Army's only Air Assault Division. The unit is a joint air-ground division with an authorized strength of 20,539 soldiers. The division, which has been at Fort Campbell since 1956, is often one of the first units to deploy to theatre and its missions often combine ground and air operations over large areas of land.

In 2005, Army Transformation resulted in the addition of a fourth infantry brigade combat team (BCT) to the 101st. Unit training is focused around the combat readiness requirements of four brigade combat teams, two combat aviation brigades, and a Sustainment brigade. For this reason, sufficient training for the division must include the ability to use the entire installation and its facilities for ground and air exercises, as well as the ability to fly long distances outside of the installation.

160th Special Operations Aviation Regiment (Airborne)

"Nightstalkers Never Quit"

Since 1981, the mission of the 160th Special Operations Aviation Regiment (SOAR) at Fort Campbell has been to organize, equip, train, resource and employ Army special operations forces worldwide in support of contingency missions and warfighting. The unit has an authorized strength of 1,381 soldiers. The 160th SOAR is the Army's premier night fighting aviation force and the Army's only Special Operations Aviation force. Adequate training requires the unit to fly at low levels over long distances of minimally lit land using night vision goggles (NVG).

5th Special Forces Group (Airborne)

"The 5th SFG(A) has been engaged in near continuous combat operations since 11 SEP 2001"

The 5th Special Forces Group is an airborne-qualified unit and its mission is to conduct special operations (unconventional warfare, foreign internal defense, special reconnaissance, direct action, combating terrorism, counter-proliferation, and information operations) in support of the Commander, U.S. Central Command. The unit, which has been at the post since 1986, has an authorized strength of 2,191 airborne qualified soldiers. The addition of a fourth battalion has resulted in a recent increase in the strength of the 5th SFG.

86th Combat Support Hospital

"Most Frequently Deployed Hospital in the U.S. Army"

The mission of the 86th Combat Support Hospital is to deploy rapidly and establish Level III health service support to joint and/or coalition forces engaged in operations and to assume Medical Task Force command and control and conduct split based operations. The unit has an authorized strength of 438 soldiers.

U.S. Army Medical Activity Blanchfield Hospital

Blanchfield Army Hospital is a 494,000 square foot, 66-bed facility that delivers soldier health services and operates two clinics, a Department of Social Work, and a Behavioral Health Support Center. Its mission is to ensure healthy soldiers, to deploy trained and ready medical forces, and to manage the health care of soldiers, families, and retirees. The hospital's 1,137 employees support a total population of 102,161.

52nd Ordnance Group

The 52nd Ordnance Group (Explosive Ordnance Disposal) is the command and control headquarters for all Army Explosive ordnance companies and battalions in the continental United States. The unit oversees three battalions that are highly trained to defuse weapons of mass destruction and improvised explosive devices such as roadside bombs. The 52nd is currently transitioning to Fort Campbell from Fort Gillem, Georgia. When this transition is complete, more than 300 EOD Soldiers will be stationed at Fort Campbell to support assigned brigade combat teams.

US Army Garrison

The directorates, business centers and numerous agencies that make up the U.S. Army Garrison at Fort Campbell operate the installation on behalf of the Army Installation Management Command. Among the services that are provided by the garrison staff are housing, contracting and purchasing, information management, community activities, installation business, public works and public safety. The garrison and its supporting agencies comprise approximately 7,030 Soldiers, civilian employees and contractors.

Along with the major units, the post's other tenants include:

- Air Assault School
- AAFES
- American Red Cross
- Directorate of Contracting
- Defense Commissary Agency
- Document Automation & Production Services (DAPS)
- Defense Reutilization & Marketing Office
- U.S. Post Office
- Fort Campbell Schools
- NCO Academy
- Army Trial Defense Service
- Army Trial Judiciary, 2d Judiciary Circuit
- Army TMDE Support Center
- AFGE local 2022 Union
- 2-44 ADA Battalion
- 716th MP Battalion
- U.S. Army CID, 1000th MP Bn
- Co C, 1st Bn, 58th AVN Regiment
- 902d MI Group
- 31st MP Det CID (DSE)
- 621 Air Mobility Ops Grp
- A Co, 1-58th ATC
- OL-U, 621 AMOG (AMC)
- Special Operations Recruiting Team
- U.S. Air Force 19th ASOS
- U.S. Air Force Det 2, 10th Combat Weather Squadron
- Directorate of Health Services
- TN Valley Veterinary Command
- AMC Logistics Support Element
- 326th Engineer Battalion
- 1000th MP BN (CID)
- 18th Weather Squadron, Det. 4
- 1108th/1109th/1110th USAR Mobilization Support BNs

As with most Army installations, Fort Campbell functions as a self-sustaining community for its personnel and their families, offering on-post housing, a complete K-12 school system, health care facilities, child care facilities, personal services, recreation facilities, and a town center with numerous retail facilities.

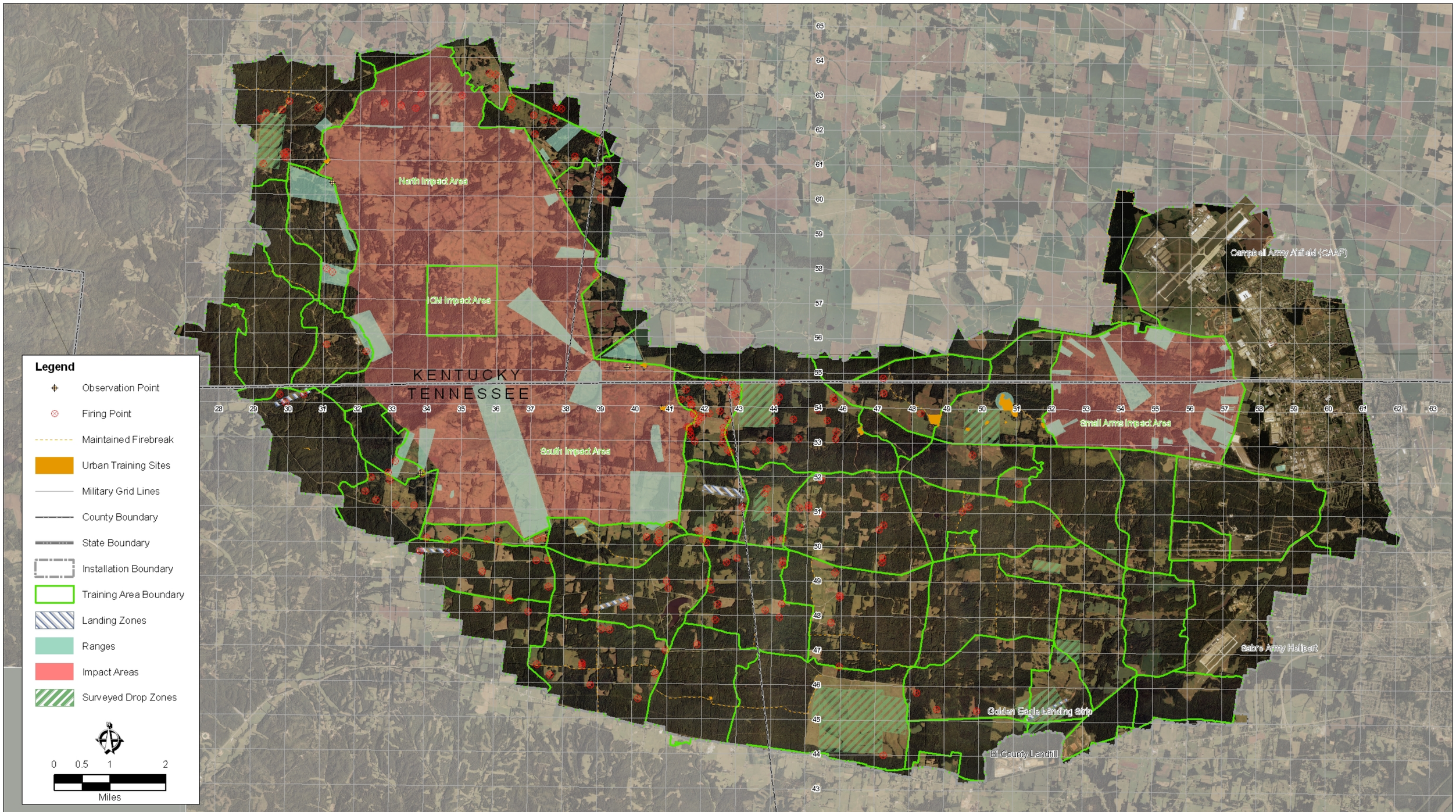

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Figure 2
Fort Campbell Training Areas

October 2009

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TRAINING RESOURCES

TRAINING RANGES

The installation has two impact areas for live fire training that comprise a total of 26,627 acres of land (See **Figure 2**). Fort Campbell has a total of 53 training areas, 92 ranges and 130 artillery firing points, four sets of Brigade Qualification Training Ranges, a Special Forces Range Complex, fifteen urban combat training sites, and seven shoot-houses (see **Table 6**). Ranges accommodate training and qualification firing for individual and crew-served weapons systems, as well as anti-tank weapons, demolitions, helicopter gunnery, 25 mm gun and 120 mm tank gun firing. The installation also has approximately 340 pre-surveyed artillery and mortar firing points capable of supporting 105 mm through 155 mm howitzers and 60 mm through 120 mm mortars.

Aside from the ranges, Fort Campbell's other training facilities include five drop zones, seven observation points, four Military Operations in Urban Terrain facilities, and five landing zones. The installation also has a Multi-Purpose Range Complex (MPRC) and a special forces training complex. Since the mix of forest and open land at Fort Campbell creates favorable conditions for light infantry maneuvers, the Army designates approximately 64,000 acres outside of the impact areas as maneuver space.

AIR CAPABILITIES

Fort Campbell contains facilities for both fixed-wing and rotary-wing aircraft. Campbell Army Airfield is one of the largest airfields in the U.S. Army, spanning 2,500 acres and capable of accommodating any aircraft in the Department of Defense (DoD) inventory. The airfield has two runways, an 11,800 foot primary strip and a 4,500 foot secondary strip, with a Maximum on Ground (MOG) capacity to accommodate 15 C-5 or 20 C-17 aircraft. CAAF operates as a full-service 24/7/365 DoD airfield capable of transporting soldiers and equipment directly to a theater of operation. It also serves as a HURRIVAC (Hurricane Evacuation) site for all military services during inclement weather.

Sabre Army Heliport is south of the installation's cantonment area and serves as the installation's primary airfield for Night Vision Device (NVD) training. The facility has a 4,450 foot runway used primarily for rotary wing aircraft; however, the strip can support C-17 cargo aircraft and other fixed-wing aircraft.

TABLE 5

Annual Aviation Operations at Fort Campbell

	2001	2002	2003*	2004*	2005*	2006*	2007	2008*
HOP ARAC	83,785	89,600	68,731	92,383	109,833	123,183	119,303	100,907
ASR/PAR	3,129	4,375	2,244	6,155	2,056	2,146	2,978	2,505
HOP TWR	241,908	299,647	119,285	206,384	208,599	146,435	224,493	173,587
EAGLE AIC	137,022	145,009	22,500	104,801	69,828	49,476	148,529	73,655
EOD TWR	73,401	78,901	10,294	59,230	43,901	42,775	113,718	71,769
TOTAL	539,245	617,532	223,054	468,953	434,217	364,015	609,021	422,423

Notes:
HOP ARAC - Campbell Army Radar Approach Control
HOP TWR - Campbell Control Tower
EOD TWR - Sabre Tower
ASR/PAR - Airport Surveillance Radar approach/Precision Approach Radar
EAGLE AIC - Eagle Airspace Information Center

* a large number of units were deployed during these years, resulting in the lower aircraft operations numbers

In addition to CAAF and SAH, Fort Campbell provides 5 helipads throughout the cantonment area, as well as an unpaved forward landing strip (Golden Eagle) in the southeastern portion of the installation used for joint training operations.

Each of the tenant units at Fort Campbell follows established organizational Mission Essential Task Lists that support training operations. Training exercises to achieve each task include, among others, low level flight by aircraft on post at just above tree-top or ground level (also referred to as "nap of the earth" flight or "tactical terrain flight" training); parachute operations (including personnel and heavy payload drops); driving with night vision goggles (NVG) on roadways and across variable terrain; and clearing fields of fire (for defensive positions).

Table 5 displays the number of aviation operations at Fort Campbell from the years 2001 to 2008. As reflected in these figures, military personnel at Fort Campbell conduct a significant number of aviation operations on lands surrounding the installation. After a period of decline in aviation activity due to unit deployments, operations increased to more than 600,000 in 2007 and totaled 422,000 in 2008, reflecting another cycle of deployments.

AIRSPACE

Protected airspace around Fort Campbell is essential to accommodate military testing and training. Airspace corridors away from the post are also critical to connect the installation to other military facilities and training or operations areas.

Military Operations Area (MOAs)

An MOA is airspace that separates certain non-hazardous flight activities from Instrument Flight Rules (IFR) traffic and identifies Visual Flight Rules (VFR) traffic. Within these areas, the military conducts flight activities, such as acrobatic or abrupt flight maneuvers, intercepts, air combat maneuvering missions, aerial refueling and unmanned aerial vehicle flights. MOAs are three dimensional areas. In addition to mapped boundaries, MOAs have a defined floor (minimum altitude) and ceiling (maximum altitude). These altitudes can range from 500 feet above the surface to 17,999 feet above mean sea level (MSL). See **Figure 3**.

Military Training Routes (MTRs)

MTRs are similar to complex systems of interrelated and interdependent highways in the sky that connect military installations, ranges and operation areas. DoD high performance aircraft use Visual Route (VR) and Instrument Route (IR) to conduct low-altitude navigation and tactical training at airspeeds in excess of 250 knots and at altitudes as low as just above surface level. VR and IR routes are low-level, high speed routes that enable the pilot to develop the skills necessary to avoid detection by enemy radar. DoD cargo aircraft use Slow Routes (SR) to conduct low navigation and tactical training at airspeeds less than 250 knots and at altitudes as low as just above surface area. Fort Campbell has five slow routes that start at various points within 250 miles of the installation and all five terminate within the boundaries of the post at select drop zones that are used for parachute drops, container drops or assault landings.

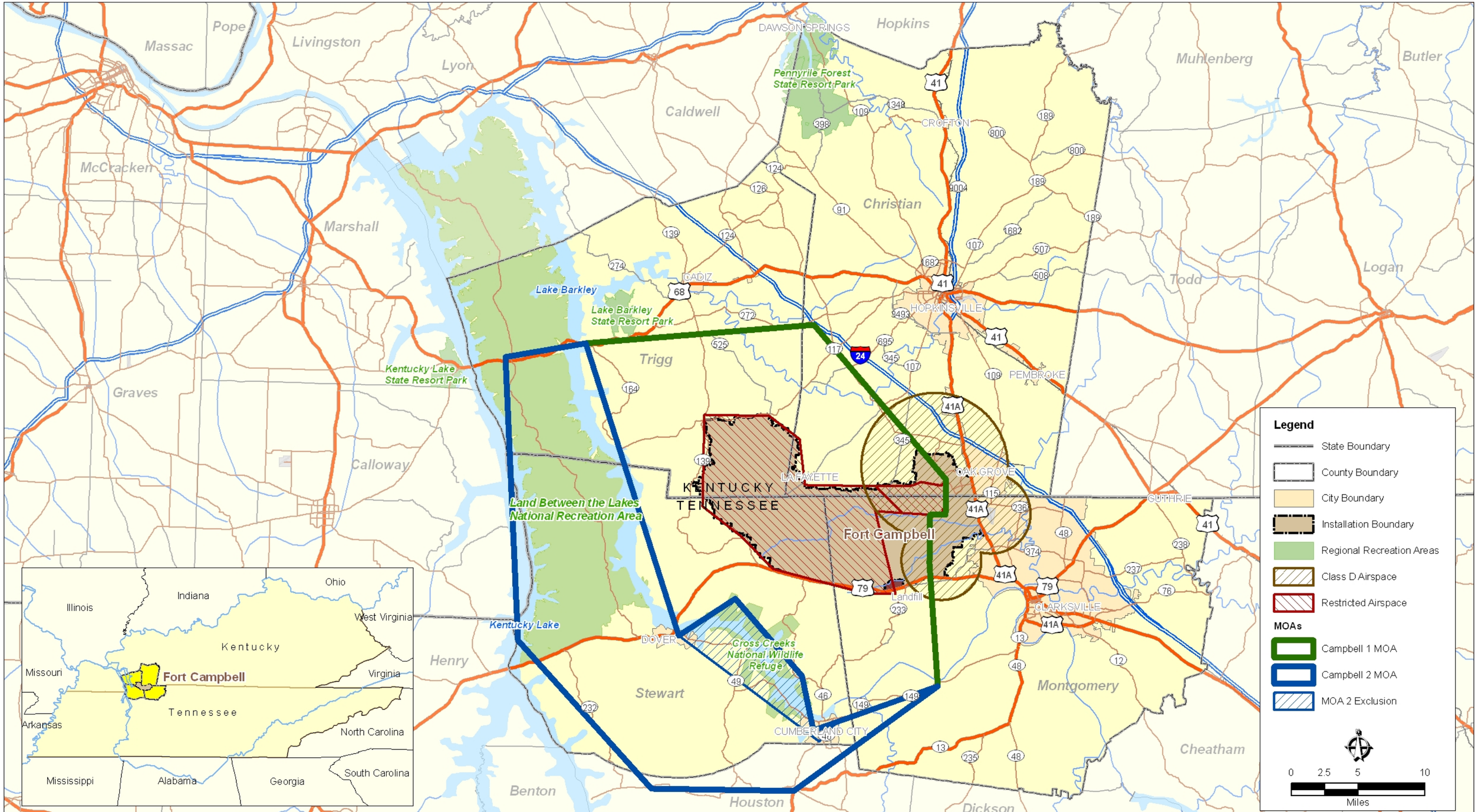

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Figure 3
Military Operating Areas (MOAs)

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Restricted Areas (RAs)

Restricted Areas (RAs) are a critical asset to the DoD because they allow for the use of weapons for training and testing purposes, such as ground weapons, mortar or artillery firing, aerial gunnery, live and inert practice bomb drops, guided missile testing and unmanned aerial vehicles or systems. RAs provide locations for training and testing to support the combat readiness of aviation and ground combat units, while separating these activities from the public and general aviation users. Fort Campbell's RAs start at the surface with a ceiling altitude of 27,000 feet. See **Figure 3**.

Altitude Reservation (ALTRVs)

Altitude Reservation (ALTRVs) can be stationary or moving. A moving ALTRV will normally include the en route and arrival phase of flight up to and including the arrival holding pattern. A moving ALTRV can be assigned to an aircraft flight plan as a block of altitudes (i.e., 5,000 block 10,000 feet) and flow for several hundred miles across the country. A stationary ALTRV will normally define a fixed airspace area to be occupied, as well as the specific altitudes and time periods the area will be in use. Fort Campbell often uses stationary ALTRVs to support armed forces training involving multiple DoD departments.

Controlled Firing Area (CFA)

Controlled firing areas contain civilian or military activities that can be hazardous to non-participants of the exercise or event. They differ from MOAs and RAs in that radar or a ground lookout observer indicates when an aircraft might be approaching the area, triggering a suspension of all activities. The Federal Aviation Administration does not chart CFAs since it does not require an aircraft not participating in the exercise or event to change its flight path. A CFA can be added to the airspace above an RA to fire weapons that exceed the maximum altitude of the RA on a random basis.

Air Refuel Routes (ARs)

Air refuel routes permit aircraft to refuel while in flight. The capability to refuel while airborne enables aircraft with limited fuel ranges to fly long distances or long periods of time without landing for additional fuel. ARs can be established for fixed wing aircraft or helicopters. Helicopter routes are generally below 10,000 feet mean sea level (MSL) and fixed wing routes are normally above 20,000 feet MSL. Fort Campbell has nine established ARs.

Exemptions

Exemptions are authorizations to deviate from Federal Aviation Regulations. Most exemptions are granted for national defense purposes or are in the public interest. Due to night vision device training, the Army has been granted an exemption to operate at night without lighted aircraft position lights. The exemption clarifies restrictions that the Army must meet to use the exemption. These restrictions ensure that non-participating military or civilian aircraft will be safely avoided by aircraft operating without position lights. The exemption, authorized in 1984, exists for select areas of airspace within 100 miles of Fort Campbell from the surface up to and including 500 feet above ground level.

Figure 4 also graphically illustrates the Federal Aviation Administration regulated imaginary surfaces (based on departure and landing directions and traffic patterns) around CAAF and SAH. These imaginary surfaces are used to protect the airfield/airspace during landings and take-offs, and includes the Primary Surface, Runway Clear Zone, Accident Potential Zones I and II, Approach-Departure Clearance Surface, Transitional Surface, Inner Horizontal Surface, Conical Surface and Outer Horizontal Surface. Additional information about each area is contained in the technical appendix. It is essential to control the height of structures in these areas to minimize any physical interference with flight routes. The Army currently owns navigational easements (which restrict structure heights, exterior lighting and certain land uses) in a fan-shaped area (See **Figure 7**) that projects to the northeast of CAAF.

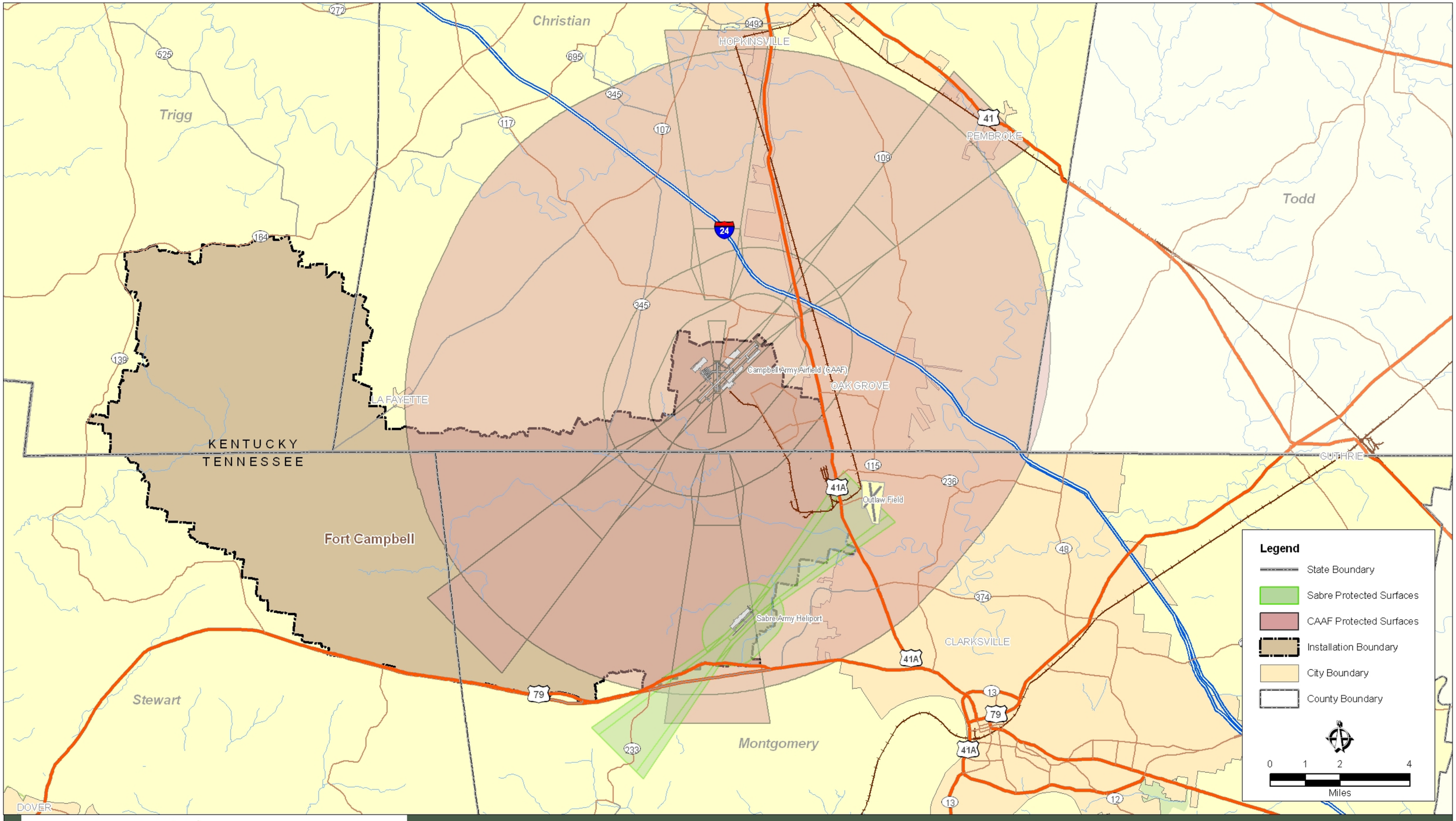

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Figure 4
Protected Airspace Surfaces for CAAF and Sabre Army Heliport

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RAIL CAPABILITIES

Rail is the primary method of deploying equipment to the Port of Debarkation. Fort Campbell has 17 miles of on-post track, 10 ramps, and a concrete staging area, supporting a rail operation facility that can process 240 railcars in a 24 hour period. The track connects to the CSX main line.

LINE HAUL ROUTE CAPABILITIES

Fort Campbell is within four miles of Interstate 24. The post has the capacity to load 160 commercial carriers in a 24 hour period for transport along the interstate system to the Port of Debarkation.

BARGE ROUTE CAPABILITIES

The Army maintains a barge facility on the Cumberland River, approximately 20 miles from Fort Campbell. The barge can transport rolling stock, containers and aircraft, primarily for training deployments.

TABLE 6

Summary of Land Use and Training Facilities at Fort Campbell	
Training and Maneuver Areas	64,000 acres
Impact Areas	26,000 acres
Built-up Areas (Cantonment)	15,000 acres
Facilities	3,918 buildings/structures
Artillery Firing Points	130
Basic Weapons Marksmanship Ranges	45
Live Fire Maneuver Ranges	21
Observation Points	7
Drop Zones/Landing Zones	5
Military Operations Urban Terrain (MOUT) Training Facilities	15
Modified Qualification Training Ranges	4
Shoot Houses	7
Urban Assault Course	
Demolition Range	
C130 Flight Landing Strip (Golden Eagle)	
Campbell Army Airfield	
Special Operations maneuver range	
Multi-Purpose Range Complex(MPRC)(RG28)	
Sabre Army Heliport	
Distributed Learning Center	
Multipurpose Training Range (RG46)	
Special Forces Training Complex	
School of Combat Medicine	
Flight Simulators	
Convoy Live-Fire Training Site	
Breach Facility (RNG 44)	

Since 1999, Fort Campbell has undertaken $1.2 billion in construction activity to enhance Power Projection/Deployment capabilities, training facilities, barracks, force protection/physical security, housing, maintenance facilities, utilities, well-being/community facilities, and administrative/ support facilities.

MILITARY ECONOMIC IMPACT

Fort Campbell is a significant economic engine for the region and the largest single mobile employer in Kentucky and Tennessee. According to statistics for FY 2008, the installation circulated more than $3 billion throughout the area, including direct payroll, construction, and contracts (See **Table 7**). The Army also estimates that over 14,000 soldiers and 40,000 family members live off-post in the Clarksville, TN-KY Metropolitan Statistical Area.

TABLE 7

Total Economic Impacts in the Region, FY 2008	
Major Construction	$350 Million
Appropriated Funds Contracts (Montgomery/ Christian)	$45 Million
Payroll	$2.64 Billion
Additional Sources	$15 Million
Total Economic Disbursement	$3 Billion

Aside from the direct expenditures associated with salaries and contracts, military activity produces significant indirect economic impacts. Active duty and civilian employees, retirees, and dependents spend their paychecks on local goods and services, generating jobs in retail and other supporting sectors. Employers then hire more workers, who in turn make local purchases, further cycling dollars through the economic region. According to a fiscal analysis conducted by the Kentucky Commission on Military Affairs, a gain of 1,000 soldiers at Fort Campbell will result in 1,033 new jobs and a payroll increase of $30 million in the State of Kentucky alone. The overall estimated employment multiplier associated with the number of military personnel assigned to a military installation typically ranges from 1.08 to 1.80. This means that for each 100 military personnel assigned to the post, the private sector will create between 108 and 180 permanent new jobs. Conservative estimates indicate that Fort Campbell had an additional multiplier impact on the region of at least $500M in FY08 (based on FY08 payroll figures).

Combat pay further accelerates the multiplier effect within the regional economy by generating more disposable income for military families. As a result of their last deployment, members of the 101st Airborne Division received increased take-home income of approximately $180 million due to tax-free income/combat pay during deployment. Soldiers also received $53 million in retention bonuses in FY08.

The Clarksville-Montgomery County Economic Development Council completed a Labor Market Assessment for the Fort Campbell region in May of 2007. The study identified the skilled and

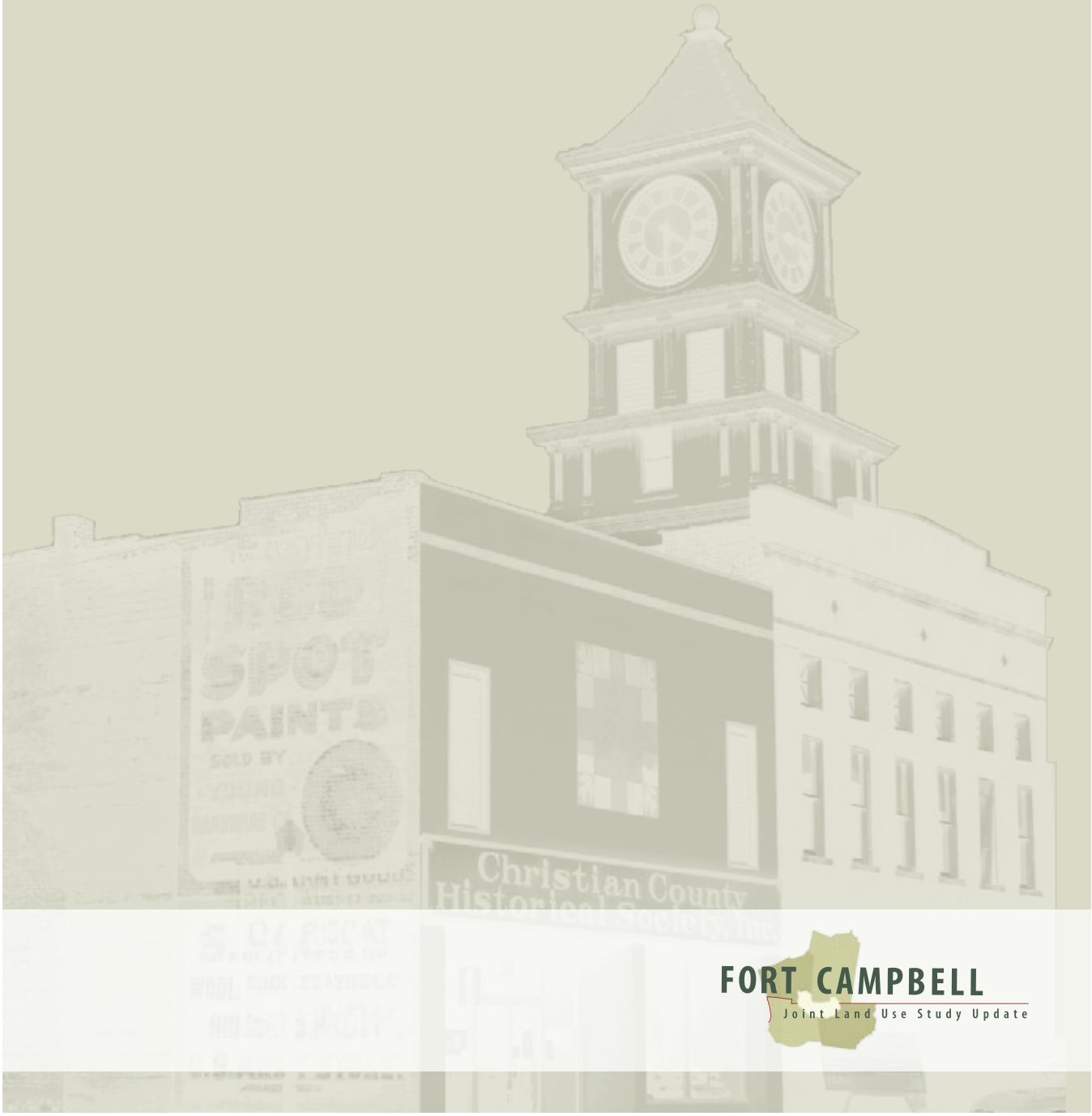
talented potential workforce of Army retirees and spouses as one of the region's strongest economic assets. Retention statistics reinforce the positive relationship between quality of life on the installation and in the surrounding communities. The 101st Airborne Division/ Fort Campbell had the highest re-enlistment rate in FY06 with over 60 percent of re-enlisting soldiers choosing to remain at Fort Campbell.

FUTURE MISSION

The convergence of several major DoD and Army initiatives has heightened the high operational tempo of the post. The Base Realignment and Closure decision, Global Defense Posture Realignment, Army Modular Force, and the Global War on Terror Support have resulted in a net increase of over 7,000 personnel at Fort Campbell since 2003. Under the latest Army projections, Fort Campbell will continue to support around 30,000 soldiers.

Currently, the planned force modernization and mission transformation are not expected to affect training requirements for ranges or maneuver areas. However, these efforts will likely continue demanding the heavy use of installation facilities into the foreseeable future. The installation has plans for the construction of a number of major range and training facilities through 2013, including the Automated Sniper Field Fire Range, Rappelling Training Area, Infantry Squad Battle Course, Scout Gunnery Range, Shoot House, Urban Assault Course, and Range Operations Command and Control Complex.

3.0 Regional Demographics and Growth Trends



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REGIONAL OVERVIEW

Once in a primarily rural area, Fort Campbell is now part of the Clarksville, TN-KY Metropolitan Statistical Area (MSA), which includes the four counties of Montgomery, Christian, Trigg, and Stewart. The four counties comprise a total land area of more than 1.4 million acres. This JLUS is focused primarily on land within the Area of Concern (AOC) in proximity to training operations and aviation activity conducted at and around Fort Campbell. The AOC covers more than 255,000 acres beyond the installation boundary. As shown in **Table 8**, the surrounding counties have 15 to 20 percent of their total land area inside the AOC, and thus potentially subject to operational impacts associated with the military mission.

TABLE 8 Size of Region and Study Area

COUNTY	ACRES	AOC ACRES	% ACRES IN AOC
TN			
MONTGOMERY	348,104	66,765	19.18%
STEWART	315,658	49,477	15.67%
KY			
CHRISTIAN	463,479	92,712	20.00%
TRIGG	307,985	46,471	15.09%
TOTAL	**1,435,226**	**255,425**	

POPULATION GROWTH

The presence of Fort Campbell, including the large number of military retirees and families drawn to the area, the comparatively low cost of living, and continued exurban growth from Nashville have all combined to spark regional expansion. According to the Clarksville-Montgomery County Economic Development Council, the MSA will grow significantly over the next decade, reaching a population of approximately 323,000 by 2020 (See **Table 9**).

According to the Tennessee and Kentucky state data centers, the Clarksville MSA is likely to gain over 100,000 net new residents by 2025, equaling a rate of about 5,000 new residents annually for the next 20 years. Moreover, the gains will accelerate over each consecutive five-year period, culminating with a net increase of 27,000 residents between 2020 and 2025. Montgomery County will absorb most of the growth, adding over 20,000 residents between 2020 and 2025.

TABLE 9 Population Trends in the Clarksville MSA and Counties

	1990	2000	% CHANGE 90-00	2010	% CHANGE 00-10	2020	% CHANGE 10-20
MSA	169,439	207,033	22%	271,793	31%	323,872	19%
CHRISTIAN COUNTY	68,941	72,265	5%	80,199	5.7%	90,981	6.7%
CITY OF CLARKSVILLE	75,494	103,455	37%	126,901	23%	155,817	23%
MONTGOMERY COUNTY	100,498	134,768	34%	163,927	22%	202,680	24%
STEWART COUNTY	9,489	12,068	27%	14,595	21%	16,960	16%
TRIGG COUNTY	10,361	12,597	22%	14,016	11%	15,455	10%

Source: Historical and Projected Populations for State of Kentucky, Area Development Districts, and Counties; UT Center for Business and Economic Research; Source: Clarksville-Montgomery County Economic Development Council; Hopkinsville-Christian County Planning Commission

The Kentucky State Data Center and Hopkinsville-Christian County Planning Commission also project steady localized growth in areas north of Fort Campbell. While still primarily rural in character, both Trigg and Stewart Counties also show steady growth rates that could result in the increased risk of land use conflict along the western edge of the installation.

Figure 5 shows population density around Fort Campbell as of 2005. The highest regional densities are along U.S. Highway 41A adjacent to the installation's cantonment area and in the urban cores of Clarksville and Hopkinsville. Other significant pockets of housing posing a higher risk of encroachment are along the far eastern portion of U.S. Highway 79 near SAH and in the City of Oak Grove in proximity to CAAF operations.

COUNTY PROFILES

MONTGOMERY COUNTY, TN

Montgomery County, which lies 40 miles northwest of Nashville, is 543 square miles. The county seat and regional urban center of Clarksville is Tennessee's fifth largest, and one of the state's fastest growing cities. Montgomery County has grown beyond its original agricultural roots to become a major transport, industrial, retail, and professional center in the state. The county is home to many Fort Campbell personnel, the students and faculty of Austin Peay State University, and a vibrant cultural and outdoor recreational scene focused around historic downtown Clarksville and the Cumberland River. Clarksville-Montgomery County lies to the east and south of Fort Campbell with approximately 19 percent of its land area falling within the JLUS Area of Concern.

STEWART COUNTY, TN

Stewart County, set along the Cumberland River, is celebrated for its cultural and outdoor recreation amenities, including the Fort Donelson National Battlefield and Cemetery, Cross Creeks National Wildlife Refuge, Lake Barkley, Kentucky Lake, Land between the Lakes National Recreation Area, Dover City Lick Creek Park, Dyer's Creek Park and Paris Landing State Park. This mostly rural county has a total land area of 493 square miles and contains a significant proportion of federally owned land. Its two municipalities are the county seat of Dover and Cumberland City. Stewart County sits to the southwest of the post. The JLUS Area of Concern encompasses about 15 percent of county land.

CHRISTIAN COUNTY, KY

Christian County, Kentucky, which lies north of the Kentucky/Tennessee border is one of the nine counties in the Pennyrile Area Region in Western Kentucky. Its county seat and major municipality

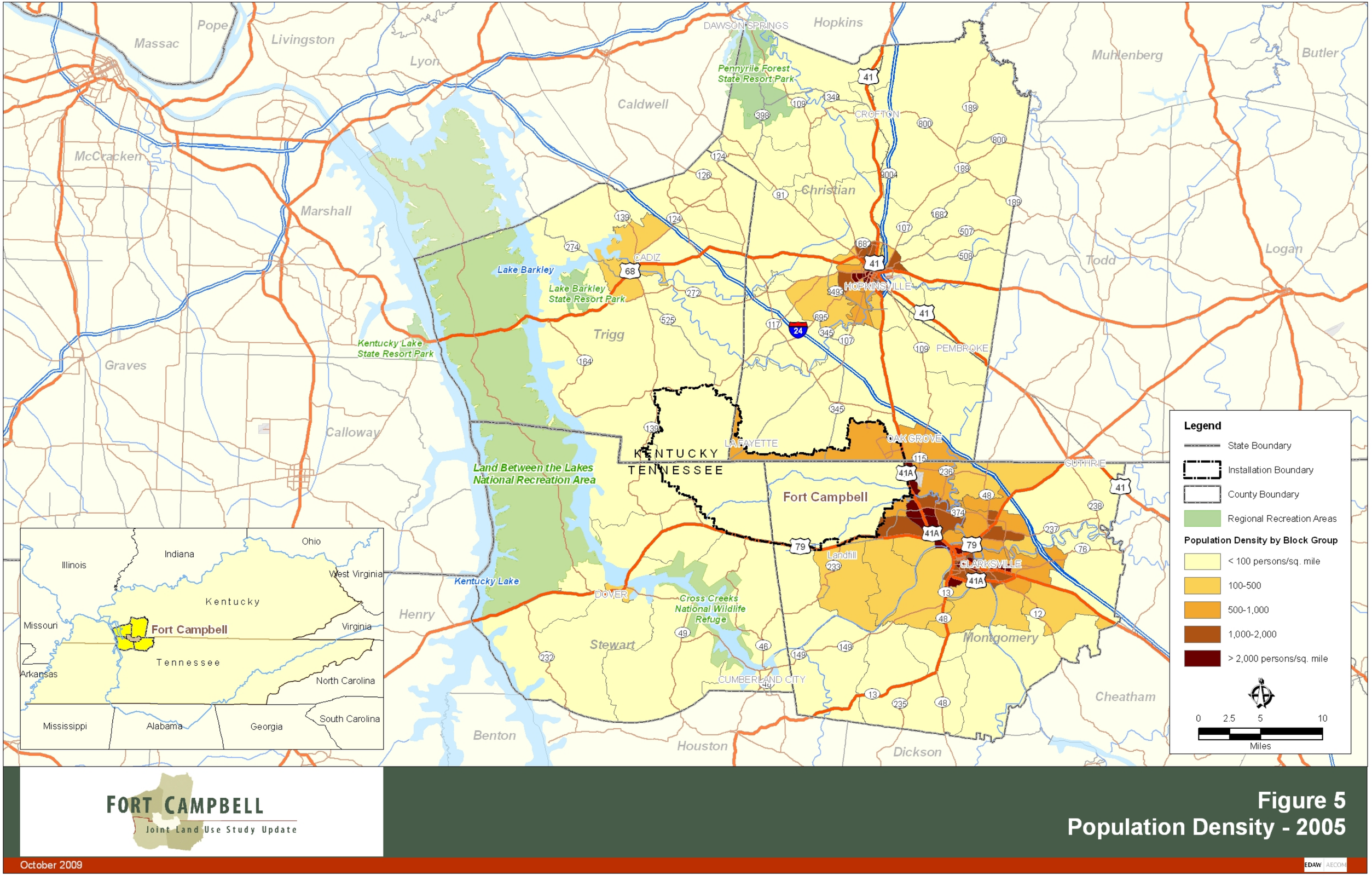

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Figure 5
Population Density - 2005

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Ringgold Creek Estates
373 lots

Peachers Mill Place
42 lots

Peachtree Section 4
171 lots

Hermitage Estates
66 lots

McClardy Manor
61 lots

West Fairfield Place
14 lots

Lone Oak Estates
4 lots

Cunningham Farms
9 lots

Chestnut Grove
320 lots

Liberty Park
350 lots

Wildwood West
113 lots

Peach Grove Estates
12 lots

Redwood Lane Acres
16 lots

Robin Lynn Hills
19 lots

Southern Heritage Estates
62 lots

Fort Campbell

Sabre Army Heliport (SAH)

Montgomery

65

70

75

Legend

Noise Contours
- 60 dB
- 65 dB
- 70 dB
- 75 dB

Accident Potential Zones (APZs)
- Clear Zone
- Accident Potential Zone I
- Accident Potential Zone II
- Road Construction Project
- Local Road
- Rail Line
- Rivers
- State Boundary
- County Boundary
- JLUS Area of Concern
- Parcel Boundary
- CAAF Easement
- Preliminary Subdivision Plat
- Installation Boundary
- City Boundary

0 0.25 0.5 1
Miles

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Figure 6
Recent Development Activity - Sabre Army Heliport Sub-Area

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is the City of Hopkinsville, a retail hub for the southwestern part of the state, and the setting for culture and historic architecture. Other municipalities include: Oak Grove, Crofton, LaFayette, and Pembroke. Christian County has a healthy base of jobs in the manufacturing, agriculture, and distribution sectors, and historic ties to Fort Campbell, which lies to its south. Given its proximity to the installation, the City of Oak Grove in particular has a strong military presence within the community. The county is geographically diverse with a total land area of 724 square miles, 20 percent of which are inside the Area of Concern.

TRIGG COUNTY, KY

Trigg County, KY, whose southern border is the State of Tennessee, is 421 square miles in area and contains a portion of the Land between the Lakes recreation area and the Lake Barkley State Resort Park. Its county seat is the historic community of Cadiz. Along with neighboring Christian County to the east, Trigg County is a member of the nine-county Pennyrile Area Development District. The county lies to the northwest of the installation and has about 15 percent of its land area inside the Area of Concern.

RECENT DEVELOPMENT ACTIVITY

The community of Clarksville to the east of the post is the fastest growing of the region's population centers. The city's residential and commercial development is along the US 41A corridor across from the post cantonment area and currently buffered from the installation's airfields and ranges. Southeast Clarksville (near the I-24 Exit 4) also has strong commercial growth. The most significant trend shaping compatibility issues near the installation is the demand for residential housing that is increasing pressure to develop the remaining farms and wooded areas on the urban edge. In Clarksville-Montgomery County, the Planned Growth Areas near Exits 1 and 4 continue to absorb growth. In the future, developers may seek opportunities for further residential development in Planned Growth Area # 1 just south of the installation and adjacent to SAH. See **Figure 6**.

The communities north of Fort Campbell are also expanding. In the late 1990s, the City of Hopkinsville annexed an 11-mile corridor along U.S. Highway 41A, bringing its corporate limits to within one mile of CAAF. Annexation has already spurred construction along the corridor, including a Wal-Mart Distribution Center, new residential subdivisions, such as Windmill Farms, and several commercial uses. The corridor will continue to draw development south toward Fort Campbell. Also in Hopkinsville, a developer has purchased two small tracts of land around Bell

Station Road just north of CAAF and has built 20-25 houses along the road. The Army holds an existing easement on a portion of one tract, limiting further development. One of the largest planned developments in the region is the 2,000-acre Interstate 24 Industrial Park just north of the I-24/41A interchange. Currently optioned by Hopkinsville Industrial Foundation, the site sits between Exits 86 and 89 along the I-24 corridor. Developers are seeking a single industrial tenant, such as an automobile plant, for the site. The land currently lacks access to water, sewer, or gas infrastructure along its southern boundary and would have to connect to existing utility systems along 41A.

The lack of wastewater treatment has historically acted as the major drag on growth in the City of Oak Grove. Facilities operate at 64 percent of available sewer capacity. Despite infrastructure challenges, the city has issued permits for 1,300 new houses. The Hopkinsville Water Environment Authority has proposed to purchase the Oak Grove wastewater collection system and treatment plant as part of FY 2010 Project Priority List for the Kentucky Clean Water State Revolving Fund. A development by the Oak Grove Tourism Commission on Walter Garrett Lane off of 41A just east of CAAF will feature a walking trail, playground, city amphitheater, and convention center. The War Memorial Walking Trail and entertainment pavilion are under construction as of 2009. The city also has a proposed open-air pedestrian mall/shopping center planned along 41A near Gate 7. Staff at Oak Grove also noted new development along KY Hwy 911 (Thompsonville Lane), including residential with pockets of commercial and big box retail.

The relatively recent expansion of US 41A to six-lanes has also facilitated commercial activity along the corridor, increasing pressure to convert the unincorporated farmland west of US 41A into more intense residential and retail uses. See **Figure 7**.

Growth to the west Fort Campbell in Stewart County, Tennessee and Trigg County, Kentucky has been slow relative to other parts of the region. The area's appealing rural character and inexpensive land costs have, however, continue to attract scattered development and new strip residential housing focused along county roads.

REGIONAL INFRASTRUCTURE

Infrastructure, particularly roads and wastewater treatment, strongly influence private property investment decisions and thus overall land use patterns within a region. System extensions enable development in previously rural areas and increased capacities can accommodate bigger scale uses. The tendency of growth to spread to rural/agricultural areas at higher intensities is the primary factor driving land use conflicts around military installations.

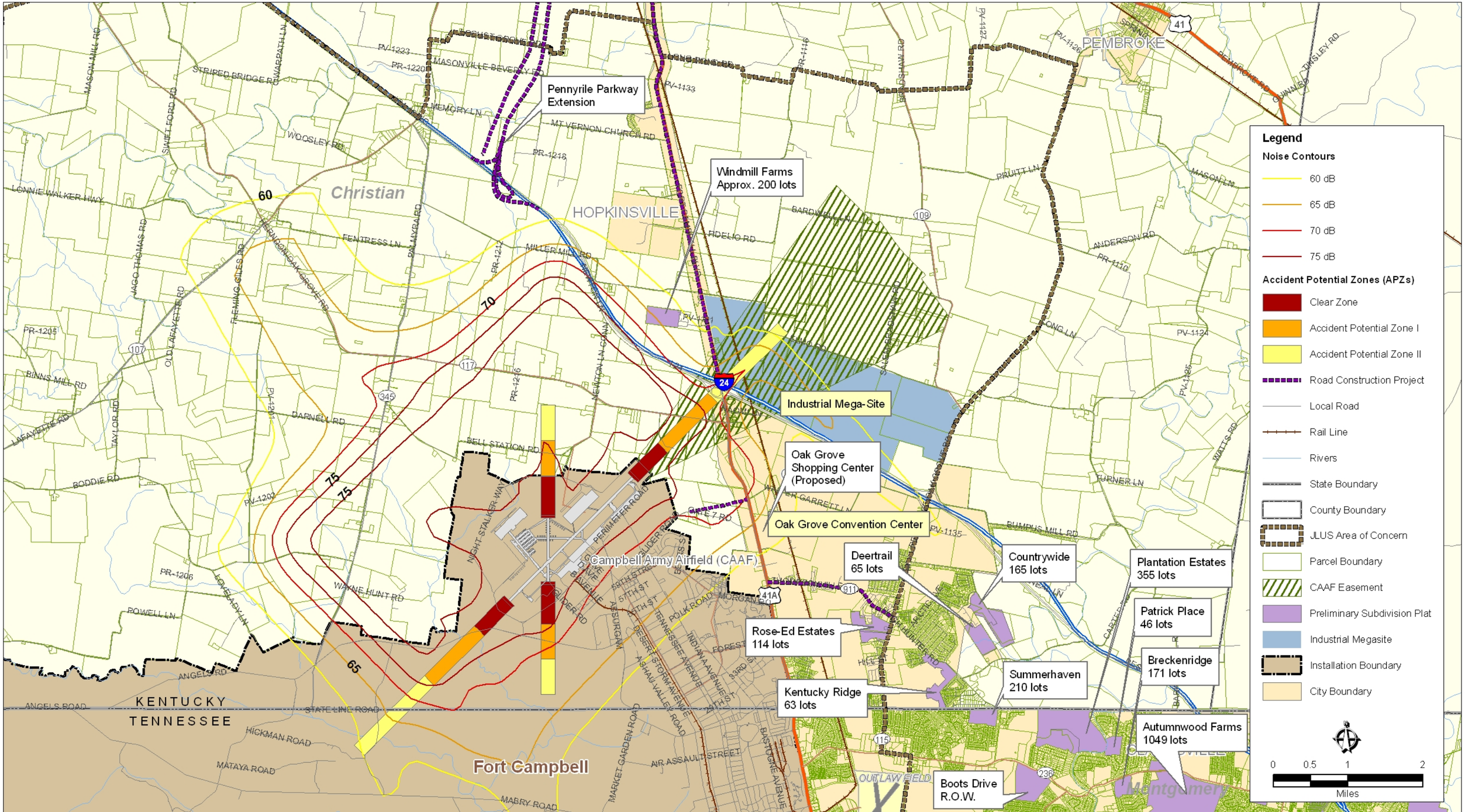

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Figure 7
Recent Development Activity - Campbell Army Airfield Sub-Area

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The current regional transportation network consists of I-24, a major northwest-southeast interstate route through southern Illinois, Kentucky, and Tennessee linking Nashville to Clarksville; US 41A, which runs north-south along the eastern border of the post and provides primary access to Fort Campbell's gates; and US 79, which runs east-west parallel to the post's southern boundary, connecting Clarksville to Dover. Interstate 24 has eight interchanges between Exit 11 in Tennessee and Exit 65 in Kentucky, forming some of the major commercial development nodes in the Clarksville-Hopkinsville metropolitan area. US 41A is a burgeoning commercial corridor that connects Clarksville, Oak Grove and Hopkinsville. Other significant roads in the regional transportation system include the Pennyrile Parkway, running north-south between the Kentucky cities of Hopkinsville, Madisonville, and Henderson; US 41, which connects Nashville to Hopkinsville east of I-24; and US 68, linking the cities of Cadiz and Hopkinsville north of the installation.

In the Fort Campbell region, several major transportation projects will support additional growth, particularly in areas to the northeast and south of the installation (See **Figure 8**). The extension of the state arterial highway, Pennyrile Parkway, from Hopkinsville to I-24 will extend the availability of utilities, thus potentially anchoring more intensive land uses in an area about 2 ½ miles north of CAAF. This area is also likely to emerge as a major commercial hub given interchange access to the interstate. Phase I of the two-to-three year project, the Eagle Way bypass, is currently underway. The likely effect of these combined projects is to draw more growth southward from the City of Hopkinsville toward aviation related activities associated with CAAF.

Also to the east of the post in the City of Oak Grove, the Kentucky Department of Transportation is currently designing a project to widen KY 911 to five lanes. Along with transportation improvements, Oak Grove has connected to the wastewater infrastructure of the City of Hopkinsville. Since constraints on wastewater availability have previously limited growth in Oak Grove, increased treatment capacity will very likely spur further development. Utility providers have planned

various other improvements focused particularly around Hopkinsville and Oak Grove, reflecting significant development pressure in these areas north and east of CAAF.

One of the region's most significant current transportation initiatives is the widening of U.S. Highway 79, an east-west arterial that parallels the southern boundary of the installation. Previously a rural two lane highway, the expanded four lane corridor will now be able to attract additional commercial and residential development in proximity to SAH and several adjacent installation training areas.

While much of the infrastructure analysis focuses on the tendency of increased capacity to induce potentially incompatible growth around Fort Campbell, the post and surrounding communities also have opportunities to enhance performance and achieve efficiency through the joint delivery of regional services. One of the best examples is the Bi-County Landfill on U.S. Highway 79. The facility provides Montgomery County, Stewart County, and Fort Campbell with over 100 years of solid waste disposal capacity.

Lake Barkley

Lake Barkley State Resort Park

Land Between the Lakes National Recreation Area

Kentucky Lake

CADIZ

HOPKINSVILLE

PEMBROKE

OAK GROVE

GUTHRIE

CLARKSVILLE

LAFAYETTE

KENTUCKY

TENNESSEE

Fort Campbell

Landfill

Cross Creeks National Wildlife Refuge

Legend

- Bridge Replacement
- Interchange Reconstruction
- Intersection Reconstruction
- Water - Improvements
- Sewer - Improvements
- Highway - Widening
- US 79 - ROW Expansion
- Road - New Construction
- Road - Reconstruction
- Road - Widening
- Road - Improvement
- Water - Proposed Lines
- Sewer - Proposed Lines
- State Boundary
- Installation Boundary
- County Boundary
- Residential Plats Dec 06
- Industrial Megasite
- Regional Recreation Areas

0 1.25 2.5 5

Miles

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Figure 8
Regional Infrastructure Projects

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4.0 Operational Impacts and Hazards

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OVERVIEW

As with all active military installations, routine training and readiness activities at Fort Campbell produce various impacts that can affect the quality of life in surrounding communities. Conversely, these military operations are susceptible to physical hazards created by certain proximate civilian activities or to complaint due to the sensitivity of affected nearby uses.

The planning team consulted with the Technical Coordinating Committee (TCC) and interviewed regional stakeholders to identify key impacts from a broader list of potential compatibility issues, including:

- exposure of residents to noise associated with aviation operations
- exposure of residents to noise associated with large arms training
- vibration and dust from training activities
- smoke from prescribed burns on the installation
- exposure of residents and businesses to the risk of an aircraft accident
- vertical structures that protrude into the controlled airspace around the post
- competition for use of the electromagnetic spectrum
- outdoor lighting systems, especially streetlights or exterior security lighting associated with large buildings that allow significant light to travel upward into an otherwise darkened sky; the resulting "light pollution" can obscure pilot vision or interfere with the use of night vision training devices
- activities that tend to attract large bird populations, such as landfills or open water
- activities that release substances into the air, such as steam, dust, or smoke that can impair aviator vision; examples of these activities are industrial plants, refineries, quarries, and sand or gravel pits
- the loss of threatened and endangered species, agricultural lands, and environmentally sensitive resources
- civilian radio frequency devices, such as those used by industry or public safety agencies that overlap with military radio frequencies, affecting on-board electronic systems and communications equipment
- transportation impacts on area roadways

Based upon feedback from the TCC and a review of existing conditions and key documents, such as the Army's Installation Environmental Noise Management Plan (IENMP), the planning team identified the following issues as the primary threats to mission viability and regional quality of life:

- exposure of residents to noise associated with aviation operations
- exposure of residents and businesses to the risk of an aircraft accident
- visual interference with the night vision training environment associated with exterior lighting

These critical issues, which are described in more detail below, create a series of overlapping spatial patterns around the installation. As shown in **Figure 9**, noise exposure of 60 dB or higher (sufficient to intrude on daily activities) affects approximately 20,000 acres off post and over 400 acres of land fall under an Accident Potential Zone associated with CAAF (See **Figure 12**). **Table 10** indicates the number of acres off post that fall into noise or air safety zones associated with the Small Arms Impact Area, North-South Impact Area, and the airfields.

These areas of off-post impact form the basis for the Fort Campbell Activity Zones identified in the recommendations section of this report. The JLUS also includes a series of strategies to address additional issues that can affect the viability of the mission and regional well-being, such as the loss of threatened and endangered species habitat, agricultural lands, and environmentally sensitive resources due to unmanaged development.

NOISE

Noise-generating training at Fort Campbell includes ground-based activities such as live-fire weapons training and unit convoy maneuvers, along with aviation activities, including air assault exercises and nap-of-the-earth flight procedures. For purposes of assessing noise impacts on the surrounding communities, the Installation Environmental Noise Management Plan (IENMP) designates three zones reflecting annualized average decibel levels or day-night sound levels (DNL). It should be emphasized that these zones, which are graphically shown as contours on maps, are not discrete lines that sharply divide loud areas from land largely unaffected by noise. Instead these zones are planning tools that depict the general noise environment around the post based on typical activities. Areas beyond the three zones can also experience levels of noise deemed unacceptable depending upon such variables as training intensity or weather conditions.

TABLE 10

Land in Noise & Air Safety Affected Areas	
IMPACT	**ACRES (outside FTC)**
CAAF Noise	
60-65dB	6,086
65-70dB	4,099
70-75dB	7,417
75dB	2,137
SubTotal	**19,739**
SAH Noise	
65-70dB	302
70-75dB	233
SubTotal	**535**
Accident Potential Zones	
CAAF	433
North Impact Area	
57 -62 CDNL	3,984
Small Arms Area	
57 – 62 CDNL	425
62 – 70 CDNL	298
> 70 CNDL	22
SubTotal	**745**

The military measures noise in decibels (dB) and assigns a weighting based on the noise frequency and source. A-weighting, expressed as dBA, depicts higher frequency noise caused by small arms firing, aircraft use, and vehicle operations. C-weighting shows the low frequency noise and vibration associated with the firing of larger weapons systems (dBC). Noise in excess of 55 dB can become intrusive and continued exposure to noise above the 85 dBA threshold can, over time, cause hearing loss.

The contours around Fort Campbell reflect an annualized noise measure that converts noise varying from peak bursts to relative quiet into a steady measure of acoustic energy over a 24 hour period. The contours take all operations that occur at the military installation over the year and divide by 365 days, producing the average day-night sound level (DNL). The measure further "penalizes" or places a higher decibel value on noise that occurs at night because it is more disruptive to the surrounding population. **Table 11** equates decibel levels with common sounds.

It should be noted that the noise modeling around CAAF and SAH give flexibility to the U.S. Army to accommodate increases in operational activity and to maintain the noise footprints on which local land use regulations are based for the foreseeable future. The contour limits for aviation and blast noise activities are 5 dB below Zone II levels and can better predict noise impacts when levels of operations at airfields or large caliber weapons ranges are above average.

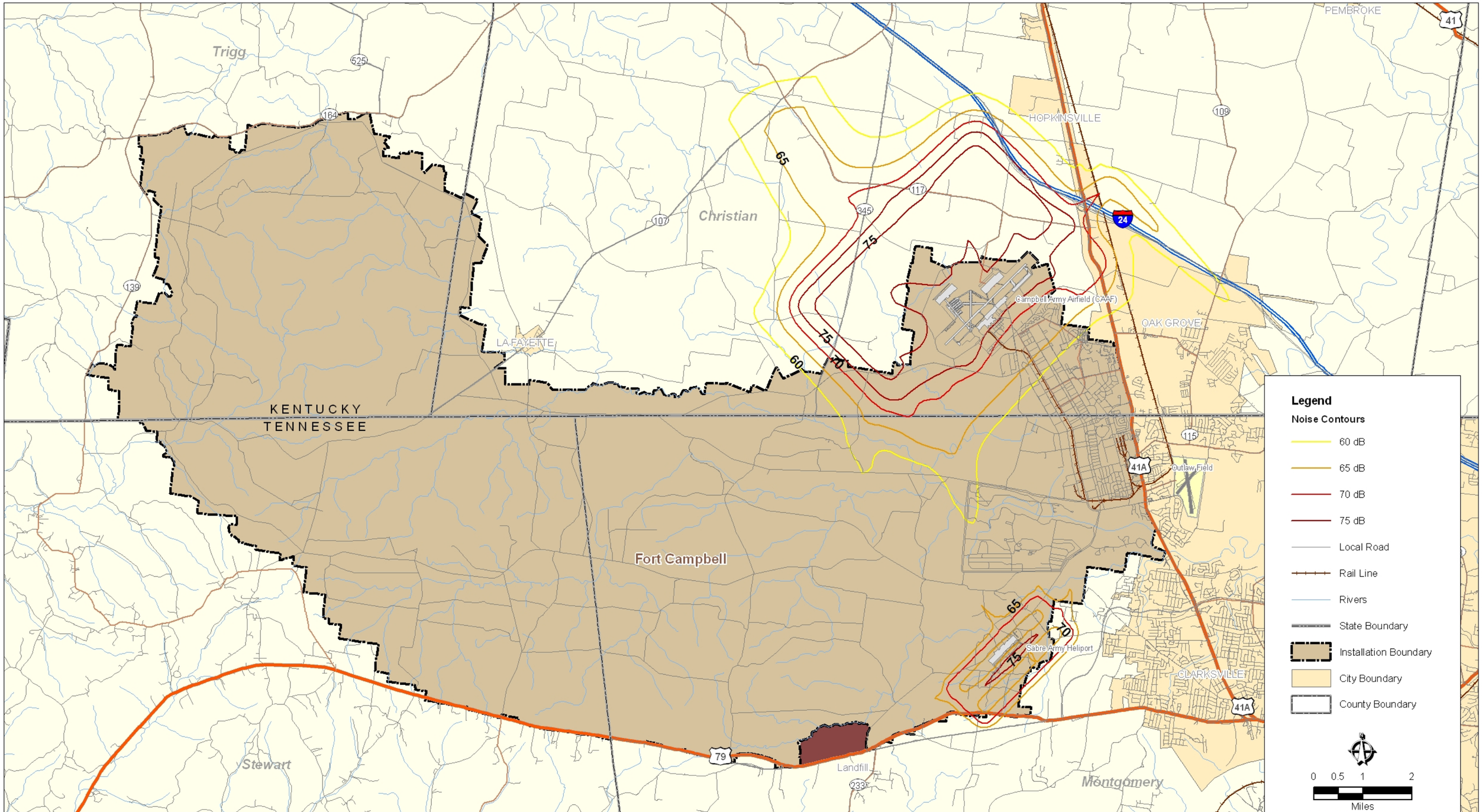

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Figure 9
Noise Contours for CAAF and Sabre Army Heliport

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Installations can also use peak noise data mapping to supplement the current method of day-night average noise modeling. Peak noise mapping contributes to an improved understanding of the noise environment around the post because it models the noise effects for the single burst of sound associated with a training event and reflects what people exposed to the noise actually hear, rather than a weighted average. Additionally, peak levels correlate well with complaint risk for individual firing activities. The Arny's noise expert, US Army Center for Health Promotion and Preventative Medicine (USACHPPM) now recommends that installations use peak level data to measure the impacts of certain training activities.

NOISE ZONE III. NZ III consists of the area around the noise-generating activity in which the DNL exceeds 75 decibels for aircraft, vehicles, and small arms (A-weighted), and more than 70 decibels, C-weighted for weapon systems larger than 20-mm. The noise level within NZ III is severe enough to conflict with many civilian activities, particularly sensitive land uses, such as housing, schools, medical facilities, and places of worship.

TABLE 11

Comparable Noise Levels

SOUND	dBA	EFFECT
Jet Engines (Near)	140	
Shotgun Firing	130	
Jet Takeoff	130	Threshold of pain (125 dBA)
Thunderclap (Near)	120	Threshold of sensation (120 dBA)
Power Saw (Chain Saw)	110	
Jet Fly-over	103	
Garbage Truck/Cement Mixer	100	Regular exposure for 1 minute or more risks permanent hearing loss
Farm Tractor	98	
Lawnmower, Food Blender	85-90	Level at which hearing loss begins (8 hour exposure)
Recreational Vehicles, TV	70-90	
Diesel Truck (40 Mph, 50 Fort)	84	
Garbage Disposal	80	Annoyance; constant exposure may cause hearing loss
Washing Machine	78	
Dishwasher	75	
Vacuum Cleaner	70	Intrusive, interference with conversation
Hair Dryer	70	
Normal Conversation	60-65	Comfortable (under 60 dBA)
Refrigerator Humming	40	
Whisper	30	Very quiet
Rustling Leaves	20	Just audible
Normal Breathing	10	
	0	Threshold of normal hearing (1000-4000 Hz)

NOISE ZONE II. NZ II consists of an area where the A-weighted DNL is between 65 and 75 decibels and the C-weighted DNL is between 62 and 70 decibels. Guidance deems noise exposure within this area to be significant and recommends limiting use of land to non-sensitive activities such as industry, manufacturing, transportation, and agriculture. However, if the community determines that land in NZ II areas must be used for residential purposes, guidance suggests that the design and construction of the buildings incorporate noise level reduction (NLR) features to minimize annoyance.

LAND USE PLANNING ZONE.

The Land Use Planning Zone consists of an area where the day-night sound level (DNL) is between 60 and 65 dBA or 57 and 62 dBC. Exposure to noise within this area is considered significant during periods of increased operations. The LUPZ accounts for the variability of noise levels caused by

higher daily numbers of operations than the annual average. It shows where levels of annoyance usually associated with Noise Zone II can be found during periods of increased operations. The LUPZ provides the installation with a means to predict possible complaints, and meet the public demand for a description of what will exist during a period of increased operations.

It should be noted that the other military services, through comparable AICUZ land use compatibility guidelines, already recommend that residential uses be considered as incompatible uses within the 65db-75db noise contour. This guidance further states that "Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited within these Zones."

AVIATION

The high number of annual aircraft operations at CAAF generates noise levels beyond the installation that can interfere with the daily activities of nearby residents. Noise contours from 75+ to 65 dBA extend north from the airfield affecting portions of Oak Grove, Hopkinsville, and unincorporated Christian County (See **Figure 9**). With the equivalent of NZ II and NZ III exposure, these areas will experience aviation-related noise that poses conflicts for sensitive uses, such as housing, schools, offices or places of assembly. Similarly, activity at SAH produces NZ II equivalent noise exposure for areas just to the east and south of the heliport. The risk of noise related incompatibilities, however, is less for the post's southern airfield due to the comparatively small area affected by operations. Fort Campbell also has two major low-level helicopter training routes, the Red and Blue Routes that mostly parallel the installation boundary. Due to high use and low flight levels, aircraft utilizing these two routes sometimes generate noise contours at noise zone II and III levels, contributing to significant noise exposure for areas adjacent to the post (see **Figures 10 and 11**). Noise contours along the Blue Route reach noise zone III at 150 feet from the centerline, noise zone II levels at 500 ft, and LUPZ levels at 800 ft. Noise contours along the Red Route reach noise zone III leves at 100 feet from the centerline, noise zone II levels at 300 feet, and LUPZ levels at 550 feet.

SMALL AND LARGE ARMS

Live training exercises at Fort Campbell include the direct and indirect firing of both small and large arms systems, including:

- small arms (.30 cal and below) at the Small Arms Impact Area west of the cantonment area and south of CAAF
- artillery and mortar at the North and South Impact Areas
- tank gunnery at Ranges 28 (South Impact Area) and 46 (North Impact Area); training consists of tactical movements in combination with weapons fire to simulate battlefield
- aerial gunnery, including 7.62 mm door gun, 20 mm gun, 30 mm gun, inert TOW missile and HELLFIRE missile
- Grenade/Claymore Mines at Range 24, Ranges 26A and 26B (inert and high explosive), Ranges 25A and 47, and Range 1

As noted earlier, most of the noise issues at Fort Campbell are aviation, rather then arms related. Small arms range activities produce noise contours that extend beyond the installation boundary, but currently do not pose significant compatibility issues with surrounding uses. The firing of large

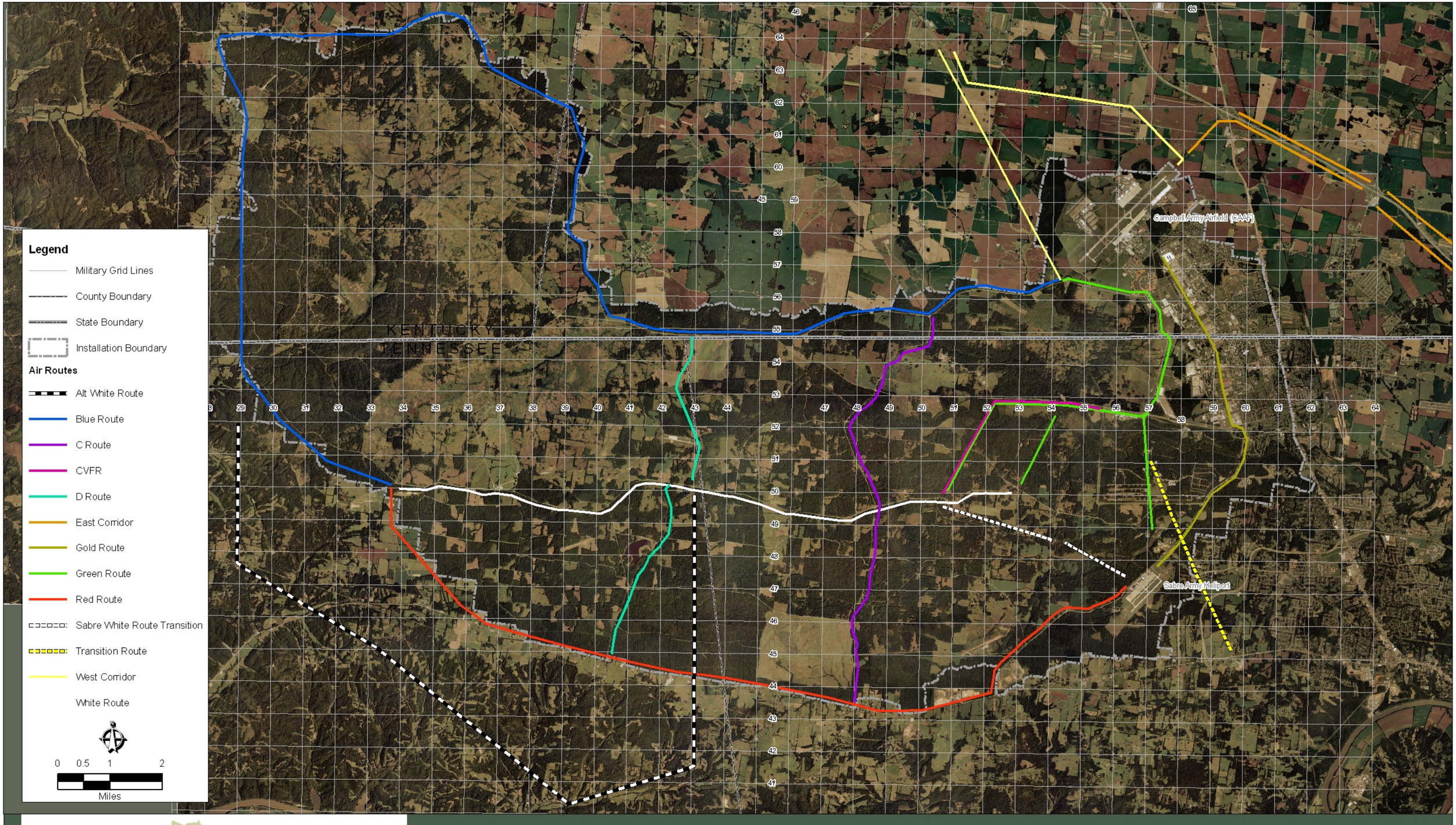

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Figure 10
Fort Campbell Air Routes

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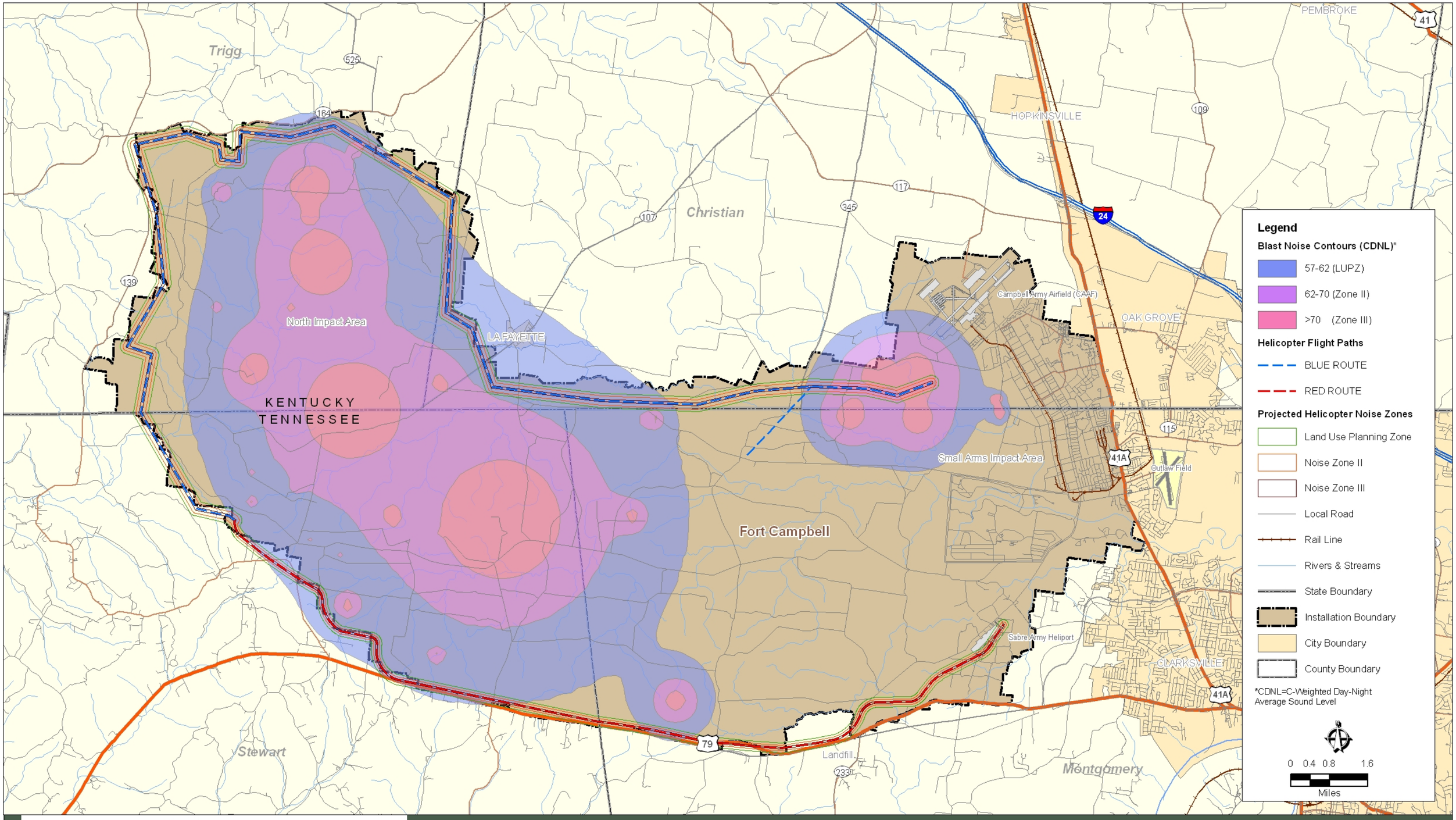

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Figure 11
Large Caliber Weapons and Projected Helicopter Training Noise Contours

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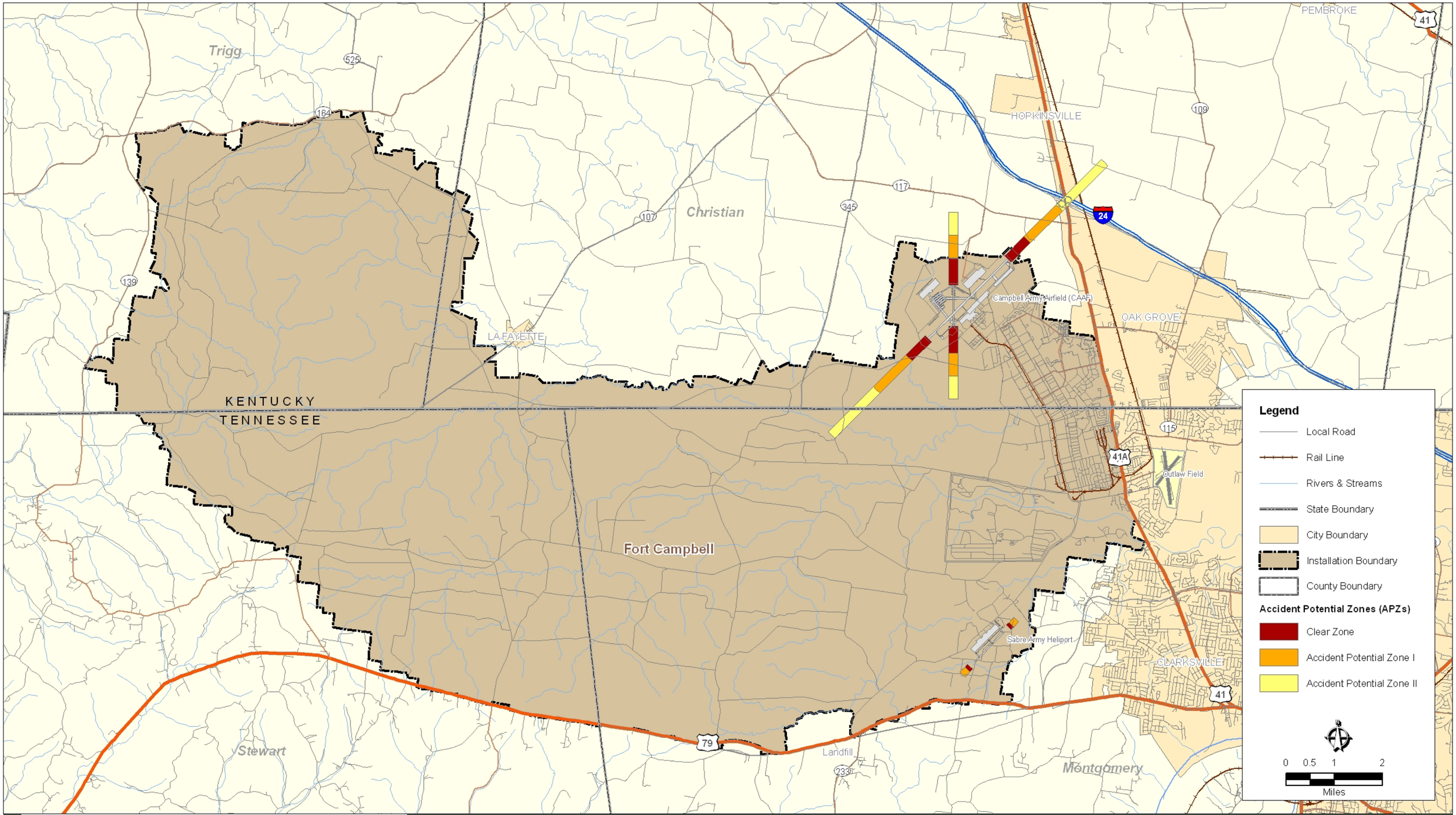

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Figure 12
Accident Potential Zones for CAAF and Sabre Army Heliport

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caliber weapons (20mm and greater) can, however, affect areas off-post, particularly portions of Stewart County to the south and Christian County and communities such as Lafayette to the north (see **Figure 11**). The new EOD units at Fort Campbell will likely increase the number of blast-related training activities conducted on-post, which may lead to a higher incidence of noise levels heard off-post.

AIR SAFETY

In addition to noise, the IENMP assesses the potential hazards associated with aviation activity. Military airfield planning analyzes historical data on military aircraft accidents to determine where a mishap is most likely to take place and the size of the area likely to be affected. The analysis does not assess the statistical probability of an accident, which is a very low risk, but high consequence occurrence for both pilot and nearby civilians. The findings of the analysis result in three air safety zones around the airfield.

CLEAR ZONE (CZ). The CZ is an area 1,000 feet wide by 3,000 feet long at the immediate end of a Class B runway. The CZ for a Class A runway is an area 1,000 feet wide by 3,000 feet long. CAAF has both Class A and Class B designated runways. The primary runway at CAAF, 05-23, is a Class B runway, and the secondary runway, 18-36, is Class A. The accident potential in these areas is sufficient to warrant the prohibition of any structures in the CZs. For safety reasons, the Army has the authority to purchase the land (or development rights) for these areas if they are not already part of the installation.

ACCIDENT POTENTIAL ZONE I (APZ I). APZ I is less critical than the Clear Zone but still possesses significant potential for accidents. The APZ I is just beyond the CZ, forming an area that is 1,000 feet wide by 2,500 feet long for a Class A runway and 1,000 feet wide by 5,000 feet long for a Class B runway. A wide variety of industrial, manufacturing, transportation, open space and agricultural uses can exist safely in this zone, though activities that concentrate people are not compatible.

ACCIDENT POTENTIAL ZONE II (APZ II). APZ II is the least critical of the three air safety zones, but still carries some risk of an accident. APZ II is 1,000 feet wide and extends 2,500 feet beyond APZ I for a Class A runway and is 1,000 feet wide by 7,000 feet long for a Class B runway. Compatible land uses include those of APZ I, as well as low density single family residential, and lower intensity commercial activities (See **Figure 7**). High density functions such as multi-story buildings and places of assembly (e.g., theaters, schools, churches and restaurants), however, raise compatibility issues.

The CAAF APZ I, APZ II, and CZs extend to the north and northeast beyond the installation boundary into Christian County. Notably, an APZ II lies over the interchange of I-24 and the 41A corridor. The CAAF Avigational Easements extends over the main runway and includes the CZ and both APZs for this approach. The air safety zones associated with SAH in contrast are fully contained on the post, thereby limiting aviation related risks on surrounding lands. (See **Figure 12**)

LIGHT INTRUSION

Night vision flight training, in which aviators use night vision goggles (NVGs) or other types of night vision systems, is essential to the missions of the modern Army. The level of aircraft and personnel at CAAF and SAH makes Fort Campbell one of the most intensively used night vision training posts in the country. Night vision systems are designed to operate away from civilization and electric lighting. Exposure to stray light can cause the vision screen to white-out, temporarily robbing the aviator of vision. The light intrusion into the night vision device training environment of the post is a leading threat to mission capabilities. A later section discusses this issue in detail.

Historically, the performance of night vision systems has been based on percentages of full moon ambient light. While prior generations required at least some ambient moonlight, the current (3rd) generation of goggles performs effectively without any ambient moonlight. Currently, it appears that aviators cope with light pollution through experience and learning to look away or remove goggles to prevent loss of night vision.

5.0 Compatibility Analysis

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COMPATIBILITY GUIDELINES

The following analysis assesses the compatibility of existing civilian land uses around the installation. When compatible, land uses can exist next to each other without causing interference with military exercises or exposing people to undue safety risks or nuisance. In this JLUS context, Army training activities raise compatibility issues when next to the following nearby land uses:

- Noise sensitive uses, such as housing, schools, medical facilities or places of worship;
- Uses that tend to concentrate people (certain higher residential densities, certain retail/ commercial uses, schools, churches, hospitals); and/or
- Uses as noted above that can interfere with safe air navigation, such as tall structures, or activities that throw off excessive lighting, smoke or dust and may impair vision.

For purposes of evaluating compatibility in designated noise and air safety zones, the JLUS draws guidance from Department of Defense and The Federal Interagency Committee on Urban Noise land use guidelines (FICUN 1980) as shown in **Tables 12** and **13**. Uses shown as "Y" are typically compatible with the level of noise exposure or safety risk associated with each particular zone. Use depicted as "YC" are conditionally compatible and may require further protection measures, such as indoor noise reduction. The guidelines deem activities shown as "N" as unacceptable within the given zones, indicating that strict prohibition of the use is the most appropriate regulatory action.

Land Use Compatibility Guidelines, Noise Contours A-Weighted

TABLE 12

FICUN	NZ I		NZ II		NZ III	
	< 55 DB	55 to 65 DB	65 to 70 DB	70 to 75 DB	75 to 80 DB	80 to 85 DB
Households	Y	YC	YC	YC	N	N
Manufacturing	Y	Y	Y	YC	YC	YC
Retail – General	Y	Y	Y	YC	YC	N
Restaurants	Y	Y	Y	YC	YC	N
Personal Services	Y	Y	Y	YC	YC	N
Hospitals	Y	YC	YC	YC	N	N
Government	Y	YC	YC	YC	YC	N
Education	Y	YC	YC	YC	N	N
Public Assembly	Y	Y	Y	N	N	N
Parks	Y	YC	YC	YC	N	N
Agriculture	Y	Y	YC	YC	YC	YC

Source: FICUN 1980 Y = Compatible; YC = Conditionally Compatible; N = Not Compatible

NOISE GUIDANCE

In general, guidance as shown in **Table 12** states that housing is compatible with noise exposure up to DNL 55 dB (shown as Y). Standards indicate that with exposure between DNL 65–75 dB, additional protective measures, such as indoor noise reduction, for residential uses may be warranted (shown as YC). For conditionally compatible residential land uses, guidelines suggest consideration of the following factors:

- Is there a demonstrated community need for residential use that would not be met if development were prohibited in these zones?
- Where the community determines that residential uses are desired, structures should incorporate noise level reduction measures of at least 25 dB (65-70 ADNL) and 30 dB (70-75 ADNL).
- Noise level reduction 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.

TABLE 13

Land Use Compatibility Guidelines, Air Safety Zones

LAND USE	CLEAR ZONE	APZ I	APZ II
Single Family Unit	N	N	YC
Multifamily Dwellings	N	N	N
Industrial/ Manufacturing	N	Y	Y
Trans, Comm and Utilities	YC	Y	Y
General Retail	N	N	Y
Restaurants	N	N	Y
Personal Services	N	N	Y
Other Services	N	N	Y
Government Services	N	N	YC
Educational Services	N	N	N
Cultural Activities	N	N	N
Medical Services	N	N	N
Churches	N	N	N
Playgrounds	N	N	Y
Regional Parks	N	YC	YC
Assembly Areas	N	N	N
Other Outdoor Recreation	N	YC	YC
Agriculture	Y	Y	Y
Livestock Farming	N	Y	Y
Forestry Activities	N	Y	Y
Permanent Open Space	Y	Y	Y

Guidelines deem noise exposure that exceeds DNL 75 dB to be incompatible (shown as N) with all residential uses. Many uses, such as manufacturing, retail, government facilities, and agriculture, however, can be suitable even within a relatively high noise setting.

AIR SAFETY GUIDANCE

Guidance for the air safety zones indicates that the statistical risk of an aircraft mishap in the Clear Zone is sufficient to warrant a strict prohibition of structures and all land uses other than agriculture or protected open space. Though slightly lower in risk exposure, Accident Potential Zone I still limits suggested uses to open space, certain passive recreational uses, and some industrial and manufacturing activities. Accident Potential Zone II is the least restrictive of the air safety planning areas and can, according to the guidelines, safely accommodate housing in a very low density pattern and small scale retail operations. Compatibility standards recommend against placing any gathering spaces or uses that concentrate people in an air safety zone.

AREA OF CONCERN

In addition to the noise and accident potential zones, a broader JLUS Area of Concern (AOC) around the installation draws from Army guidance to highlight lands that may be periodically subject to noise or other military related impacts (See **Figure 13**). The Area of Concern is based on specific Fort Campbell and U.S. Army parameters, but local government members of the TCC recommended modifying the AOC boundary to follow man-made features, such as roadways. Aligning the AOC with readily

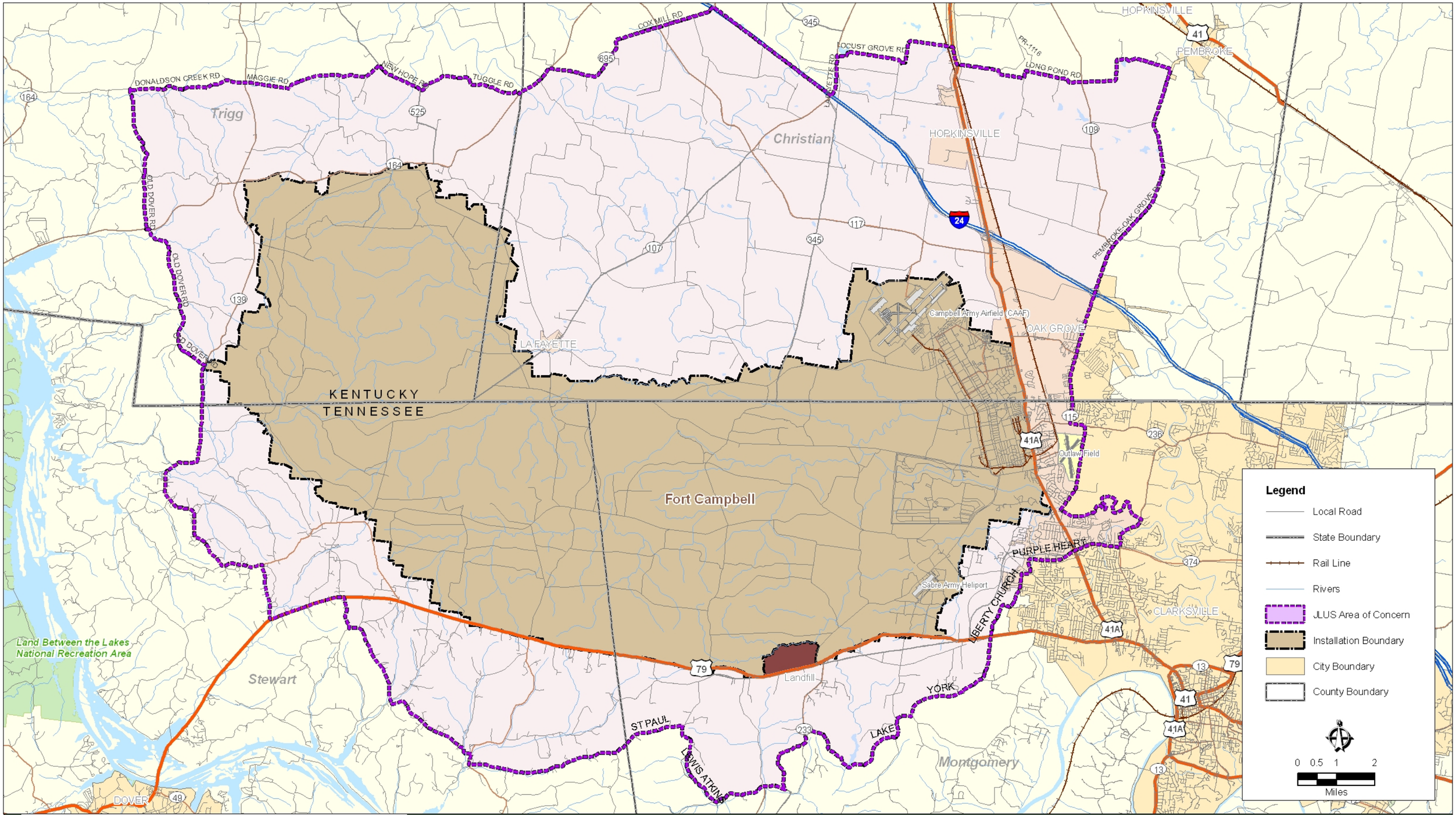

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Figure 13
JLUS Area of Concern

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distinguishable physical features facilitates use of the boundary as a planning tool and enables property owners to identify if their land falls within this designated area of possible impact.

ANALYSIS OF CURRENT LAND USE COMPATIBILITY

As shown in **Figure 14**, most of the region's residential and commercial development is east of the post, focused along the 41A corridor and the eastern segment of U.S. Highway 79. The biggest risk of land use conflict is development that is directly adjacent to CAAF or falls below the airfield's overflight areas. New subdivisions just north of CAAF along 41A within the Area of Concern and new development east of 41A in Oak Grove and immediately north of I-24 in Hopkinsville also raise compatibility issues. An emerging pattern of strip commercial development and subdivisions along 41A poses an ongoing risk of light intrusion for CAAF operations.

The risk of light pollution and noise pose similar compatibility issues in the vicinity of SAH in the southeastern portion of the installation. Several new residential subdivisions are just outside of SAH's designated "light-sensitive" area, a 2-mile radius around the heliport critical for NVD operations. Several older manufactured housing developments also fall within the high noise environment around SAH.

Land in western Christian County, Trigg and Stewart Counties is primarily in use for agriculture or forestry. Scattered pockets of large lot residential and strip commercial activity line county roads adjacent to the installation, particularly along the northern and southern boundaries. Residents in these communities have noted noise from military overflights. Some established communities north of the post such as Lafayette also experience periodic noise from large arms firing.

ANALYSIS OF FUTURE LAND USE COMPATIBILITY

While existing land use incompatibilities are not severe in most areas around the installation, growth trends combined with transportation and other infrastructure improvements signal an increasing risk of encroachment in two areas critical for the safe and effective performance of training and readiness activities:

- The area north of CAAF, particularly along the 41A corridor between Hopkinsville and Oak Grove; and
- That section of U.S. Highway 79 running parallel to the installation's southern perimeter, especially Clarksville's Planned Growth Area #1 in the vicinity of SAH.

Growth in the region has increased demand for housing in turn placing pressure on the market to convert farmland into housing and supporting commercial uses. A particular concern of Fort Campbell is that the rising cost and dwindling availability of lands east of U.S. Highway 41A will shift development west of the corridor in unincorporated rural lands directly adjacent to the installation. Similarly, the widening of the U.S. Highway 79 corridor and the limited capacity of other planned growth areas in Clarksville to absorb market needs are increasing pressure to develop on the western fringe of the city in proximity to SAH and its light sensitive zone.

Development in both areas could significantly compromise the training and deployment mission of the installation, resulting in the loss of flight corridors, less realistic training, and reduced operating

hours at airfields and firing ranges. For example, as nearby housing exceeds a density threshold of 2 to 3 residential dwellings per acre aviators must fly above 1,000 AGL (above ground level), effectively eliminating the ability to conduct nap-of-earth and other low-level flight operations.

Growth in portions of western Christian, Trigg and Stewart Counties remains mostly scattered. The absolute number of people living near the installation represents only one dimension of possible land use incompatibility. New residents drawn to large lot home sites or ranchettes introduce the demographics associated with amenity-based development. Some of these residents may be unaccustomed to the noise produced by firing range activity and aircraft operations conducted along the installation perimeter.

LAND USE COMPATIBILITY ASSESSMENT

Existing and future land use plans were compiled from planning documents prepared by the municipal, county, and regional planning agencies operating in the four-county region, and analyzed within the JLUS Area of Concern by the planning team. By far the most common existing land use (ELU) within the AOC is Agriculture/Vacant, which comprises over 77% of the total land area, not including Fort Campbell (see **Table 14**). Future land use (FLU) plans anticipate that some of this land will transition to other land uses while still remaining the most significant land use within the AOC. Residential land use will grow most substantially in the AOC, shifting from 6.27% of the total in existing land use to 10.34% in future land use plans. This trend bears particular importance for future land use compatibility, as residential land uses are the most sensitive with regards to military operations.

TABLE 14

Land Use Acreage Summary, Existing & Future Land Use

Acreage Statistics		
ELU	**Acres**	**% of AOC**
Agriculture/Vacant	114,274	77.39%
Commercial	1,440	0.98%
Industrial	342	0.23%
Residential	9,256	6.27%
Forest	10,510	7.12%
Other	11,836	8.02%
FLU	**Acres**	**% of AOC**
Agriculture/Vacant	111,270	75.36%
Commercial	2,236	1.51%
Industrial	1,407	0.95%
Residential	15,268	10.34%
Forest	10,484	7.10%
Other	6,993	4.74%

To more fully assess encroachment trends around the installation, the planning team evaluated the existing and future land use of each parcel in the Area of Concern, noise contours, and air safety zones based upon the compatibility guidelines identified in **Tables 12** and **13**. If the guidelines listed the designated use as compatible under some conditions and incompatible under other conditions, then the team coded the parcel as a "conditionally compatible" yellow color. Fully compatible uses, as in the case of "forest," are green. Due to the minimal encroachment of the most restrictive Accident Potential Zones (Clear Zones and Accident Potential Zones I), the analysis did not identify any specific uses as incompatible under all circumstances. Typically even within noise contour areas and Accidents Potential Zones, many land uses may not pose a conflict under certain development conditions; therefore, **Figure 15** highlights existing compatibility issues in the form of conditionally compatible residential and commercial activity, primarily along U.S. Highway 41A and U.S. Highway 79.

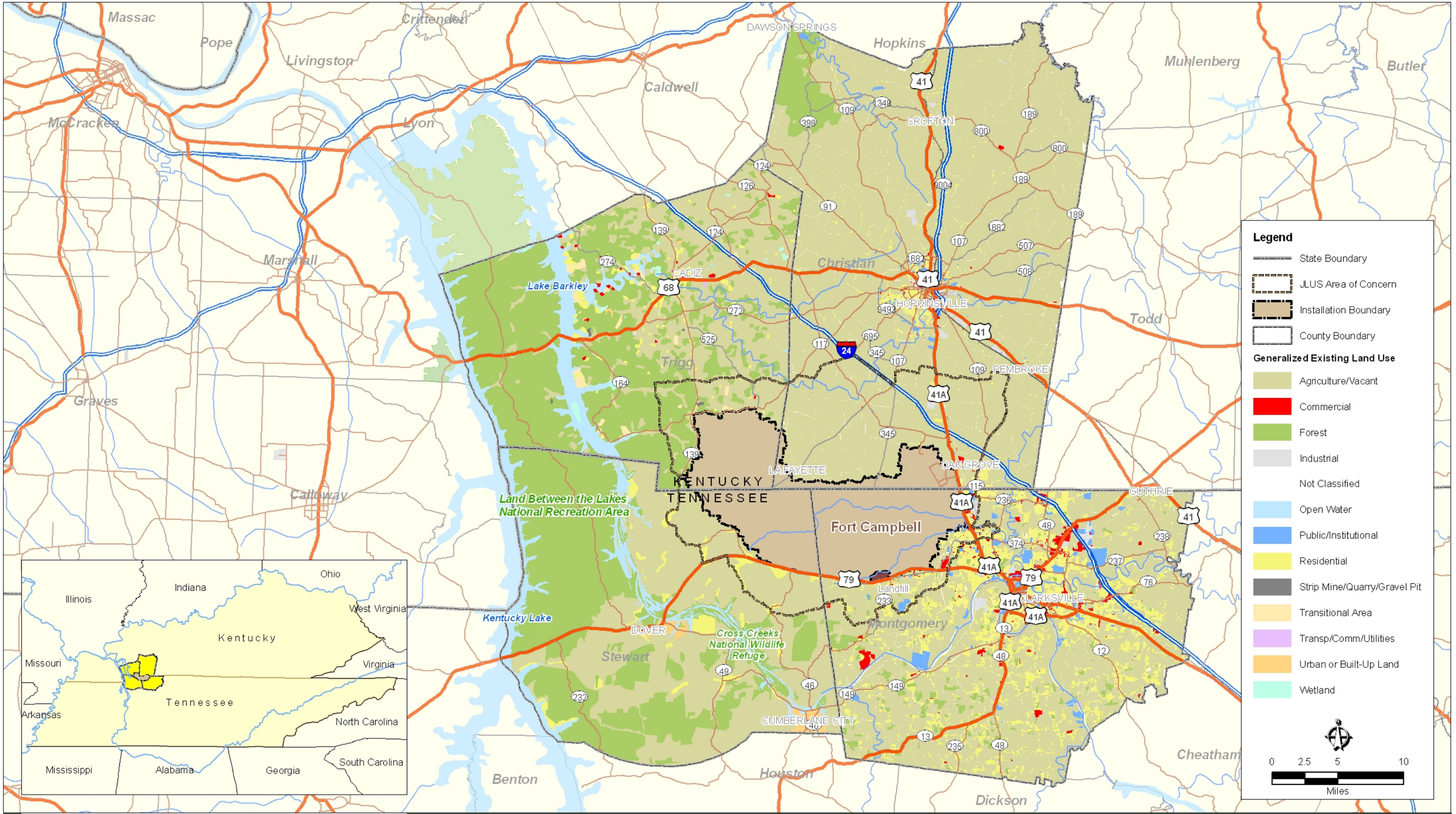

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Figure 14
Regional Existing Land Use

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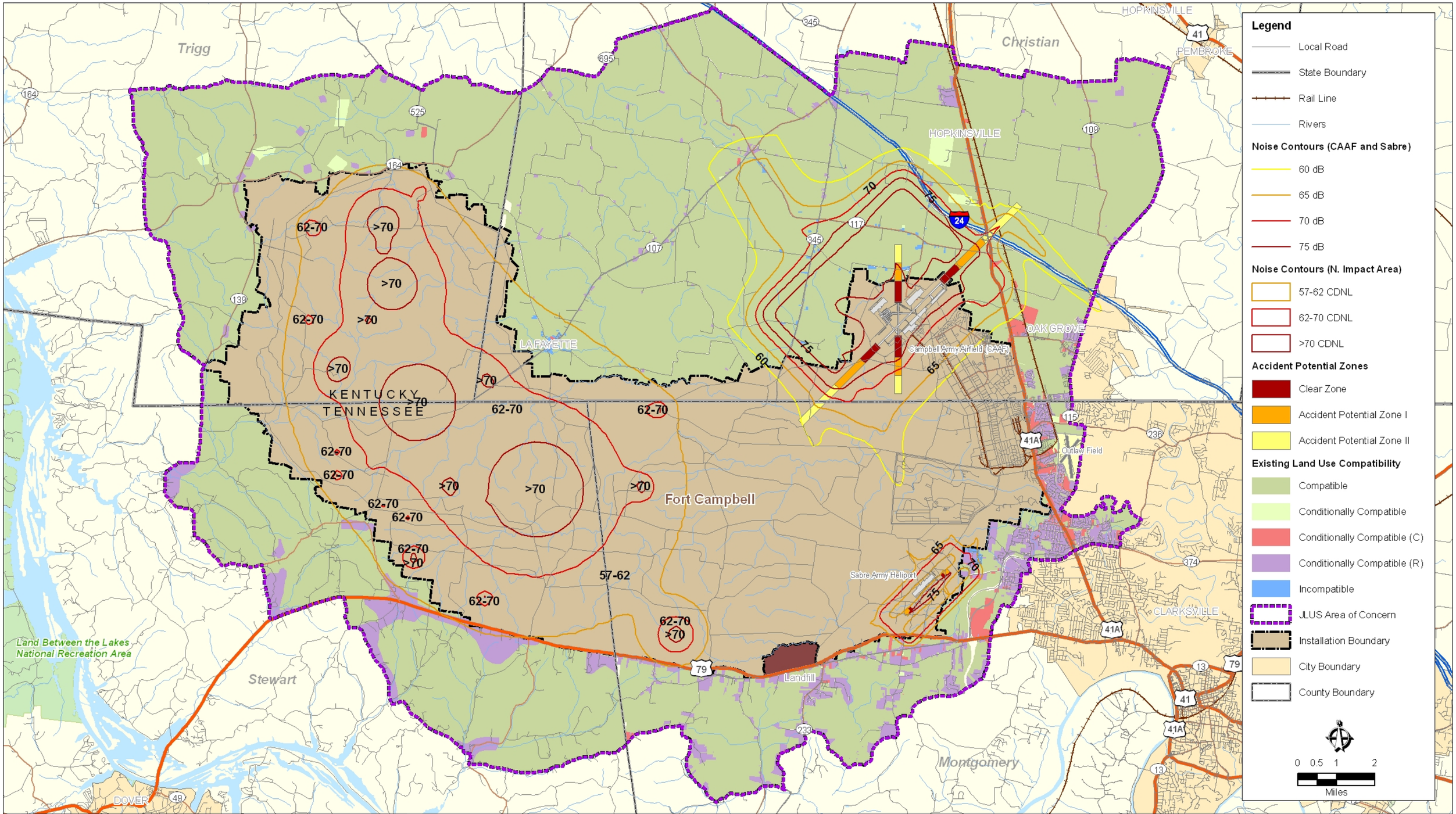

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Figure 15
JLUS Area of Concern - Existing Land Use Compatibility

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The analysis then evaluates each parcel in the Area of Concern on the assumption that it develops as designated under each local government's future land use plan. The findings highlight land around the installation that is the most susceptible to change and potential land use conflicts based upon existing land use and growth policies and current trends. In Oak Grove along US 41A near CAAF, a long strip of land is in transition from agriculture to commercial, all the way up to the easements around the Accident Potential Zones. A significant amount of agricultural land is also converting to housing just east of U.S. Highway 41A and inside the Area of Concern.

In Clarksville, agricultural land is giving way to residential uses around the Sabre Heliport. Additional parcels are becoming residential within the 70db noise contours, potentially raising compatibility issues. Conditionally compatible growth is occurring within the noise contours of both Fort Campbell airfields; however, while there is some development within 70 db contour, no activity falls within the more heavily exposed and restrictive 75 db noise areas. The ability to establish a clear baseline of compatibility-coded parcels and to compare these existing conditions (ELU) to foreseeable development conflicts under future land use scenarios (FLU) allows planners to better quantify and track the level of encroachment around the installation. **Table 15** shows the acreage of land that is compatible or conditionally compatible under existing and future land use designations.

TABLE 15

Compatibility Acreage Summary, Existing & Future Land Use

Acreage Statistics	
ELU	**Acres**
Compatible	135,779
Conditionally Compatible	774
Conditionally Compatible Commercial	1,408
Conditionally Compatible Residential	9,293
Incompatible	404
FLU	**Acres**
Compatible	126,686
Conditionally Compatible	1,841
Conditionally Compatible Commercial	2,108
Conditionally Compatible Residential	16,542
Incompatible	481

As shown in **Table 15** just over 400 acres of land pose a conflict with existing operational impacts generated by Fort Campbell. Under future land use designations, this encroachment could increase to 481 acres. The table also indicates that without the implementation of local government growth management measures to reshape established future land use policies, an additional 9,000 acres around Fort Campbell could under current plans convert to a use that is less compatible than today. While the acreage of land affected may not be extraordinary, the emergence of potential land use conflicts along U.S. Highway 79 and U.S. Highway 41A may significantly hinder future operations at SAH and CAAF. (See **Figure 16**)

Table 15 further distinguishes Conditionally Compatible Commercial and Conditionally Compatible Residential uses. Uses identified only as Conditionally Compatible consist of non-residential or non-commercial uses. The conditional designation does not indicate that housing and commercial development are inappropriate in all areas identified, but that local governments should consider additional measures to reduce the risk of conflicts with Fort Campbell operations. Commercial uses in this area, for example, can achieve compatibility through application of the shielded outdoor lighting practices described in the Implementation section of this report. Real estate disclosure (described later in the Implementation section), indoor noise attenuation, and limits on density can assist in protecting quality of life for residents living in housing near noise and air safety impacts.

BUILD OUT ANALYSIS

In determining a reasonable forecast for future build out, the planning team analyzed the zoning space requirements/regulations for residential, industrial, and commercial designations within the JLUS Area of Concern. This forecast reflects a "worst case" or full build out scenario. Market forces combined with public decisions regarding infrastructure will limit full development. The analysis does, however, indicate the capacity for significant future development within the Area of Concern (AOC).

RESIDENTIAL - In determining build out potential for future residential, the planning team determined the density by dividing minimum lot sizes by the total area of a given parcel. In the case of Clarksville-Montgomery, the County has numerous residential zoning designations with differences in minimum lot sizes often within a few thousand square feet of each other. Therefore, the analysis used the minimum given in the ordinance for calculations. Oak Grove, on the other hand, has significantly fewer residential designations, often with a range of minimum lot sizes, which are determined based upon other criteria, such as the housing type. In this case, the analysis used a number closer to the upper minimum in the range under the assumption that residential density will reflect lower density in Oak Grove. The only other area that has land use changes within the AOC is Stewart County. These parcels are low density residential, and the analysis assumed that lot requirements for Stewart County would be approximately two dwelling units per acre.

TABLE 16

Acreage & Square Footage Summary, Full Build Out Scenario

Summary Table for Buildout Analysis within the Area of concern

LAND USE	AREA (SF) OF LAND USE CHANGE	ACRES	UNITS/SF	
MONTGOMERY COUNTY				
Residential	167,860,866	3,854	14,218	Units
Commercial	9,786,755	225	255,649	SF
Industrial	5,917,267	136	3,550,360	SF
STEWART COUNTY				
Residential	126,529,698	2,905	5,806	Units
Commercial	N/A	N/A	N/A	
Industrial	N/A	N/A	N/A	
CHRISTIAN COUNTY				
Residential	90,720,049	2,083	16,556	Units
Commercial	29,856,964	685	16,418,681	SF
Industrial	27,626,005	634	27,626,005	SF
TRIGG COUNTY				
N/A	N/A	N/A	N/A	
Totals for all counties inside Area of concern				
Residential	385,110,613	8,841	36,583	Units
Commercial	39,643,719	910	16,674,330	SF
Industrial	33,543,272	770	31,176,365	SF

Total Changing Land Use

SF	ACRES
458,297,604	10,521.07

COMMERCIAL - For commercial land use changes, the number used for the analysis was maximum lot coverage. In some cases, maximum lot coverage was not provided, so the analysis used 50 percent, which was the most common for both Clarksville and Oak Grove. The planning team then calculated the area in square footage for each parcel that was showing a change in land use, and multiplied that number by the coverage requirement.

INDUSTRIAL - In determining build out potential for industrial land use, the team employed the same methodology as for the commercial uses.

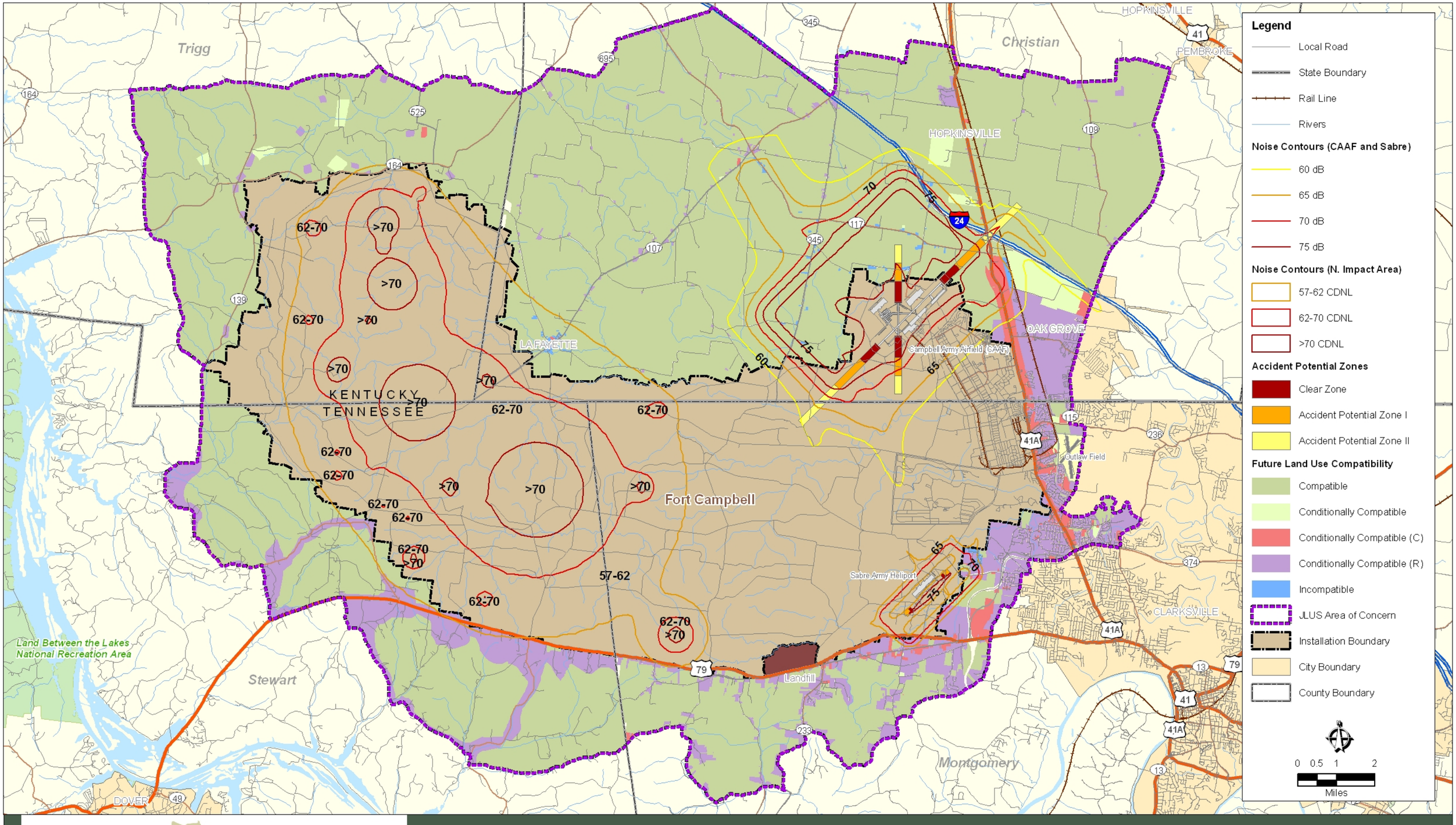

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Figure 16
JLUS Area of Concern - Future Land Use Compatibility

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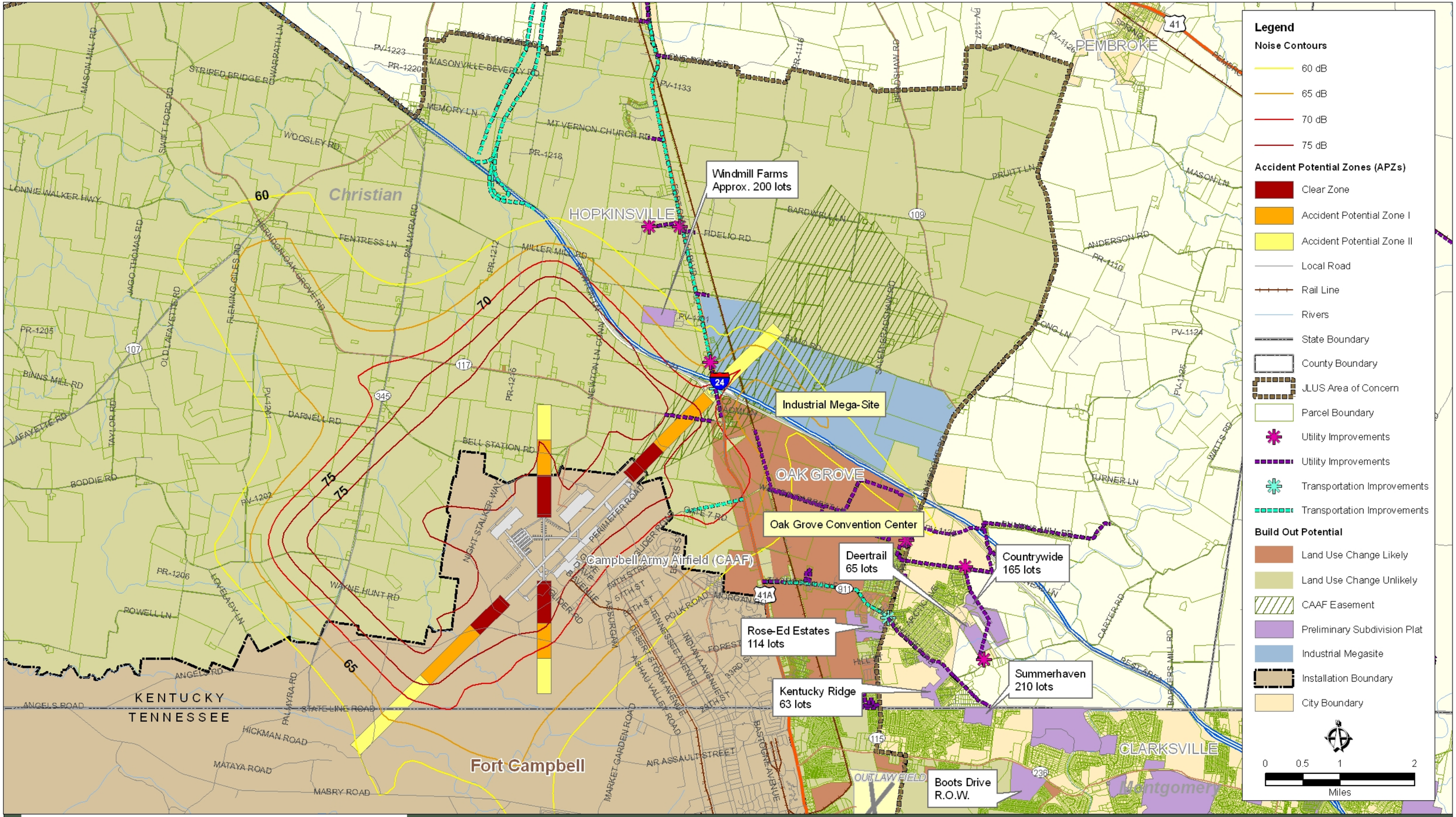

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Figure 17
JLUS Area of Concern - Campbell Army Airfield Build-Out Potential

EDAW | AECOM

Peachtree Section 4
171 lots

Hermitage Estates
66 lots

West Fairfield Place
14 lots

Lone Oak Estates
4 lots

Cunningham Farms
9 lots

Chestnut Grove
320 lots

Liberty Park
350 lots

Wildwood West
113 lots

Peach Grove Estates
12 lots

Redwood Lane Acres
16 lots

Robin Lynn Hills
19 lots

Southern Heritage Estates
62 lots

Sabre Army Heliport (SAH)

Fort Campbell

Landfill

Montgomery

CLARKSVILLE

Legend

Noise Contours
- 60 dB
- 65 dB
- 70 dB
- 75 dB

Accident Potential Zones (APZs)
- Clear Zone
- Accident Potential Zone I
- Accident Potential Zone II

- Local Road
- Rail Line
- Rivers
- State Boundary
- Road Construction Project
- County Boundary
- JLUS Area of Concern
- Parcel Boundary

Build Out Potential
- Land Use Change Likely
- Land Use Change Unlikely
- Preliminary Subdivision Plat
- Installation Boundary
- City Boundary

0 0.25 0.5 1
Miles

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Figure 18
JLUS Area of Concern - Sabre Army Heliport Build-Out Potential

EDAW | AECOM

Based on the analysis, a reasonable build out potential within the AOC could include: 36,583 new residential units, 16,674,330 square feet (SF) of commercial space, and 31,176,365 SF of industrial space (see **Table 16**). Given its currently mostly rural/agricultural condition, Christian County has the highest potential for future development.

Figures 17 and **18** show the full build-out scenario for the sub-areas focused around CAAF and SAH. Each parcel identified as having a land use "likely to change" reflects a zoning designation, such as residential or commercial, that differs from the parcel's currently undeveloped state. As apparent in both maps, significant parcels in proximity to CAAF and SAH have attached development rights that could produce compatibility issues under favorable market conditions. It should be noted that other sub-area parcels currently without a developed zoning designation, such as agricultural (and thus shown as "land use change unlikely" on each figure) could receive additional development rights through a local re-zoning or development process. Parcels in proximity to proposed road construction and infrastructure projects are the likeliest to transition to more developed activities and thus potentially conflicting uses.

NIGHT VISION TRAINING ENVIRONMENT

As noted earlier, night vision flight training, in which aviators use night vision goggles (NVGs) is a critical component of training for the Army and provides the U.S. military with a significant tactical advantage during operations. These night vision systems are designed to operate away from civilization and electric lighting. Exposure to stray light can cause the vision screen to white-out, temporarily robbing the aviator of vision. The light intrusion into the night vision device training environment of the post is a leading threat to mission capabilities.

Historically, the performance of night vision systems has been based on percentages of full moon ambient light. While prior generations required at least some ambient moonlight, the current (3rd) generation of goggles performs effectively without any ambient moonlight. Currently, it appears that aviators cope with light pollution through experience and learning to look away or remove goggles to prevent loss of night vision.

A 1999 study conducted a survey of light pollution and its effects on night goggles. The resulting report proposed a system for addressing stray electric lights as a function of ambient moonlight, size and distance and recommended that criteria be developed "…to insure that required training is conducted safely."

A scientific system for describing the impact of light pollution on night vision as a function of light source, size, and brightness of the offending source(s) does not exist, but would be highly desirable both for the purposes of developing regulations and maintaining the safety of the night vision training environment.

The analysis of land use and growth trends clearly indicates that continued growth around the installation is imminent. **Figure 19** and **Figure 20** show night time aerial imagery of the study area in 1993 and 2003. The major population centers, such as Hopkinsville and Clarksville produce

significant sky glow around the post in both images. However, after a decade of growth, the sky glow has spread further along the region's major corridors, linking previous islands of light.

Development from the east and northeast around Hopkinsville and Oak Grove will exacerbate this trend, directly affecting night aviation at CAAF. To the south, the size and continued growth of Clarksville pose long term concerns for increased light pollution around SAH. The widening of the 79 corridor also places the heliport and a primary flight corridor at further risk of light intrusion.

The distant sky glow from the installation is significant and rivals the sky glow observed for either Hopkinsville or Clarksville. Throughout the post's developed areas, a significant percentage of the installed lighting is inadequately shielded to prevent light pollution. Aviators have identified some of this unshielded lighting on the installation as the cause of ongoing problems with night vision equipment and operations.

The area generating the most complaints of light interference is northeast of Fort Campbell at the US Highway 41A/I-24 interchange. The area is generally beneath the approach path for most landings at the main airfield.

Aviators have cited a gas station at this intersection, along with several other gas stations at other exits as significant sources of light pollution. In general, the lighting of these stations is consistent with practices across the country in areas without lighting ordinances and likely exceeds recommendations (Illuminating Engineering Society of North America RP-33-99 Lighting for Exterior Environments) for service station lighting in areas of low ambient lighting. The worst case service station was unusual in having an all-concrete apron, while most other stations have concrete under the canopy but bituminous paving (blacktop) all around.

The Wal-Mart distribution center, also cited as a major problem by aviators, did not have poorly shielded lighting, high lighting levels, or any other obvious lighting issue. However, illumination of the façade of the entire loading dock zone makes the facility a very large lighted area.

Billboards along the freeway are uplighted, a technique that runs the risk of temporarily blinding even a bare-eyed aviator. Street lighting throughout the region employs mostly drop lens cobrahead luminaires. Offset unshielded roadway luminaires were noted along the 101st Airborne Division Parkway in Clarksville. Some flat lens luminaires were noted, including downtown Hopkinsville. Commercial lighting throughout the area is a modern mixture of well designed fully-shielded lighting, less-desirable sag-lens luminaires and a number

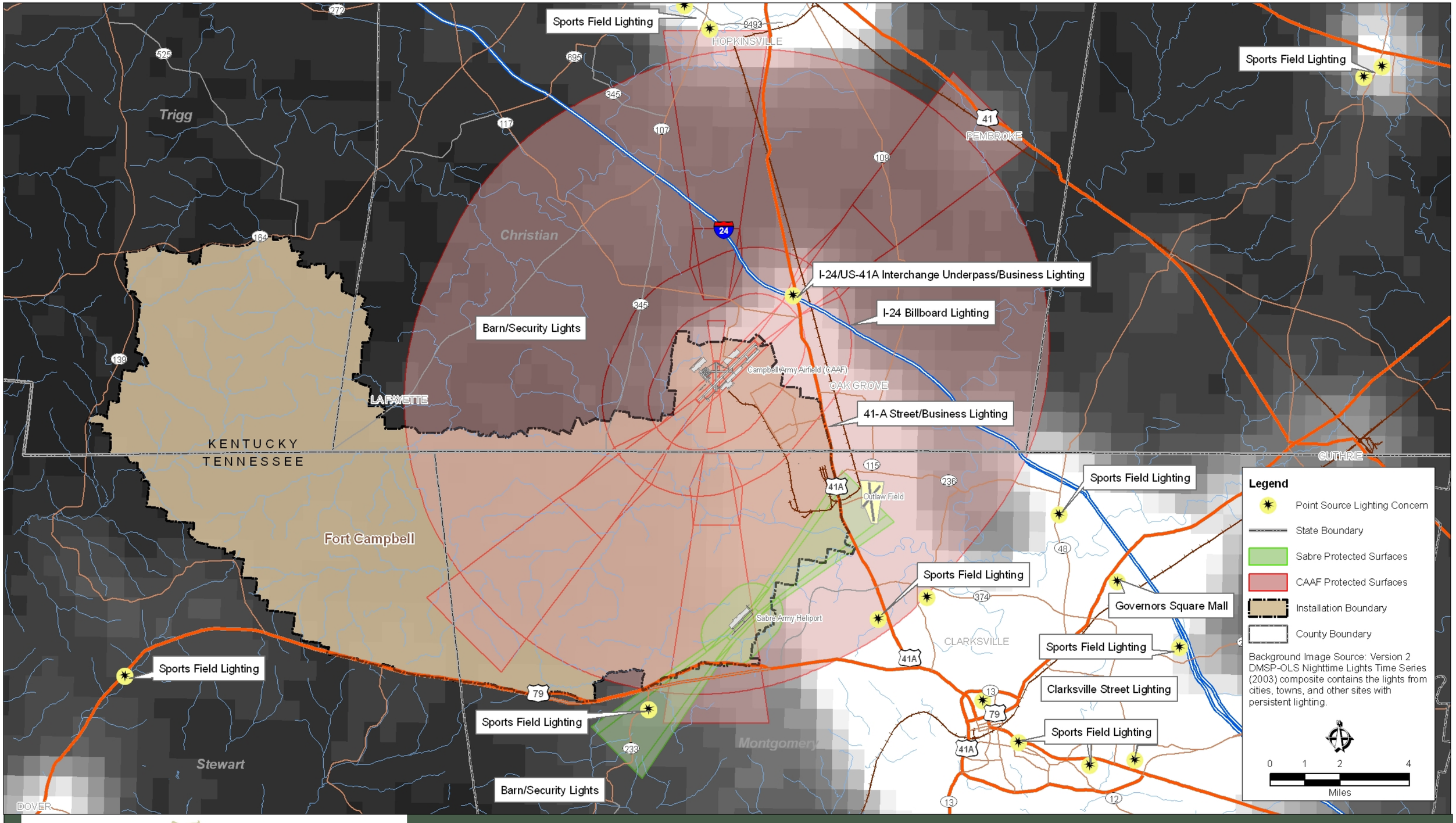

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Figure 19
1993 Lighting Concerns and Protected Airspace Surfaces for CAAF and Sabre

Sports Field Lighting

Pennyrile Parkway Extension

Hopkinsville development expansion

Sports Field Lighting

Wal-Mart Distribution Center

I-24/US-41A Interchange Underpass/Business Lighting

I-24 Billboard Lighting

Barn/Security Lights

41-A Street/Business Lighting

Clarksville development expansion

Sports Field Lighting

Sports Field Lighting

Governors Square Mall

Sports Field Lighting

Clarksville Street Lighting

Sports Field Lighting

Highway 79 Widening

Sports Field Lighting

Barn/Security Lights

Trigg

Christian

KENTUCKY

TENNESSEE

Fort Campbell

Stewart

Montgomery

Campbell Army Airfield (CAAF)

Sabre Army Heliport

Legend

- Point Source Lighting Concern
- Road Construction Project
- State Boundary
- Sabre Protected Surfaces
- CAAF Protected Surfaces
- Installation Boundary
- County Boundary

Background Image Source: Version 2 DMSP-OLS Nighttime Lights Time Series (2003) composite contains the lights from cities, towns, and other sites with persistent lighting.

0 1 2 4

Miles

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Figure 20
2003 Lighting Concerns and Protected Airspace Surfaces for CAAF and Sabre

of poor lighting practices, such as unshielded HID floodlighting and wallpacks.

Commercial and industrial over-lighting and the resulting light pollution are internationally recognized issues. Standards for lighting levels, which are expressed in footcandles, are typically exceeded, especially in commercial districts. While often linked to safety or security, overlighting is more often the result of "light wars" between competing big box store chains, service stations, and auto dealerships. The region around Fort Campbell displays the typical characteristics of commercial lighting.

However, restrictions to lighting levels, which are typically measured as footcandles of horizontal illumination, do not address the type of light pollution caused by unshielded sources. While sometimes attractive when viewed from an overlook, upward lighting is wasteful, and to an aviator it is a source of disability glare.
Overlighting and unshielded light both act as sources of light pollution that affect night vision equipment. For instance, both the 1999 report and comments concerning the Wal-Mart distribution center suggest that large lighted areas cause problems as severe, or perhaps more severe, than small, very bright objects. The Sam's Club property near I-24 Exit 4 in Clarksville poses similar challenges to aviators.

6.0 Overview of Compatibility Efforts

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OVERVIEW

The complexity of coordinating land use issues across jurisdictional boundaries and the limited authority and resources of any individual entity requires concerted action among multiple stakeholders, including federal, state, regional and local government governments; the military and civilian sectors; non-profit organizations; and private landowners. This section gives an overview of compatibility efforts undertaken to date and assesses the degree of partner adherence to the recommendations of the 1996 JLUS.

CURRENT ARMY COMPATIBILITY TOOLS

The Army uses several key tools to promote land use compatibility and minimize operational impacts on surrounding lands, including ongoing outreach strategies and mitigation procedures laid out in planning documents, such as the Installation Environmental Noise Management Plan (IENMP), sustainability initiatives, including the Army Compatible Use Buffer (ACUB) program, and regional land use planning efforts such as this Joint Land Use Study.

INSTALLATION ENVIRONMENTAL NOISE MANAGEMENT PLAN

As noted earlier, the post's IENMP lays out the primary strategies for addressing land use conflicts related to noise and accident potential. In addition to establishing compatibility guidelines and defining areas of concern, the IENMP promotes education for the military and civilian community, the management of noise complaints, mitigation, the "Fly Neighborly" program, and noise abatement procedures.

Examples of noise mitigation measures include:

- using designated corridors and visual flight rule routes to minimize the effect of aircraft noise;
- restricting the altitude for aircraft flying over urbanized areas to 1,000 feet above the ground;
- avoiding residences, buildings, and farm-related facilities during overflights; and
- directing aircraft away from several designated "flight avoidance" properties due to excessive noise complaints.

As described in the next section, Fort Campbell has also implemented several of the recommendations of the 1996 JLUS, including developing a user-friendly brochure on compatibility issues, signing a Memorandum of Agreement with surrounding communities on communication procedures, and conducting routine briefings with the local governments on post activities and projects.

SUSTAINABILITY/ARMY COMPATIBLE USE BUFFER PROGRAM

FORT CAMPBELL 25-YEAR SUSTAINABILITY PLAN

The U.S. Army has embraced sustainability as an overarching framework for addressing multiple threats to its operational capabilities, from the diminishing availability of training areas and aging infrastructure to the use of scarce resources and the increasing stringency of the regulatory environment. Sustainability reflects a long-term, strategic perspective that urges the Army to look beyond the installation to the broader region and to recognize economic, social, and natural interdependencies between the military and its neighbors. Based on this guidance, the Fort Campbell Sustainability Plan seeks to balance protection of the mission, environment and

community. The goal of the plan is to meet current and future mission requirements, while safeguarding human health, improving quality of life, and enhancing the natural environment.

The Sustainability Plan completed in 2004 addresses a series of interrelated themes including:

- ensuring that installation lands and infrastructure will support training and combat readiness;
- providing infrastructure that meets the needs of users, reduces overall costs, and limits dependence on non-renewable energy sources;
- promoting sustainable regional development that protects and enhances the mission of Fort Campbell, the regional environment, and the regional quality of life; and
- maintaining cost-effective, reliable, safe, secure, and pollution-free transportation systems in partnership with the local communities and states.

The sustainability plan encourages installation planners to integrate efforts across previously separate functional areas and to conduct community outreach efforts that include awareness, engagement, support, and education. Planners monitor various aspects of the sustainability program through the Fort Campbell Environmental Management System and the Fort Campbell Strategic Plan. The installation intends to update its Sustainability Plan in 2009-2010.

ARMY COMPATIBLE USE BUFFER PROGRAM

Combat success requires sufficient land for maneuvers, live fire, testing and other operations to prepare and train soldiers. Army Compatible Use Buffers (ACUBs) support the Army's mission to fight and win the nation's wars by establishing buffer areas around installations that limit effects of encroachment and maximize the lands inside the installation that can be used to support training and readiness activities. The ACUB program is an integral component of the Army's sustainability efforts to protect mission, environment, and community and is an innovative tool in preventing incompatible development around installations.

Title 10, Section 2684a of the United States Code authorizes the Department of Defense to partner with non-Federal governments or private organizations to establish buffers around installations. The Army uses this authority to reach out to partners to identify mutual priorities for conserving land and to prevent development of critical open areas.

The core implementation strategy of the ACUB program is to acquire conservation easements on lands with high conservation value that prohibit incompatible development in perpetuity, while allowing the fee interest ownership of the land to remain in private hands. The program allows the Army to contribute funds to the partner's purchase of easements or properties from willing landowners. While the restrictive covenant prohibits urban development, it accommodates low impact uses such as farming and forestry that do not pose a risk of encroachment to nearby training activities. The ACUB program thus achieves the complementary goals of limiting disruptions to training capabilities or flexibility, while protecting key environmental resources and high-value habitat, thus producing a win-win transaction for property owners, the environment, and the military.

The specific training needs of the post's tenant units depend upon the presence of compatible uses on privately owned adjacent lands that serve as over-flight and/or noise buffers. After exploring various options, the U.S. Army and Department of Defense determined

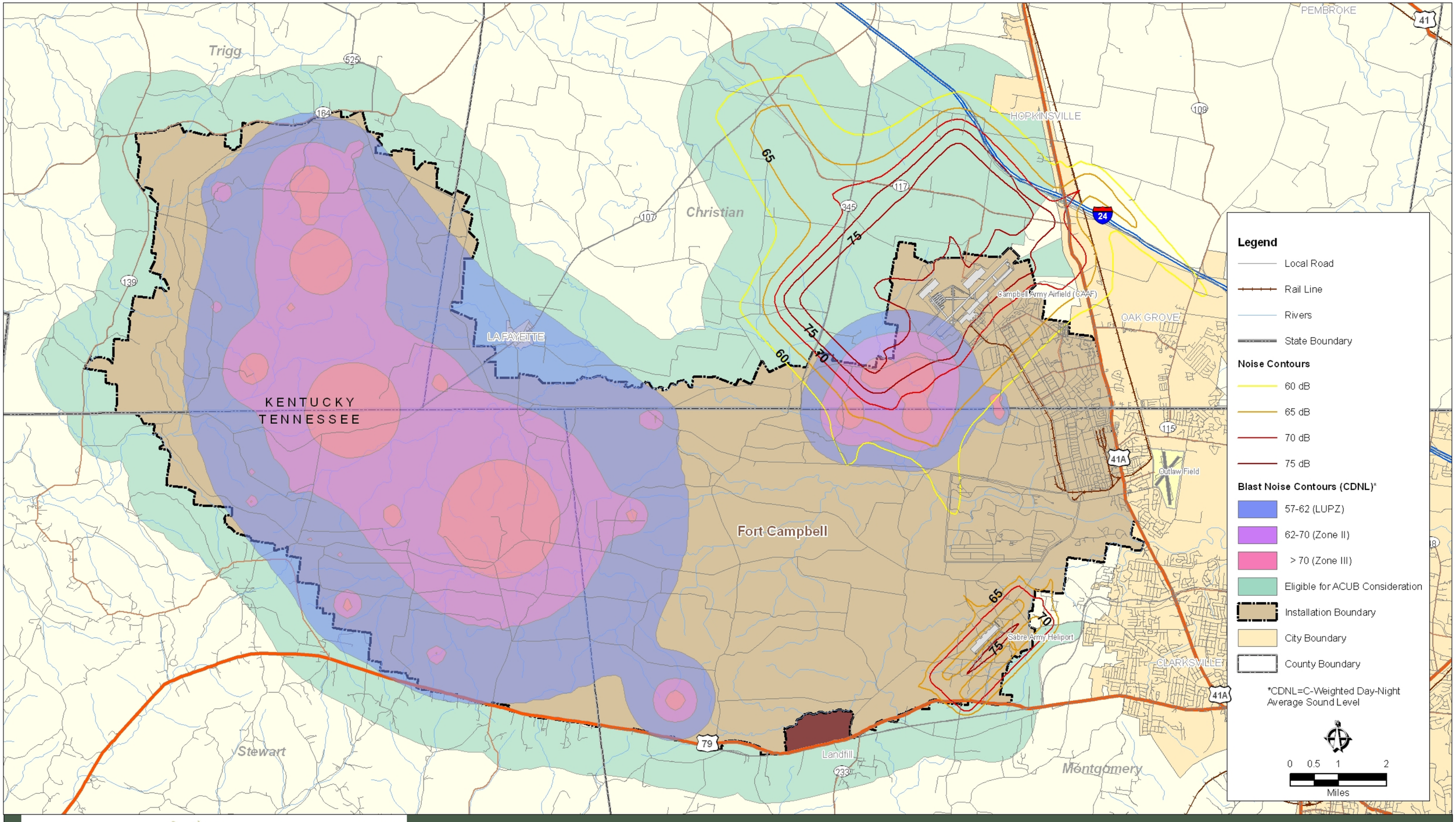

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Figure 21
Army Compatible Use Buffer (ACUB) and Noise Contours

EDAW | AECOM

that the ACUB was less costly, time-consuming, and controversial than fee-simple real estate acquisition as a means to reduce encroachment. Fort Campbell sought approval for multi-year funding (beginning in FY06) to implement an ACUB program around the installation (See **Figure 21**). The program allows installations to partner with conservation organizations to coordinate habitat conservation planning at the ecosystem level. Fort Campbell identified four ACUB priority areas based in part upon the following criteria:

- the land is in a designated high noise area;
- it is under or near a major flight corridor;
- it is within a 1+ mile zone of influence;
- it is within the designated "light sensitive" area;
- it is in the Military Operations Area that has been approved by FAA for low-level flights; and/or
- it has high conservation value.

The purpose of ACUB priority #1 is to protect Fort Campbell's two airfields, CAAF and SAH. The airfields are vital to the military mission, but remain vulnerable to emerging land use conflicts. The ACUB includes sub-areas created for each airfield, including the entire CAAF overflight area. Both sub-areas satisfy all six criteria; land around CAAF also features some of Kentucky's most fertile farmland. The overall size of this priority zone is approximately 9,900 acres.

ACUB priority #2 is a 29,100 -acre buffer zone consisting of a one-mile buffer in Christian County, KY and a one-mile buffer in Montgomery County, TN. The area adjoins US 79 and includes mostly undeveloped farmland with some residential strip development. This area is intended to buffer the southern flight approaches into Golden Eagle FLS, SAH, and Suckchon Drop Zone, a perimeter flight corridor, and maneuver areas near the installation boundary from future commercial and residential development along a widened US 79 corridor.

ACUB priority #3 is a 19,680 -acre area includes a one-mile buffer portion of Trigg County, KY and Stewart County, TN. The primary objectives of ACUB area #3 are to limit development in the high noise zones associated with the North-South Impact Area, as well as to preserve a primary Fort Campbell flight route. The land is mainly agricultural, but is at risk for conversion to strip residential development along county roads adjacent to the post.

ACUB priority #4 is a 40,000-acre area located between the Land Between the Lakes Recreational Area and Fort Campbell in Trigg County, KY and Stewart County, TN. The zone, which is largely forest and agricultural land, has a high conservation value due to the presence of habitat for several endangered species. Since this expansive, privately owned area is at somewhat lower risk of encroachment relative to the other priority areas, Fort Campbell ACUB Partners will focus on securing easements for certain properties with high mutual benefit.

It should be noted that growth just outside the installation fence poses risks to mission viability beyond exposure to noise and accident potential. The continued loss and fragmentation of surrounding natural habitat due to unmanaged development can, for example, cause species to seek out the remaining intact open lands on post. The presence of threatened and endangered species on the installation can in turn lead to training restrictions. Fort Campbell is currently home to two listed threatened and endangered species: the Gray bat (Myotis grisescens) and the Indiana bat (Myotis sodalis); and another four species of state concern. While protection of these species

does not yet result in operational limitations, the continued loss of nearby habitat places an additional burden on the Army to maintain open space, thus restricting training flexibility.

Fort Campbell's training areas also contain around 4,000 acres of unique grasslands referred to as barrens and recognized as an area of exceptional ecological importance in the Interior Low Plateau Ecoregion and some of the best remnants of native grasslands east of the Mississippi River. Along with its ACUB partners–the Land Trust for Tennessee, the Kentucky Department of Agriculture–Fort Campbell has identified over 80,000 acres around the installation that are eligible for ACUB consideration. Conservation efforts will likely be limited to a relatively small portion in the foreseeable future. The Recommendations section of this report explores additional strategies for promoting sustainability partnerships throughout the region.

OTHER REGIONAL PARTNERING EFFORTS

In addition to addressing its operational impacts, Fort Campbell has engaged regional partners in a series of broader efforts related to land use and transportation planning. The installation participated in an exchange of 358 acres of Army property for 670 acres owned by Bi-County (Montgomery and Stewart Counties) Solid Waste Management. The exchange, completed in 2008, allowed Bi-County to expand its public landfill and provides Fort Campbell with replacement training land and long-term refuse disposal rights.

As part of a second initiative, the Army conveyed 200 acres of land to TDOT to facilitate the widening of U.S. Highway 79 to four lanes. Under an MOA updated in 2006, TDOT provided Fort Campbell with funds to acquire replacement property, which is currently underway. Both actions reduced the amount of privately-owned land located adjacent to installation training areas.

Fort Campbell also launched an effort in 2004 to acquire restrictive easements on 4,000 acres of privately owned land adjacent to the CAAF main approach, using MCA funding acquired through the efforts of the Citizens for Fort Campbell. The objective of the Army project is to protect the main runway and flight approach from height obstructions and incompatible land uses. The Army completed almost all easement acquisitions under this project in 2008. The Army also is in the process of conveying an unused portion of its railroad property to the City of Hopkinsville for use as a utility and recreational corridor.

The Kentucky Transportation Cabinet is widening Cole Rd/Gate 7 to relieve congestion on US 41A and to improve installation access. The Cabinet is currently acquiring right-of-way and completion is scheduled for 2011.

Under a second transportation/infrastructure effort, the Army is installing concrete barrier walls along US 41A to provide security from potential terrorist attacks and to serve as a noise and privacy barrier for installation housing areas. The project is slated for completion in 2009.

The Clarksville-Metropolitan Planning Organization, the Departments of Transportation (DOT) in Kentucky and Tennessee, and Fort Campbell are jointly planning the installation of variable message

boards along US 41A, KY 911, and Tiny Town Road. The DOTs will primarily use the boards to notify motorists of traffic-related events, but Fort Campbell will also use them to provide information to the public, such as access control point changes and gate closures. Kentucky Transportation Cabinet is scheduled to complete its portion of the project in 2009.

Finally, Kentucky Transportation Cabinet is planning reconstruction of the KY Highway 911/115 intersection. The objective of the project is to improve safety and access to the installation, as well as improve mobility in Oak Grove. The project is slated for completion in 2010.

1996 JLUS AND PROGRESS SURVEY

1996 JOINT LAND USE STUDY

The Fort Campbell region was an early adopter of coordinated military/civilian land use/encroachment prevention planning. In 1996, the Army and participating local governments completed a JLUS for the surrounding four-county area of Montgomery, Stewart, Christian and Trigg Counties. The study articulated the following mission statement:

> *Recognizing the vital role of Fort Campbell and related facilities for the Kentucky and Tennessee communities and recognizing the vital role of Kentucky and Tennessee communities on the region, it is important that a military and community partnership is developed, which encourages balanced growth and development.*

The plan also established both community and military goals, including:

- Controlling development in the vicinity of Fort Campbell and Outlaw Field;
- Planning for the orderly accommodation of new development;
- Minimizing the impact of growth on existing development, streets, and resources;
- Promoting the public health, safety, comfort, and general welfare of the inhabitants of Fort Campbell, Montgomery County and Stewart County, Tennessee and Christian County and Trigg County, Kentucky;
- Restricting land uses that are recognized as incompatible in noise sensitive areas and those prohibited in clear zones for aircraft safety;
- Limiting the density of development and intensity of use in areas below the take-off and approach flight paths that are exposed to significant danger of aircraft accidents;
- Basing land use compatibility standards on noise sensitivities; and
- Basing land use planning and zoning in the military environs on non-military issues, such as existing land use patterns and socio-economic considerations.

To achieve these stated goals, the JLUS recommended a series of encroachment reduction strategies for the surrounding communities and Fort Campbell. Tools emphasized included special purpose zoning to reduce the exposure of development to excessive noise and safety risks, height restrictions to protect the navigability of air space, indoor noise reduction requirements, real estate disclosure, the coordination of infrastructure policy, and participation in memoranda of understanding among affected interests.

TABLE 17

1996 JLUS Recommendations by Community Partner

ACTION	Oak Grove	La Fayette	Christian Co./ Hopkinsville	Clarksville/ Montgomery Co.	Stewart & Trigg Counties
Adopt zoning to restrict height of structures and protect airspace	√	√	√	√	√
Special district guidelines in zoning and subdivision regulations that reflect APZs and noise zones	√	√	√	√	
Include indoor noise reduction standards	√	√	√	√	√
Establish noise disclosure procedures	√	√	√	√	√
Meet regularly with Fort Campbell representatives to coordinate the planning of water, wastewater and transportation	√	√	√	√	√
Sign an MOU with Fort Campbell	√	√	√	√	√
Distribution of brochure/handouts	√	√	√	√	√
Prepare a land use plan to manage growth around Fort Campbell		√			
Amend zoning to include annexed property along 41A			√		
Prepare an Urban Fringe Area Plan to minimize encroachment			√	√	√
Revise Comprehensive Plan to promote compatibility goals			√	√	√
Adopt special purpose zoning for areas near Fort Campbell			√	√	√

The purpose of this update is to build on the 1996 study by assessing the degree of partner adherence to suggested strategies and further refining recommendations to reflect current development issues, growth trends, and changing mission needs. **Table 17** illustrates specific recommended actions by local government partner under the 1996 JLUS.

The 1996 report recommended the following recommendations for Fort Campbell to:

- Developing a procedure for managing noise complaints
- Developing an easy to understand brochure on noise impacts
- Providing cities with periodic updates on studies being conducted to reduce building vibration from blast noise
- Making data from noise monitors available to public officials and planning agencies
- Establishing a waiver on the firing of artillery on Sundays from 9 AM to Noon (Lafayette, KY)
- Meeting regularly with community representatives to coordinate the planning of water, wastewater and transportation
- Signing an MOU with affected local governments
- Relocating the NAVAID at CAAF
- Clearly delineating installation boundary in the vicinity of Lafayette, KY
- Using Explosive Research Group evaluation of good/bad firing conditions to reduce complaints
- Securing avigation easements & noise agreements on properties surrounding Fort Campbell

Fort Campbell has complied with seven of the 1996 recommendations including: managing noise complaints; developing an outreach brochure; periodically briefing cities; participating in MOUs; relocating NAVAID; evaluating firing conditions; and securing avigation easements.

JLUS PROGRESS SURVEY

To assess the priorities of decision-makers and to determine the effectiveness of previous compatibility actions, as well as interest in exploring new anti-encroachment tools, the planning team administered a short JLUS Progress Survey to members of the Executive Committee. Members of the Technical Coordinating Committee also provided responses. **Tables 18** and **19** display the results of the survey.

The survey asked respondents to answer the following questions on a scale of 1 to 4 with a score of 1 indicating a weak response and 4 indicating a strong response. All respondents recognized Fort Campbell as a significant economic driver of the region. Both committees viewed the level of collaboration and communication between Fort Campbell and local governments as moderately strong, though Technical members tended to rate the strength of the military/community relationship slightly higher. Technical Committee members believed that existing community policies have been more effective in limiting incompatible growth than their senior official counterparts. Respondents indicated relatively limited concern in the surrounding communities about noise and other operational impacts, but suggested the need for increased community awareness of the constraints that incompatible growth can impose on the military mission.

The survey then asked respondents to evaluate the need for exploring a series of possible

strategies to promote compatible land uses around the installation. A score of 1 indicates no need to pursue a particular tool and a score of 4 indicates a strong need. All respondents viewed land use and zoning controls as an essential tool in managing encroachment. Technical Committee members also placed strong emphasis on outdoor lighting standards to protect the night vision training device environment. Improved communication and regional coordination, the use of real estate disclosures and the securing of conservation easements scored favorably. The Executive Committee saw less value in the direct acquisition of land by the Army, indoor noise reduction requirements, and controls on transportation improvements.

TABLE 18

Progress Survey Results, Question Responses

QUESTION	Executive Committee Avg. Score	Technical Coordinating Committee Avg. Score
1. How would you characterize the overall level of collaboration between your community and Fort Campbell?	3	3.5
2. How would you characterize the level of communication between your local community and Fort Campbell?	3.2	3.5
3. How important is the continued mission of Ft Campbell to your community in terms of sustaining economic growth and job creation?	4	3.8
4. How effective do you think that existing community policies have been in limiting incompatible growth around the installation?	2.8	3.3
5. What is the level of concern in your community about noise or other impacts generated by operations and training activities at Fort Campbell?	2.4	2.8
6. What is the level of awareness in your community about the effects of incompatible development on the Fort Campbell mission?	2.4	2.7

CURRENT LOCAL GOVERNMENT COMPATIBILITY TOOLS

The local governments surrounding Fort Campbell have adopted various measures to promote compatible land use around the installation. The major encroachment reductions implemented by community to date are:

STEWART COUNTY

- The County has signed an MOU with Fort Campbell; increased emphasis on implementation of the MOU is recommended

TRIGG COUNTY

- The County has signed an MOU with Fort Campbell; increased emphasis on implementation of the MOU is recommended
- The Trigg County Planning Commission attaches noise warnings to plats within an established distance from the installation

TABLE 19

Progress Survey Results, Question Responses Ranking of Possible Compatibility Tools		
TOOL	Executive Committee Avg. Score	Technical Coordinating Committee Avg. Score
Land use/zoning	3.4	3.8
Improved communication with military	3.3	3.6
Conservation easements	3.0	3.4
Acquisition of land by the Army	2.0	3.6
Real estate disclosure	3.2	3.2
Outdoor lighting standards	3.2	3.8
Improved regional coordination	3.0	3.2
Indoor noise reduction standards	2.3	3.0
Controls on infrastructure improvements	2.8	3.0
Controls on transportation improvements	3.2	3.6

OAK GROVE

- The city has signed an MOU with Fort Campbell and implemented its provisions
- City agencies send development plans to Fort Campbell for review as though it were another city department
- Oak Grove passed a city-wide lighting ordinance in August of 2007; the ordinance requires that all lighting installed face downward
- The city adopted a sign ordinance in 2008 regulating the height of signs

HOPKINSVILLE

- The city has signed an MOU with Fort Campbell and implemented its provisions
- Hopkinsville has adopted a military overlay district that includes height restrictions, noise attenuation standards, and exterior lighting design criteria
- Hopkinsville grants the Army an opportunity for site/subdivision review and comment

CHRISTIAN COUNTY

- The county has signed an MOU with Fort Campbell and implemented its provisions
- The MOU also requires plats in noise zones to carry noise warnings
- The county allows the installation an opportunity to review development proposals in south Christian County
- The county has incorporated supportive compatibility language into their Comprehensive Plan
- Christian County supported the State's enactment of the KY Airport Zoning around CAAF

CLARKSVILLE/MONTGOMERY COUNTY

- Clarksville/Montgomery County has signed an MOU with Fort Campbell and implemented its provisions
- The planning commission grants the Army site/subdivision review within a one+ mile buffer surrounding the installation

- Montgomery County has adopted the Sabre Heliport Overlay District ordinance, which regulates land use and lighting design criteria within the Aircraft Light Sensitive Area, Noise Zones, Military Noise Disclosure Areas, and Approach Departure Surface Areas
  - » The ordinance requires noise level reduction for new residences, offices, churches, and schools built in Noise Zones 2 and 3
  - » In the Military Noise Disclosure Area, all subdivision plats and site review plans require disclosure
  - » Also, building permit applicants must sign a noise disclosure stating that premises may be exposed to excessive noise levels from the heliport in Noise Zones 2 and 3
- Clarksville-Montgomery County has updated the Comprehensive Plan to reflect compatibility with Fort Campbell; specific language includes:

  It was deemed important by the Coordinating Committee to maintain lower level of residential development in the areas surrounding Fort Campbell because of problems with noise and light pollution. Residential development is adversely affected by the bright lights associated with development which could interfere with night flight training exercises. Reference should be made to the Joint Land Use Study of 1996.
- Clarksville is in the process of revamping zoning districts to incorporate smart growth and compact development; these are tools that can enhance the ability to manage growth in transitional areas near the installation
- The Clarksville-Montgomery County Growth Plan encourages higher density residential, commercial, and industrial development in an Urban Growth Boundary contiguous with the City of Clarksville; designated Planned Growth Areas are appropriate for low to moderate density growth; the plan designates rural areas outside the Urban Growth Boundary and the Planned Growth Areas; these plans facilitate land use compatibility with the military mission and reduce the risk of encroachment by guiding new growth away from rural areas in proximity to the installation

It should be emphasized that Fort Campbell and the partner communities of the JLUS maintain a close and collaborative relationship. As evident from the list of actions taken, local governments are planning proactively to protect the mission viability of the post and to reduce the exposure of residents to noise, air safety hazards, and other operational impacts. However, the review of current policy also suggests key gaps in compatibility planning, including the lack of appropriate land use controls in Trigg, Christian and Stewart Counties. The recommendations of this report focus on strengthening the encroachment reduction tools available to local planners and decision-makers.

FEDERAL AND STATE INITIATIVES

SUSTAINABLE RANGE PROGRAM

The Department of Defense (DoD) developed the Sustainable Range Program (SRP) to give Army installations access to an array of planning, facilities management, environmental management, munitions management, and safety program tools. The SRP is a comprehensive approach to improve the way the Army plans, manages, and uses its ranges in support of long-term viability, more efficient and effective training, and reduced demands on scarce resources, such as land, air, water, and energy. The SRP includes several major efforts:

- The Range and Training Land Program (RTLP) plans for the safe day-to-day management of

range lands and enhanced training performance;

- The Integrated Training Area Management (ITAM) Program seeks to achieve the optimum use of lands for combat realistic training through planning, rehabilitation, maintenance, mapping, assessment, and monitoring; and
- The Readiness and Environmental Protection Initiative (REPI) is a collaborative effort to reduce the risk of encroachment from off-post activity as described below.

READINESS AND ENVIRONMENTAL PROTECTION INITIATIVE

Once specifically sited in remote areas, military installations are now often in the path of advancing exurban development or have generated external growth through spin-off economic activities. Over the past decade, the DoD has increasingly recognized encroachment as a major constraint in safely and effectively carrying out the training and readiness activities of the military.

In an effort to protect the future use of installations and training land, the FY2003 National Defense Authorization Act authorized the Military Services (Army, Navy, Marine Corps and Air Force) to enter into agreements with non-federal conservation organizations to acquire real estate (from willing sellers only) in the vicinity of military installations such as bases, posts and forts. The statutory authority can be found in the United States Code at 10 U.S.C. 2648a.

The Readiness and Environmental Protection Initiative (REPI) grants the military the ability to enter into agreements with eligible entities, such as local governments, non-governmental organizations, and willing land owners to secure conservation easements on property in the vicinity of, or ecologically related to, a military installation or military airspace. The Army implements REPI strategies through the Army Compatible Use Buffer program described earlier. The agreements enable private organizations to acquire, on a cost-shared basis, development interests in the properties of voluntary sellers. The property owner typically continues to hold the title for the land, but receives monetary compensation and tax breaks to maintain the encumbered property in a highly limited use that preserves habitat and avoids interference with the operational procedures of the nearby installation. REPI is the fastest growing conservation-based program in the federal government today.

STATE INITIATIVES

Complementing federal policy efforts, states have increasingly mandated collaborative planning among military installations and local governments. The State of Kentucky, for example, requires jurisdictions near military installations to include a military compatibility component in their comprehensive plans, but does not require local entities to consult with the military installation regarding proposed land use changes. The State of Tennessee does not mandate local compatibility planning around installations. In 2006, state legislators introduced a measure to require local governments or regional planning commissions to notify military installations of proposed land use or zoning decisions on land within one mile of any installation. The bill did not pass. It should be noted, however, that Montgomery County already performs consultation as proposed under the 2006 Tennessee bill.

Various states have also formed advocacy bodies to strengthen the relationship between state agencies, installations, and local communities. The Kentucky Commission on Military Affairs has adopted a strategic plan to protect military interests within the state and has performed an economic analysis of the military presence in Kentucky. Current efforts, to date, have focused

primarily on Fort Knox, Kentucky. Tennessee also has a state military affairs commission, but that body is not currently active.

Kentucky Revised Statute 183.861 establishes a state-operated Airport Zoning Commission and delegates all powers to establish zoning and land use regulation within and around publicly owned airports to this Commission. This authority explicitly includes military airports. This Commission operates out of the Kentucky Transportation Cabinet, Department of Aviation.

The Kentucky Airport Zoning Commission is authorized to consider the following factors in developing zoning and land use regulations around publicly owned airports:

- Safety of airport users
- Safety of surface persons and property
- Character of flying operations
- Terrain
- Height of existing structures or trees
- FAA guidance
- Future development plans of the airport
- Densities of dwellings with regards to public safety
- Protection of the public investment in airports
- Views of surrounding land owners

As such, the Kentucky Airport Zoning Commission is empowered to regulate land use, including density and building height, in order to ensure the future compatibility of military operations at airports with surrounding land uses. The powers of the Kentucky Airport Zoning Commission, however, do not prevent local governmental authorities from also regulating land use. Local governmental authorities may also use land use regulations to protect safety and the public interest in and around airports; however they must defer to the Kentucky Airport Zoning Commission where the Commission's requirements are more stringent.

7.0 Compatibility Tools

FORT CAMPBELL
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OVERVIEW

The JLUS Update document is intended as a series of tools that the Army and the local governments can choose to adopt during the implementation phase of the JLUS process. All of the entities participating in the JLUS, including the Army and cities and counties, retain the responsibility of selecting those compatibility tools that best reflect the specific issues, concerns, and needs of each stakeholder.

The tools identified below are the result of a thorough, good-faith effort on the part of the Technical Coordinating Committee (TCC) and the Executive Committee (EC) to assess the existing and foreseeable effects of Fort Campbell, Campbell Army Airfield (CAAF), and Sabre Army Heliport (SAH) on adjacent land and to develop a set of options that promote collaborative regional decision-making and balance community and military interests while meeting the following goals:

- Protect the military mission
- Protect the health, safety and welfare of the military and civilian communities
- Sustain economic development and protect property rights
- Protect the environment
- Tailor options to each community
- Secure proper funding and administrative resources for implementation
- Maintain political feasibility

This section organizes findings into two parts:

1. An overview of available encroachment reduction strategies
2. A prioritized list of feasible encroachment reduction measures

The supporting Appendices include land use compatibility guidelines, specific examples of recommended ordinances, agreements, and public outreach materials.

AVAILABLE ENCROACHMENT REDUCTION STRATEGIES

The TCC evaluated a wide range of tools based on criteria such as: feasibility; likely effectiveness; the availability of resources for implementation; the ability to protect the military mission and installation sustainability; the ability to protect the economic health of the region and individual property rights; and the overall ability to protect health, safety, welfare, and quality of life.

The tools are also intended to address a variety of possible land use and operational issues, including physical adjacency to Fort Campbell/CAAF/SAH, conservation or natural resource value, noise, air safety (both for people on the ground and for aviators), and light pollution.

The descriptions below include strategies that may not yet be fully feasible in the Fort Campbell region, but have value as long-term approaches to minimizing incompatible development around the installation. In other cases, the participating entities have partially adopted available strategies and the prioritized recommendations focus on enhancing these current measures. As development conditions and mission impacts evolve, the JLUS encourages local officials and planners to revisit this list of strategies to further refine and strengthen their set of encroachment reduction tools.

CONSERVATION

Conservation refers to a series of tools designed to eliminate land use incompatibilities and preserve critical lands through voluntary transactions in the real estate market and local development process. These strategies are particularly effective because they advance the complementary goals of shifting future growth away from the installation, while protecting the environment and wildlife habitats, maintaining agriculture/silviculture, and conserving open spaces and rural character.

As part of this strategy, Fort Campbell has partnered with the Land Trust for Tennessee and the Kentucky Department of Agriculture to explore the purchase of conservation easements from willing property owners within high priority acquisition areas identified under the Army Compatible Use Buffer (ACUB) Program. The Army has identified priority areas near CAAF and other lands to the north and south of the installation. The ACUB program has emerged as one of the most effective of the sustainability initiatives in preventing encroachment around installations. The core implementation strategy of the program is to acquire conservation easements that prohibit incompatible development in perpetuity, while allowing the land to remain in private hands. While the restrictive covenant prohibits urban development, it accommodates low impact uses such as farming and forestry that do not pose a risk of interference with nearby training activities.

Local governments can participate in the conservation process by acting as direct cost-sharing partners in conservation easement purchases or by aligning their infrastructure and land use policy to reinforce the rural/agricultural character of areas near or within the designated ACUB. The prioritized actions identify specific complementary roles for adjacent local governments in the acquisition of development rights or the use of quality growth strategies to direct public services and new growth away from undeveloped areas in proximity to the installation.

ZONING

Zoning requires activities, such as industry, retail, recreation, agriculture, and very low density/rural residential that maintain compatibility with post and airfield operations and overflight areas. Compatible activities generally avoid the concentration of people and show lower sensitivity to noise and other possible operational impacts. Zoning typically also regulates the effects of private land uses on nearby military training by, for example, minimizing light pollution or limiting the height of structures that may interfere with navigable airspace. As part of this strategy, local governments would create a specialized Military Activity Zoning District that governs uses within established noise zones contours and Accident Potential Zones.

While several jurisdictions, including the City of Oak Grove, the City of Hopkinsville, and Montgomery County have zoning procedures in place to promote the compatibility of development near military activity, unincorporated portions of adjacent counties, particularly to the north and southwest of the post, are not subject to comparable land use controls under a county-wide zoning ordinance. Currently, Christian, Trigg, and Stewart Counties do not have county-wide zoning in place.

The JLUS emphasizes that county-wide zoning in Christian, Trigg and Stewart Counties can be an effective long-term strategy for managing eventual residential and commercial growth around the installation, as well as promoting quality, cost-efficient development throughout the

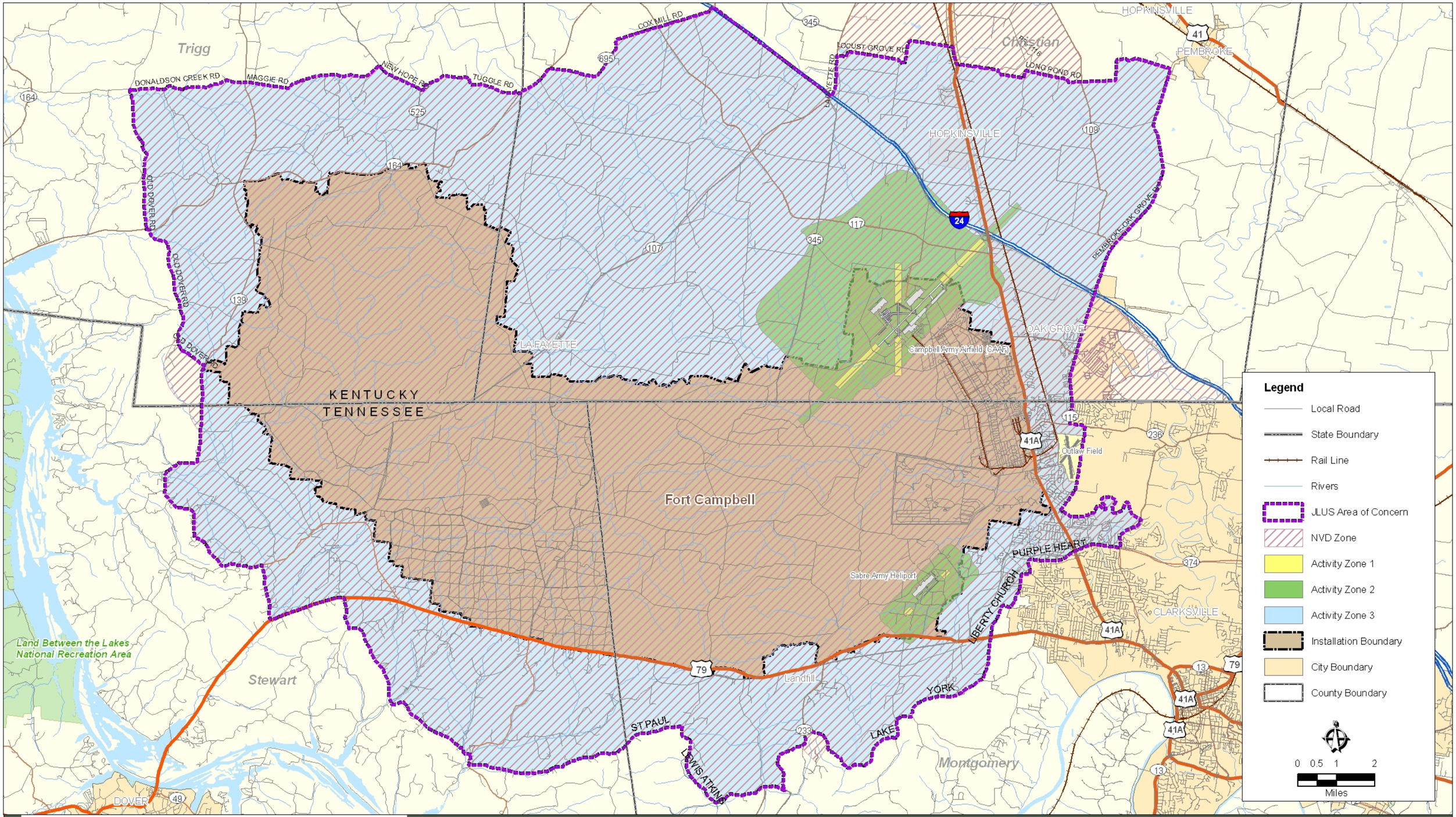

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Figure 22
Fort Campbell Activity Zones

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counties. However, it should be noted that zoning can only be implemented at the discretion of the local jurisdiction. Fort Campbell or the JLUS Partnership does not have any authority to impose zoning regulations/land use controls on local jurisdictions.

Appendix H contains a model ordinance for possible zoning districts around Fort Campbell. The ordinance divides land into three zones based upon the level of impact from military operations and then regulates residential density, intensity of non-residential uses, building height, and exterior lighting, and requires indoor noise attenuation and real estate disclosure.

Three districts are established for the Fort Campbell Activity Zones (FCAZ): FCAZ I, FCAZ II, and FCAZ III. FCAZ I includes the Clear Zones and Accident Potential Zone I associated with Campbell Army Airfield. FCAZ II includes Accident Potential Zones II and all areas within the noise zone LDN 70 (see the Public Safety Buffer Area on **Figure 22**). FCAZ III includes all land inside the JLUS Area of Concern. Regulations are the most restrictive in FCAZ I and relax for FCAZ II and III.

While this section identifies zoning as a long-term strategy that warrants ongoing consideration by local officials and residents, the list of prioritized actions below explores near-term alternative land use policies that can assist in reducing emerging conflicts at the community/military interface, as well as other mechanisms for addressing lighting and height issues.

SUBDIVISION REGULATIONS

Even communities without zoning often have subdivisions regulations at the engineering and site planning stage in the development process that govern the size, shape, configuration, orientation and utility access for a tract of land or an individual lot. Special environmental considerations have become accepted as part of the subdivision development process and are justified under the delegated police powers to protect the public health, safety, and general welfare.

In the interest of protecting public health and safety, a subdivision regulation may prohibit the subdividing of property into residential lots if the tract is within a designated ICUZ/ENMP high noise zone recognized by the local approving authority as the maximum threshold for intrusive noise. Similarly, commonly used local police powers can prohibit the subdivision of land into residential building lots if the subject property is in one of the more restrictive air safety zones, such as a Clear Zone or Accident Potential Zone I.

NOISE ATTENUATION

Attenuation refers to special design and construction practices intended to lower the amount of noise and vibration that penetrates the windows, doors, and walls of a building. Local governments should require attenuation as part of building code enforcement for new residential and other noise sensitive construction in certain noise affected areas (typically in excess of 60 dB). Attenuation practices are most effective for areas subject to A-weighted noise, generated by aviation activity. Air operations are the major source of noise affecting surrounding lands. Both the City of Hopkinsville and Montgomery County have adopted military noise reduction standards for development in proximity to CAAF and SAH.

Sound attenuation guidelines are available in the latest advisory document: *Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations, 2005.*

REAL ESTATE DISCLOSURE

Disclosure requires the release of information on possible impacts (dust, smoke, noise/vibration, air safety zones) to prospective buyers or renters as part of real estate transactions for properties close to Fort Campbell/CAAF/SAH (i.e. inside the JLUS Area of Concern). Local governments would implement this tool by adopting a local real estate disclosure ordinance and seeking the participation of real estate professionals.

Montgomery County requires that building permit applicants sign a noise disclosure stating that premises may be exposed to excessive noise levels from the heliport in Noise Zones 2 and 3.

Appendix C contains a sample real estate disclosure form and real estate disclosure ordinance.

AVIGATION EASEMENTS

An avigation easement is a form of disclosure aimed at the developer, rather than the individual buyer, during the initial stages of platting. An easement is the right granted to a third person to use private real property in a specified manner. An easement may be given, for example, for overhead wires, underground gas, power, sewer or storm drain lines, and sidewalks or roads. An avigation easement is a property right acquired from a land owner that grants the right of military training activities in proximity to the affected parcel, including the right to:

- cause noise, vibration, dust, etc.
- restrict or prohibit certain lights, electromagnetic signals, or land uses that could interfere with communications technology and safe aircraft operation; and
- ensure unobstructed airspace over the property above a specified height

The easement runs in perpetuity with the deed to the property. Local governments increasingly rely on such easements to protect military operations against encroachment from nearby developing areas. Local governments, for example, may establish the granting of an avigation easement by the developer as a condition for the approval of a proposed new residential subdivision in areas subject to military training impacts, such as a high noise zone or Accident Potential Zone.

Appendix D contains a sample avigation easement form.

COMPREHENSIVE PLANS

As part of this option, local governments would include specific language on JLUS coordination as part of Comprehensive Plan development or update. The Comprehensive Plan establishes a firm legal basis for the implementation of compatibility actions and sets the policy framework to regulate development through local land use regulations.

The plan can emphasize the relationship between the community and the military, the desire to promote cooperative land use planning and complementary land use goals, such as agricultural conservation and environmental protection, and clear guidelines about appropriate future land use in areas vulnerable to encroachment.

An increasingly popular strategy is for local governments to develop a Military Influence Planning

District (MIPD) Element within the Comprehensive Plan. This element is devoted exclusively to the collaborative relationship between the local government and military installation and integrates all policies that may promote compatible development, including communication procedures, conservation and land use policy, and transportation and infrastructure policy. The current Clarksville-Montgomery County and Hopkinsville-Christian County Comprehensive Plans already contain some language on military compatibility. In the State of Kentucky, KRS 183 requires a military compatibility section in Comprehensive Plans for those jurisdictions in proximity to an installation.

Appendix F contains sample Comprehensive Plan language.

INFRASTRUCTURE

The provision of infrastructure is typically based on public need and necessity and reflects the Comprehensive Plan of the city or county. As part of this strategy, local governments would consider the impacts of both public and private infrastructure installation/extension (e.g. water and sewer facilities) into noise and safety affected areas around Fort Campbell/CAAF/SAH. New infrastructure can induce or support incompatible growth patterns, such as denser residential development, especially if compatible zoning and land use guidelines are not in place.

Since capital investment decisions in turn influence private market location decisions, it is critical that local governments link their Work Programs and Capital Improvement Plans to compatibility goals. Installing infrastructure such as water, sewer and roads in planned growth areas and away from areas of operational impact clearly reduces the conflicts associated with denser development near the installation. Regional Transportation Improvement Plans (TIP) should also reflect the need to limit road capacity projects in areas near the installation where development can interfere with the military mission. Community officials should also consult with military installation planners as part of the local planning and facilities programming decisions.

COMMUNICATION

Under this approach, participating jurisdictions would develop appropriate mechanisms to ensure that residents, developers, businesses, and local decision-makers have adequate information about Army operations, possible impacts on lands surrounding Fort Campbell/CAAF/SAH, procedures to submit comments, and any additional local measures to promote land use compatibility around the installation. Governments should use all available media, including posters, brochures, and city and county web sites to convey the information.

In addition to the actions of the local governments to communicate the impacts of Fort Campbell/CAAF/SAH, the Area Development Districts and Regional Councils should post maps on their websites of properties within the designated noise, safety and planning buffers. Ideally, land owners, developers, and prospective renters or buyers could access a searchable database of properties in these areas.

Similarly, the Army would build on existing communication with its neighbors through methods such as publishing planned training schedules (training schedules change day-to-day) and operational guidelines for night training on the post web site; ensuring a continued role for a highly visible Fort Campbell liaison to address noise and other issues and brief the communities; enhancing current noise reporting procedures; providing a central (toll-free) contact number for the public to report military concerns; and updating the brochure/poster on post mission and

activities, operational impacts and mapped noise contours, and other compatibility issues.

COORDINATION

Under this approach, local governments would promote collaboration by sharing information on specific community development proposals (rezonings and subdivisions) within designated buffers around Fort Campbell/CAAF/SAH. Several local governments (the City of Oak Grove, the City of Hopkinsville, Clarksville-Montgomery County, Christian County) have established procedures for consulting military representatives regarding development activity within a designated buffer of the installation (typically one mile).

It should be noted that only the local government can approve or disapprove zoning and subdivision proposals. Fort Campbell consults strictly on an advisory basis. The JLUS recommends enhancing current coordination measures by including jurisdictions that have not yet established a comparable consultation process and by encompassing all property within the JLUS Area of Concern.

A Memorandum of Understanding (MOU) is a "good faith" document that further establishes procedures for communication among affected parties and formalizes collaboration among multiple stakeholders. Several jurisdictions currently have active MOUs in place with Fort Campbell, including the City of Oak Grove, the City of Hopkinsville, Clarksville/Montgomery County, and Christian County. Prioritized actions suggest enhancing existing agreements to include additional provisions related to lighting, conservation, and infrastructure extensions and broadening participating entities to include all counties around the installation, as well as Departments of Transportation and local utility providers.

Appendix E contains examples of MOUs.

CLUSTERING

Clustering can be an effective tool in promoting land use compatibility around a military installation, particularly on larger parcels that straddle a noise or safety boundary. Under clustering (also known as conservation design), developers can separate the buildable areas of the parcel from areas that have a development constraint, such as noise or safety risk exposure. The district then allows more compact lots in the developable portion of the site in exchange for the permanent protection of land in the constrained area. This essentially becomes a density-neutral transfer of development rights onto another portion of the same parcel outside of areas adjacent to the post, targeted conservation areas or designated noise or air safety zones. Also as part of this strategy, local governments could require developers to use low impact site design principles, including the creation of green space/conservation buffers that can support noise and safety impact mitigation.

TRANSFER OF DEVELOPMENT RIGHTS

Local governments could also pursue a pure transfer of development rights (TDR) program, which shifts growth from a designated "sending area" with development constraints (noise or air safety

zones, areas adjacent to the post, conservation buffers) to a designated "receiving area" that does not have site limitations. This transaction takes place voluntarily in the free market. The owner of the constrained land sells the development credits established under zoning to a buyer who then can develop additional residential density on another property based on the number of credits purchased. Both Kentucky (KSR 100.208 Transferable development rights) and Tennessee state laws grant local governments the authority to adopt a local TDR program. This option poses more of an administrative challenge than the simple clustering of houses and requires strong market pressures for development combined with a limited supply of available land. Given the relatively rural character of the region, a TDR program is not be feasible tool in the near-term, but may have long-term applicability in select areas, particularly in Clarksville-Montgomery County as population growth continues.

OUTDOOR LIGHTING STANDARDS

While military flight operations generate noise and pose a statistically measurable, albeit low, safety risk to surrounding areas, nearby civilian uses can, in turn, produce conditions that interfere with aircraft operations. Among the most common of these hazards stems from the use of excessive and unshielded outdoor lighting. Outdoor lighting systems, especially lighting associated with billboards, gas stations, major roadways, athletic fields, and large commercial or industrial uses often allow significant light to travel upward into an otherwise darkened sky. The resulting "light pollution" can obscure pilot vision or interfere with the use of night vision training devices.

Montgomery County has established the Sabre Heliport Overlay District ordinance, which regulates design criteria within the Aircraft Light Sensitive Area and the City of Hopkinsville adopted lighting design criteria in 1999 as part of its zoning overlay. The City of Oak Grove adopted an ordinance for outdoor lighting standards in August of 2007. The consistent application of exterior lighting standards around the installation is critical for maintaining the safety of aviation operations.

Appendix G contains two models of proposed outdoor lighting regulations.

PRIORITIZED LIST OF ENCROACHMENT REDUCTION MEASURES

As noted earlier, the four surrounding counties have adopted some of the best compatibility practices available to defense communities throughout the country. A review of current measures, however, indicates critical gaps in the region's encroachment reduction approach, both in the form of geographic areas that remain unregulated and or in existing policies that require stronger provisions.

The following is a list of feasible, near-term measures developed on the basis of the planning team's compatibility findings and feedback from area stakeholders and officials. While the communities and the Army should continue to broaden and refine their array of compatibility planning tools, these high priority actions seek to address the most pressing land use conflicts around Fort Campbell.

1. ADOPT OUTDOOR LIGHTING STANDARDS TO PROTECT THE NIGHT VISION DEVICE ENVIRONMENT FROM LIGHT INTRUSION

Previous descriptions of Fort Campbell's military mission emphasize that the installation is one of the most intensively used night-time training facilities in the U.S. Army. Continued community growth, particularly along U.S. Highway 41A and U.S. Highway 79 in the vicinity of CAAF and SAH will continue to exacerbate current issues of overlighting and unshielded lighting. The resulting light pollution adversely affects night vision device (NVD) operation and could curtail future night time training and readiness activities at the post. Regulations that minimize interference with the NVD environment do not require the strict prohibition of exterior lighting or the complete replacement of existing lighting fixtures. Instead, regulations focus on installing less intrusive lighting applications either for new development or as part of the routine maintenance/ replacement of public utilities.

Local governments and Fort Campbell have two options for implementing exterior lighting standards:

- A zoning-based method that regulates the performance of new lighting applications within a geographically targeted area, through a zoning overlay district
- Use of building permit process as the regulatory vehicle to control poor quality exterior lighting

1.A Zoning Based Lighting Regulations

Based upon analysis of planning team members assessing the night vision device environment, a regionally-based model lighting ordinance with standards for the following property types and facilities would be the most effective tools for protecting aviator and overall safety.

- Commercial applications
- Utility company provided residential lighting systems
- Public streets, roads and highways
- Public structures
- Fort Campbell
- Signs
- Temporary lighting

The supporting Appendix contains a model lighting ordinance that requires fully shielded lighting applications for new non-residential uses within the designated Night Vision Devise (NVD) Lighting Zones (See **Figure 23**).

This model is intended as an interim ordinance that local governments can readily adapt to conform to the National Model Lighting Ordinance (MLO) now being developed jointly by the Illuminating Engineering Society and the International Dark Sky Association.

The ordinance proposes an NVD zone as shown on **Figure 23**. This zone is intended to encompass all property in proximity to airfield operations and the post's low level flight corridors. The proposed ordinance refers to this area as the "Night Vision Device (NVD) Influence Area." The recommended NVD Influence Area includes the following features:

- flight approaches of SAH & CAAF

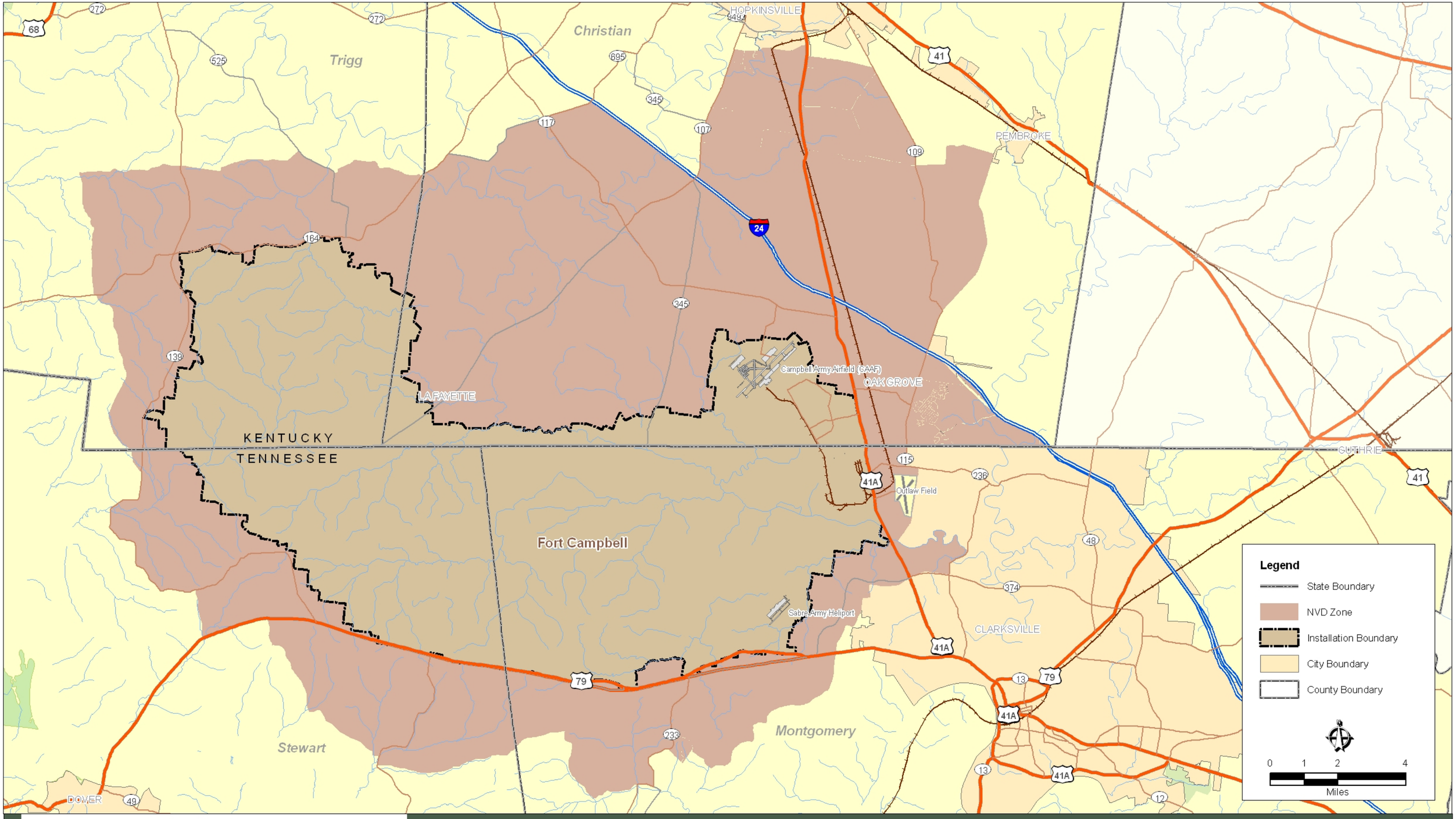

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Figure 23
Night-Vision Device Lighting Zone

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- primary flight corridors surrounding the installation
- Fort Campbell Zone of Influence
- key interchanges in close proximity to Fort Campbell and/or major aviation routes
- existing light-sensitive zones (SUD-41A, SAH Overlay & Oak Grove Lighting Ordinance)

The boundary of the NVD zone is tied to nearby local roads or other easily-identifiable features to ease identification of regulated areas. Fort Campbell operations can also be affected by large highly-lit projects (such as large interchanges or major industrial/commercial developments) constructed outside of the NVD. Beyond this boundary, the installation has indicated an interest in working with local officials on a case-by-case basis.

Under the Tier 1 Ordinance, all unzoned land or property zoned for agricultural and residential uses within this boundary defaults to Lighting Zone 2 (LZ2). All other zoned property, including commercial, industrial and institutional uses falls under the standards set for Lighting Zone 3 (LZ3). Property owners may request a re-designation to a higher and therefore less stringent lighting zone as part of the rezoning or development process.

- ***LZ 2.*** Low-density suburban and urban neighborhoods and suburban commercial districts. This zone is intended to be the default condition for suburban areas.
- ***LZ 3.*** Medium to high-density urban neighborhoods and districts, shopping and commercial districts, industrial parks and districts. This zone is intended to apply only to Central Business District(s) and areas having unique character such as auto malls.

The ordinance is a prescriptive-based code that regulates the installation of new lighting systems, modifications to existing lighting systems or the replacement of lighting fixtures for non-residential uses, common residential areas and street lights. Property owners outside of these zones are encouraged, but not required to comply with the lighting provisions.

See Appendix G for two sample model ordinances. The Tier 1 sample is a more comprehensive ordinance appropriate for mid- to long-range implementation by partner jurisdictions that includes provisions to control the impacts of unshielded and overly intense lighting, as well as reduce light trespass on neighboring properties. The more basic Tier 2 ordinance is intended to address the immediate need for preventing improper lighting practices that lead to uplighting. The lighting zones (LZ 2 and LZ 3) described above are only applicable for the more advanced Tier 1 ordinance.

1.B Building Code Based Regulations

Jurisdictions that lack the formal powers to enact land use regulatory language based on zoning ordinances can use the building permit process as the regulatory vehicle to control poor quality exterior lighting. Local governments would require that site plans submitted as part of the commercial, industrial, and multi-family permitting process include information on the design of outdoor lighting to be installed in the project. Failure to comply with the requirement for fully shielded lighting would result in a building denial or a required modification of lighting practices prior to permit approval.

In addition to developing regulatory or code enforcement tools to promote the use of shielded lighting applications within the Night Vision Devise Influence Area, local communities should continue to conduct an aggressive outreach campaign to educate business owners, developers,

and representatives from State Departments of Transportation and local utilities about the importance of installing less intrusive lighting fixtures. Street lighting in particular is an ongoing source of light pollution. The integration of shielded fixture designs in roadway projects can play a major role in reducing night sky degradation. Similarly, private utility companies often provide property owners with security and agricultural lighting. The distribution of more sensitive lighting applications within the surrounding four-county area would also assist in eliminating sporadic light intrusion inside and outside of the Night Vision Device Influence Area. A later recommendation includes examples of agreements with transportation and utility officials intended to reinforce their cooperation.

Appendix G contains a series of supporting documents to facilitate community outreach on lighting issues: an Ordinance narrative intended for use as a handout to members of the public; Sample Lighting Applications by User Type; and International Dark-Sky Association Information Sheets on topics such as billboards, gas stations, sports lighting, towers, canopy lighting, cobra head style lighting, full cut off fixtures, and good and bad lighting examples.

2. CONTROL DEVELOPMENT DENSITY IN THE PUBLIC SAFETY BUFFER AREA AT CAAF

The JLUS compatibility analysis has identified the Public Safety Buffer to the northwest of Campbell Army Airfield as the most critical area around the installation to protect from future residential and intensive commercial growth. The buffer as shown on **Figure 24** includes land that falls within the 70 dB noise contours, the Accident Potential Zone I and Accident Potential Zone II associated with the north-south CAAF runway, and the previously secured avigation easements for property under the primary runway oriented to the northeast of CAAF.

Land use compatibility guidelines from the Department of Defense suggest that multi-family homes or single-family housing in excess of one dwelling unit per acre may pose a conflict with the noise and air safety risks associated with nearby aircraft operations. Any housing construction in this zone should also incorporate indoor noise reduction practices. The guidelines indicate that less people-intensive non-residential uses, such as warehousing, agriculture, and very small scale retail may be an appropriate fit. Certain noise sensitive uses and/or uses that concentrate people, such as schools, churches, and medical facilities are particularly vulnerable to the risks of aircraft operation and are accordingly deemed incompatible. These lower residential densities are also desirable for maintaining the rural agricultural character of this area.

Typically, local communities can regulate the size, intensity or type of land use in a specific area through zoning procedures. The Public Safety Buffer at CAAF falls within unincorporated Christian County, which does not currently exercise zoning authority. As noted earlier, comprehensive county-wide zoning would be an effective local vehicle for preventing incompatible development around Fort Campbell and promoting quality growth outcomes.

The county, however, has several policy tools available to restrict future development in the Public Safety Buffer without county-wide zoning. Feasible near-term options include:

- Limiting the public extension of centralized wastewater services into the designated Public Safety Buffer; or
- Restricting the subdivision of land for residential purposes in a higher noise zone or Accident

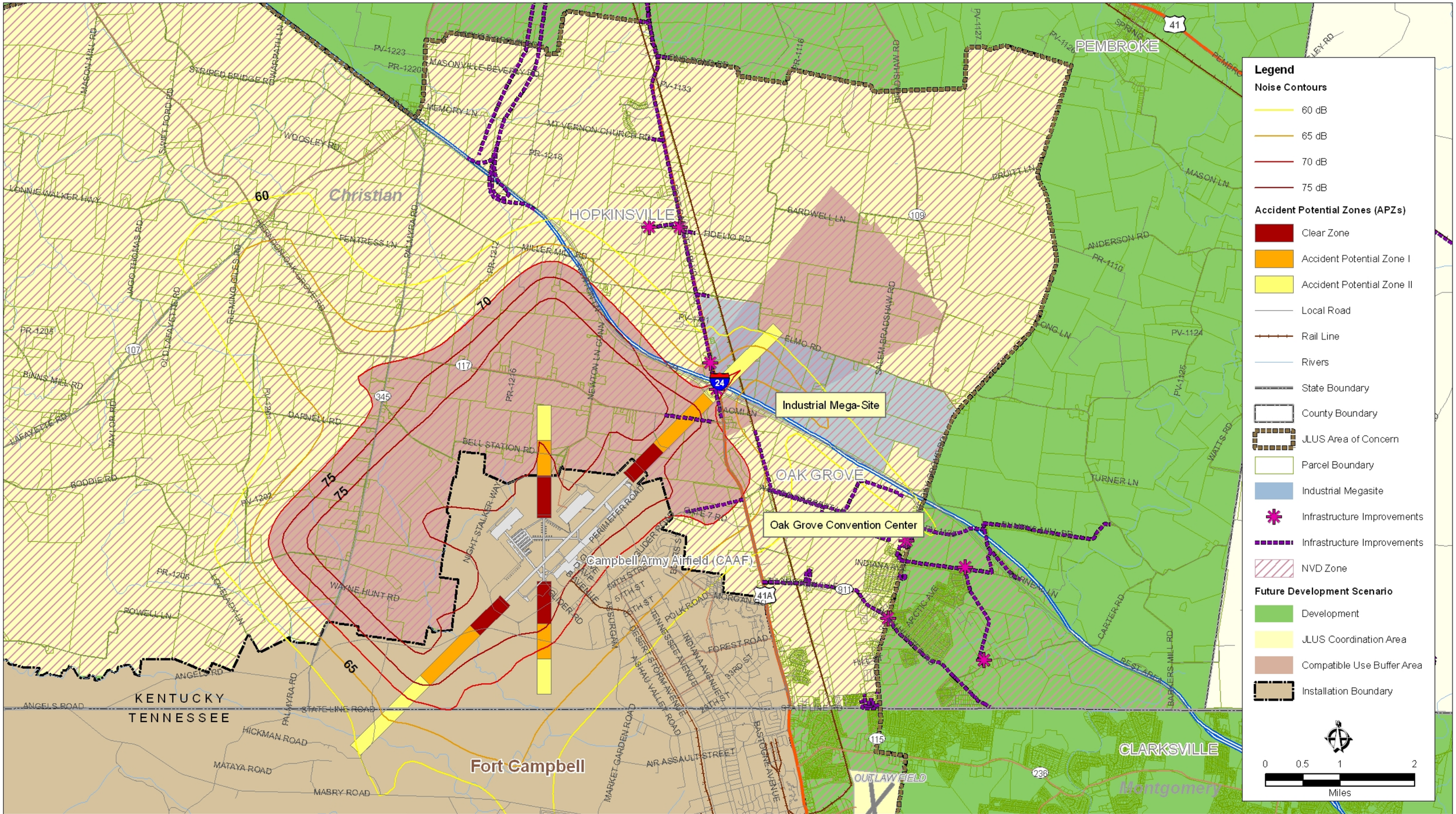

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Figure 24
JLUS Area of Concern - CAAF Sub-Area Future Compatibility Scenario

EDAW | AECOM

Potential Zone based on a public health, safety, and general welfare provision.

Limitations on Wastewater Treatment Infrastructure Extensions

The provision of sewer capacity has the well-documented effect of physically shaping a community's growth patterns and supporting more intense development within its service areas. While land in the Public Safety Use Buffer is currently without access to centralized wastewater lines, the eventual extension of such infrastructure could facilitate land subdivision and development. This strategy does not recommend a prohibition of central system connections to privately financed infrastructure installations, but instead urges local utility authorities to minimize publically funded improvements that could have the unintended result of inducing incompatible development near Fort Campbell. Limitations on access to public sewer specifically within the Public Safety Buffer (See **Figure 24**) would alter the economics of land development (making development more costly and thus less appealing to developers) and require larger lots to support individual septic systems, thus effectively capping potential residential density.

The county could put this strategy in place by developing infrastructure extension guidelines for the Hopkinsville Water Environment Authority and the Oak Grove Water District that restrict public expenditures for the installation of new sewer lines in the Public Safety Buffer.

Public Safety Subdivision Regulation Provisions

Even without zoning, the local subdivision process commonly includes special environmental considerations that protect the public health, safety, and general welfare of the community based on delegated police powers. Regulations could, for example, deny approval for the subdivision of land for residential purposes in areas with characteristics such as the floodplain of streams and rivers and steep or unstable slopes. The regulations could therefore justifiably recognize the inherent risk of placing housing in proximity to active aviation operations by adding similar provisions to prohibit the creation of individual housing lots within a designated high noise zone (deemed as 70 dB+) and within a designated APZ-I.

Hopkinsville-Christian County Industrial Mega-Site

Along with protecting the Public Safety Buffer, local officials should ensure that any future development of the industrial mega-site in Christian County follows several development conditions to minimize the risk of air safety conflicts, including:

- prohibiting the manufacture or storage of chemical and hazardous materials on the site;
- prohibiting the use of the site in any manner that creates electrical interference with navigational signals or radio communication between CAAF and aircraft;
- prohibiting the use of the site in any manner that interferes with aviator vision, including any type of reflective/glare-producing building exterior; unshielded, high-intensity exterior lighting or signage; highly reflective surface lot or roadway materials; smoke, gas or steam emissions
- prohibiting any site elements or land uses that may attract birds or water fowl, such as water features or landfills;
- enforcing consistency with existing CAAF avigational easement conditions on the site;
- minimizing the placement of structures or labor-intensive activities in Accident Potential Zone 1 (APZ I); site design should set a maximum total lot coverage of 20 percent; establish

a one-story maximum for any buildings; and direct activities that concentrate employees during regular shift hours away from APZ I

The site must also comply with the airspace regulations enacted by the KY Airport Zoning Commission . If the industrial mega site anchors a major economic generator, such as an automobile assembly site, it could also spur ancillary development in the form of suppliers, supporting retail, and workforce housing. Local officials should prepare for such induced development by identifying suitable growth areas away from the noise zones and active airspace associated with CAAF.

3. CONTROL DEVELOPMENT DENSITY IN THE RURAL PLANNING AREA WEST OF SAH

The Sabre Heliport Overlay District ordinance in Montgomery County, TN effectively governs land use in the Public Safety Buffer that encompasses noise contours from the airfield and land that is in close proximity to the installation boundary north of the old U.S. Highway 79 alignment. The ordinance regulates development and lighting, requires disclosure and indoor sound attenuation, and restricts structure height in Approach and Departure Surface Areas.

This recommendation instead focuses on an area of the county to the west of State Road 233, shown as the Rural Planning Area on **Figure 25**. New roadway capacity along U.S. Highway 79 will very likely induce commercial growth and residential subdivisions along this corridor in the years ahead.

Clarksville/Montgomery currently designates this area as rural because it is outside of the Urban Growth Boundary and the Planned Growth Areas. The city/county should seek to preserve the rural character of this area even as market conditions evolve by directing future development back to land that is contiguous with existing development and public infrastructure. Under quality growth planning, mixed use nodes and traditionally designed neighborhoods in Planned Growth Areas could readily absorb future population increases, while relieving pressures to develop on the urban fringe.

All infrastructure, land use, and environmental protection policies should work in concert to reinforce this critical boundary and minimize scattered residential and commercial uses along U.S. Highway 79. Future development permitted in this area should not exceed more than one dwelling unit per acre and should fully comply with measures to reduce night sky degradation from exterior lighting sources.

4. CONDUCT CORRIDOR MANAGEMENT STUDIES ALONG U.S. HIGHWAY 41A AND U.S. HIGHWAY 79

Growth along U.S. Highway 41A between Oak Grove and Hopkinsville and on U.S. Highway 79 west of Liberty Church Road represents the most significant foreseeable land use compatibility threat to Fort Campbell. Early access management along developing corridors is one of the most effective mechanisms for controlling the vehicular, aesthetic, and development impacts of strip commercial activity.

Access management entails the coordination of driveway design and spacing, median openings, interchanges, traffic lights, and street connections. The primary purpose of the management plan is to create access for future land development, while preserving the safety and efficiency of the transportation system. The State of Kentucky has implemented an Access Management Program.

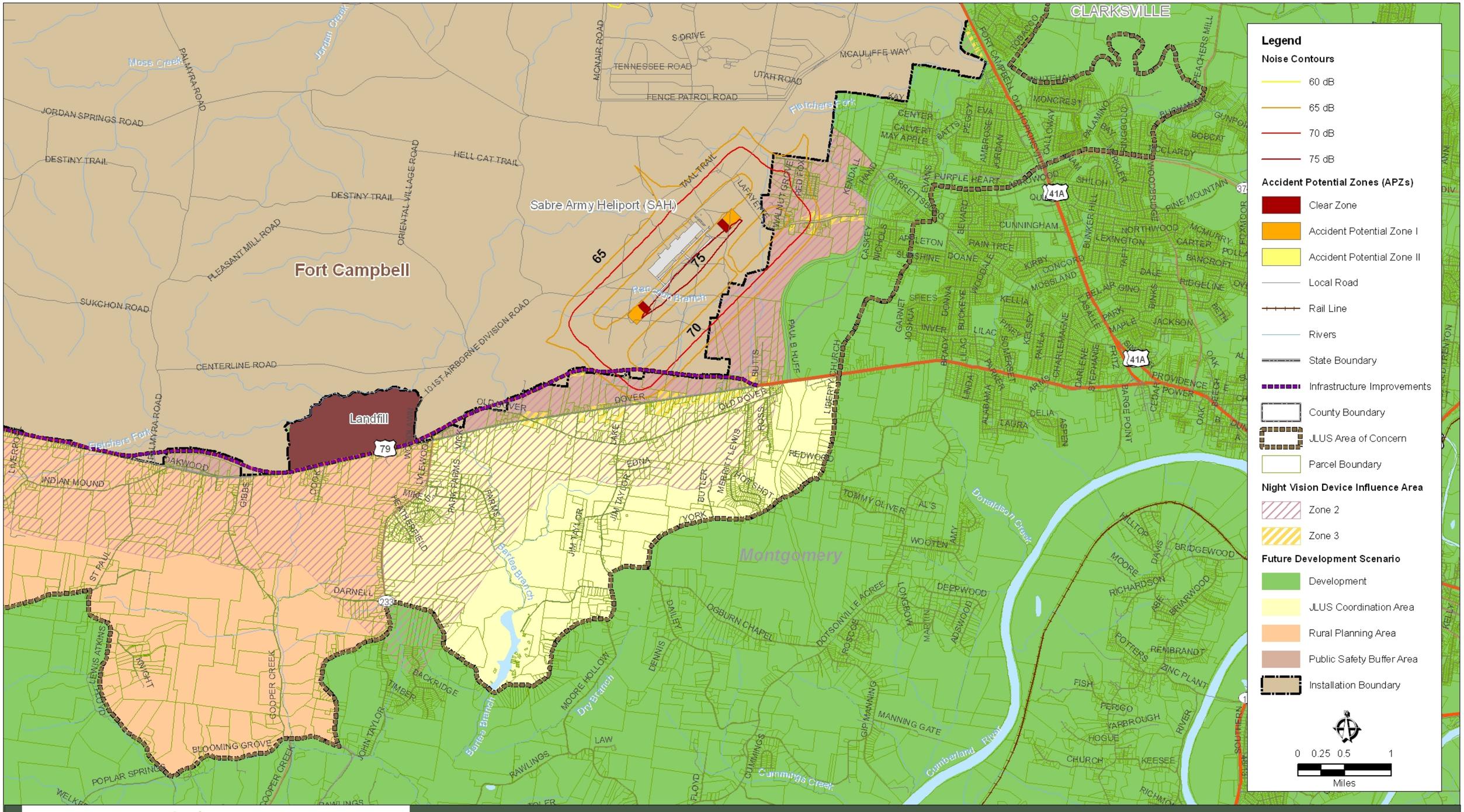

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Figure 25
JLUS Area of Concern - Sabre Sub-Area Future Compatibility Scenario

Tennessee has less comprehensive regulations controlling driveway spacing on interstate highways.

While access management efforts are mainly geared toward easing the flow of vehicular traffic, corridor management plans can also include a land use and design component. As part of this broader effort, participating stakeholders can develop a long-term vision for the corridor under study and identify supporting land use policies to cluster development at key intersections and to protect open space along strategic stretches of the roadway. Active planning is essential to counteract the common market tendency to evenly spread low density commercial in a linear pattern along road frontage.

Adherence to quality growth principles could, for example, reinforce green space separators between communities such as Hopkinsville and Oak Grove and guide new commercial uses toward designated activity nodes at major intersections contiguous with developed areas and existing infrastructure. This nodal, rather than linear, form of growth could reduce commercial activity near CAAF and SAH and along the installation's southern boundary. Corridor planning efforts are best conducted as a regional and multi-jurisdictional process that includes all affected communities and their key stakeholders.

5. EXPAND COORDINATION AND COMMUNICATION POLICIES FOR DEVELOPMENT WITHIN THE JLUS AREA OF CONCERN

Communities should continue or expand the use of two essential communication practices to maintain an ongoing dialogue about compatibility among local governments, the military, and affected private property owners:

- Consultation with Fort Campbell military planners on development proposals; and
- Area of Military Impact notification on plats.

Development Consultation

While communities to the east of Fort Campbell, including Christian County, Clarksville-Montgomery, Hopkinsville, and Oak Grove have established procedures for consulting with Fort Campbell on proposed development activity near the installation, Trigg and Stewart Counties do not have comparable mechanisms for seeking input on the possible effects of adjacent development on the military mission. As development pressure increases and spreads west, Trigg and Stewart Counties should regularly consult with Fort Campbell military planners on plans for major residential subdivisions (i.e. in excess of five housing units) and large commercial and industrial uses. The intent is not to require the review of all development projects, but to ensure adequate coordination on new planned communities, retail plazas, industrial parks and other large land users that may concentrate people or generate secondary issues such as light intrusion. Consultation is recommended only for those proposed developments inside the JLUS Area of Concern.

Local governments to the east of the installation should continue to consult with Fort Campbell regarding development proposals for land inside the JLUS Area of Concern. This consultation would include property designated as part of the JLUS Coordination Area shown in **Figures 24** and **25**. Fort Campbell should also consult with local jurisdictions on military actions that may significantly affect surrounding communities.

Area of Military Impact Plat Notification

In addition to promoting coordination between the community and military sectors, local officials should ensure that property owners receive adequate information on the impacts of nearby military activity. At a minimum, all plats inside the Area of Concern should contain language on possible exposure to noise and military overflights.

6. CONTINUE AND EXPAND REGIONAL COORDINATION

The stakeholders of the region have a history of collaboration dating back more than a decade to the 1996 Joint Land Use Study effort. Community representatives meet as part of the JLUS Partnership and Fort Campbell conducts regular briefings for civilian officials on compatibility and conservation projects and mission-related activities. This JLUS effort strongly urges the continuance of these regional forums on approximately a bi-annual basis to maintain an open dialogue between military and community leaders and planners. It is also critical that communities that have been previously less engaged in the joint planning process designate a clear point of contact to interact consistently with Fort Campbell military planners.

The JLUS Partnership should also consider updating its charter to reflect emerging issues related to transportation and utilities infrastructure, regional waste, and regional development.

7. CONTINUE TO IMPROVE OVERALL COMMUNICATION

Under this approach, participating jurisdictions would ensure that residents, developers, businesses, and local decision-makers have adequate information about Army operations, possible impacts on lands surrounding Fort Campbell/CAAF/SAH, procedures to submit comments, and any additional local measures to promote land use compatibility around the installations. Governments should use all available media, including posters, brochures, and city and county web sites to convey the information.

In addition to the actions of the local governments to communicate impacts of Fort Campbell/CAAF/SAH, the Area Development Districts and Regional Councils should post maps on their websites of properties within the designated noise, safety and planning buffers. Ideally, land owners, developers, and prospective renters or buyers could access a searchable database of properties in these areas.

Similarly, the Army would maintain and improve communication with its neighbors through methods such as publishing planned training schedules (training schedules change day-to-day) and operational guidelines for night training on the post web site; continuing a role for a highly visible Fort Campbell liaison to address noise and other issues in the community; and creating a brochure/poster on post mission and activities, operational impacts and mapped noise contours, and other compatibility issues. The Army would also enhance on-post procedures for the public to obtain information and report concerns.

8. STRENGTHEN AND EXPAND MEMORANDA OF UNDERSTANDING WITH REGIONAL STAKEHOLDERS

Several local governments have signed memoranda of understanding (MOUs) with Fort Campbell laying out procedures for sharing information and promoting land use compatibility around the installation. These agreements, though not binding, are essential for maintaining continuity in regional actions to reduce encroachment.

The JLUS recommends that local governments that have previously participated in MOUs revisit their agreements and sign a more robust document that specifically references designated Public Safety Buffer Areas and additional policies related to conservation and sustainability partnerships, exterior lighting controls, and public infrastructure improvements. The Appendix contains an example of a Tier 1 MOU intended for communities such as Clarksville-Montgomery County, the City of Oak Grove, and the City of Hopkinsville. A more basic Tier 2 MOU (see Appendix) is appropriate for local governments, such as Trigg County and Stewart County that have less severe compatibility issues and growth pressures to address. Trigg County and Stewart County, however, could be more aggressive in carrying out the provisions of previously signed MOUs and in identifying a clear point of contact to assist in coordinating compatibility issues with Fort Campbell and participating in ongoing regional initiatives.

While local governments are typically the signatories on such MOUs, the JLUS also recommends that Fort Campbell seek similar agreements with other regional partners whose cooperation is essential in minimizing incompatible development. The Appendix contains examples of MOUs appropriate for representatives of state Departments of Transportation and Metropolitan Planning Organizations (MOU-DOTs/ADDs/MPOs) and local utilities (MOU-UTILITIES). These MOUs address issues related to public infrastructure improvements and outdoor lighting applications.

9. EXPLORE STATE COMPATIBILITY MEASURES

State legislatures may choose to pass legislation to require, by local planning statute, compatible land use plans that support the readiness missions of a nearby military installation. The State of Kentucky, for example, has a statutorily enabled (KRS 183.861) Kentucky Airport Zoning Commission and delegates all powers to establish zoning and land use regulation within and around publicly owned airports to this Commission. This authority explicitly includes military airports. This Commission operates out of the Kentucky Transportation Cabinet, Department of Aviation.
The Kentucky Airport Zoning Commission is authorized to consider the following factors in developing zoning and land use regulations around publicly owned airports:

- Safety of airport users
- Safety of surface persons and property
- Character of flying operations
- Terrain
- Height of existing structures or trees
- FAA guidance
- Future development plans of the airport
- Densities of dwellings with regards to public safety

- Protection of the public investment in airports
- Views of surrounding land owners

As such, the Kentucky Airport Zoning Commission is empowered to regulate land use, including density and building height, in order to ensure the future compatibility of military operations at airports with surrounding land uses. The Commission could be requested to enact land use regulations in order to enforce the recommendations of the JLUS study.

The powers of the Kentucky Airport Zoning Commission, however, do not prevent local governmental authorities from also regulating land use. Local governmental authorities may also use land use regulations to protect safety and the public interest in and around airports; however they must defer to the Kentucky Airport Zoning Commission where the Commission's requirements are more stringent.

The State of Tennessee does not currently have a comparable body, but the JLUS recommends that regional officials advocate for state-based legislative measures to bolster local planning efforts around military installations.

As an example, Florida is one of the innovators of state-wide planning to prevent encroachment around military facilities. In 2004, the state Legislature revised Chapter 163, Part II, Florida Statures, by adding section 163.3175 and revising sections 163.3177, 163.3187 and 163.3191 of the Growth Management Act. These sections require each affected jurisdiction to consult with the commanding officer of any nearby installation regarding proposed changes to the comprehensive plan and land development regulations that would affect the intensity, density or use of land adjacent to military operations. The law required affected local governments to amend their comprehensive plans by 2006 to include criteria that promote the compatibility of surrounding land uses with military installations. To facilitate the exchange of information, local jurisdictions must include a representative of a military installation as an ex officio, nonvoting member of the local government's land planning or zoning board. The four county governments participating in this effort will prepare amendments to their comprehensive plans after reviewing the results of the study with the Department of Community Affairs and the Navy.

Similarly, the State of Georgia requires local planning entities to request written recommendations from the military commander regarding any rezoning activity within 3,000 feet of an installation or the Clear Zone and Accident Potential Zones Numbers I and II of a military airport. Specifically, planning entities are to consider the following given the proposed land use's proximity to the military facility:

- If the proposal will permit a suitable use to the nearby uses;
- If the proposal will adversely affect the existing use or usability of nearby property;
- If the affected property has a reasonable economic use as currently zoned;
- If the proposed use could cause safety issues to existing infrastructure such as streets, transportation facilities, utilities or schools
- If the proposed change conforms with the policy and intent of the adopted land use plan; and
- If there are existing or changing conditions that would affect the use of nearby property.

10. EXPLORE USE OF STATE CONSERVATION PROGRAMS

The conversion of agricultural land to housing and other uses is one of the growth trends that puts America's military installations at risk. As market conditions change, farmers often seek economically viable alternative uses for their large land holdings. Various state programs recognize the value of protecting farming and silvicultural functions. Kentucky's Purchase of Agricultural Conservation Easement (PACE) Corporation, for example, authorizes the state to purchase agricultural conservation easements. The owner agrees to maintain the land in agricultural production and gives up the right to develop the tract in return for compensation. Such tools are a highly effective way to reduce the risk of incompatible development in rural areas in proximity to Fort Campbell such as Christian and Trigg Counties.

As an example of statewide conservation efforts around military installations, Florida has used its land acquisition program, the Florida Forever program to purchase land surrounding military installations for the purpose of reducing future encroachment risks. In 2003, the State of Florida, the U.S. Department of Defense and The Nature Conservancy entered into a partnership to establish a 100-mile protected corridor that connects Eglin Air Force Base and the Apalachicola National Forest. Similarly under its Encroachment Partnering Program, the Navy partnered with the State of Florida in September 2005 to acquire 1,650-acres of buffer land on the eastern and northeastern border of the Outlying Landing Field Whitehouse in Jacksonville. Contributing $1,695,000 in funds, combined with about $2,000,000 from the DoD and $11,000,000 from the State of Florida, the Navy acquired permanent deed restrictions on the property, limiting its use to light recreational activities. The state has now placed the property in its conservation program.

11. DEVELOP REGIONAL SUSTAINABILITY PARTNERSHIPS

Fort Campbell is a relatively land-constrained installation and therefore must obtain maximum use of its existing training areas through scheduling, infrastructure improvements, and the protection of adjacent buffers. This notion of the judicious use of available resources is at the heart of the sustainability movement. As with the Army, the surrounding local communities must also get the highest benefit from their limited access to water, farmland, wildlife habitat, and local public funds.

Traditionally, the JLUS process has focused on the careful use of private lands around installations to minimize physical encroachment. The U.S. Army, however, has been actively seeking partnerships with surrounding communities to conserve a broader array of vital resources, such as water and energy. Under Executive Order 13148 "Greening the Government through Leadership in Environmental Management," the Army required all of its installations to implement an Environmental Management System (EMS).

These emerging sustainability partnerships not only protect the long-term viability of the military mission, but improve the efficiency of local governments and enhance overall quality of life for both military personnel and residents. Beyond the widely accepted realm of land development planning, Fort Campbell and the region's counties and cities can collaborate on a variety of strategies intended to improve public infrastructure capacity, increase opportunities for joint service delivery, protect the environment, and promote economic activity, including, but not limited to:

- Evaluating the recreational use of Fort Campbell's training lands to increase recreational access for the region's residents;
- Initiating an outreach/education/awareness program that explores sustainability strategies;
- Creating on-post pilot programs to demonstrate sustainable practices and technologies (such as fully shielded lighting) and participating in a joint web site that contains links to sustainability resources;
- Exploring reduction, reuse, recycling, and composting methods to lower the quantity of solid waste diverted to the Bi-County Landfill and other area landfills;
- Jointly pursuing watershed protection strategies, such as wetlands banking, low impact site development techniques, maintenance of natural vegetative buffers, and stream restoration to ensure surface and ground water quality;
- Sharing regional GIS data on land uses, environmental features, and infrastructure to assist in tracking and monitoring trends;
- Establishing a pilot project to demonstrate alternative energy sources, such as hydrogen fuel cell power or hybrid fuel power;
- Requiring military, as well as new publically funded community facilities to incorporate green building and site design standards or to comply with the Leadership in Energy and Environmental Design (LEED) Green Building Rating System;
- Encouraging the construction of more sustainable systems that use less energy and water;
- Participating in a Sustainable Transportation Plan process that includes community partners, MPOs and ADDs and focuses on long-term performance in areas such as renewable energy, reducing hazardous air emissions, and promoting alternative transportation options;
- Adopting both military and local government procurement practices that support sustainability, such as environmentally preferable cleaning products and more energy efficient building systems;
- Developing a series of sustainability indicators to monitor quality of life in the region and to specifically track growth patterns and encroachment issues around the installation;
- Publishing an annual Sustainability Report that highlights joint military/community initiatives and success stories.

8.0 Implementation Plan

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ACTIONS STEPS BY PARTNER

The following section organizes recommended actions by regional partners and divides the suggested measures into near-term (1 to 2 years); mid-term (3 to 5 years); and long-term actions (5 years +). Near-term actions reflect the prioritized strategies identified in the prior section, while mid-term and long-term actions include additional tools discussed in the section on available encroachment reduction strategies.

CHRISTIAN COUNTY

Near-term Actions:

- Adopt proposed exterior lighting controls in the form of building permit requirements in the expanded NVD Influence Area (APPENDIX G)
- Develop one or more of the recommended policy tools to control the subdivision of property and the resulting residential density of development in the designated Public Safety Buffer near CAAF
- Educate property owners about ACUB, PACE and other federal or state funded opportunities to donate or sell development rights on lands with agricultural and silvicultural value
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 41A to shape land use form and commercial sites
- Consult with the Kentucky Airport Zoning Commission to evaluate the feasibility of delegating land use regulation in the vicinity of Fort Campbell
- Sign a Tier 1 MOU intended to expand current information sharing efforts within the JLUS AOC (APPENDIX E)
- Continue to participate regularly in the JLUS Partnership forums and continue consultation procedures with military planners
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Update the County Comprehensive Plan to include a Military Influence Planning District Element (APPENDIX F)
- Consider development of a rural conservation based subdivision ordinance that would permit property owners to cluster homes away from the operational impact areas of the installation and set aside noise and safety affected areas for permanent open space protection
- Explore full real state disclosure for properties within the JLUS Area of Concern to include a special emphasis on land in the noise zones associated with large arms firing near Lafayette and air operations at CAAF (APPENDIX C)

- Participate in regional sustainability partnerships with Fort Campbell
- Consider establishing preservation plans/programs to protect key open space including prime farmland containing high noise areas adjacent to the installation

Long-Term Actions:

- Explore county zoning as a means to prevent encroachment and promote more efficient, quality growth outcomes, including creation of a Fort Campbell Activity Zone District (APPENDIX H)

CITY OF HOPKINSVILLE

Near-term Actions:

- Extend existing outdoor lighting regulations into the expanded NVD Influence Area
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 41A to shape land use form and commercial sites
- Coordinate annexation, infrastructure, and transportation policies to minimize the public expenditure of funds on projects that may induce incompatible development in the Public Safety Buffer Area around CAAF
- Sign a Tier 1 MOU intended to expand current information sharing efforts within the JLUS AOC (APPENDIX E)
- Continue to participate regularly in the JLUS Partnership forums and continue consultation procedures with military planners
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Update the Comprehensive Plan to include a Military Influence Planning District Element (APPENDIX F)
- Explore full real state disclosure for properties within the JLUS Area of Concern (APPENDIX C)
- Designate Urban Service Area and Planned Growth Area boundaries contiguous to existing public infrastructure to control the extent of growth on the urban fringe
- Participate in regional sustainability partnerships with Fort Campbell

CITY OF OAK GROVE

Near-term Actions:

- Continue enforcement of the current lighting ordinance
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 41A to shape land use form and commercial sites
- Coordinate annexation, infrastructure, and transportation policies to minimize the public expenditure of funds on projects that may induce incompatible development in the Public Safety Buffer Area around CAAF
- Sign a Tier 1 MOU intended to expand current information sharing efforts within the JLUS AOC (APPENDIX E)
- Continue to participate regularly in the JLUS Partnership forums and continue consultation procedures with military planners
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)
- Consider requiring indoor noise attenuation for new residential construction in the 60 dB + noise contours around CAAF

Mid-Term Actions:

- Update the Comprehensive Plan to include a Military Influence Planning District Element (APPENDIX F)
- Explore full real state disclosure for properties within the JLUS Area of Concern (APPENDIX C)
- Participate in regional sustainability partnerships with Fort Campbell
- Revisit the existing lighting ordinance to incorporate the more robust prescriptive measures in the proposed Tier 2 ordinance, including measures to control lighting intensity and light trespass (APPENDIX G)

TRIGG COUNTY

Near-term Actions:

- Identify a point of contact to participate regularly in the JLUS Partnership and to interact with Fort Campbell military planners
- Adopt proposed exterior lighting controls in the form of building permit requirements in the expanded NVD Influence Area (APPENDIX G)
- Develop a public safety-based provision in subdivision regulations to control residential lotting and infrastructure and the resulting density of development in the JLUS Area of Concern (residential density should not exceed one dwelling units per acre)
- Educate property owners about ACUB, PACE and other federal or state funded opportunities to donate or sell development rights on lands with agricultural and silvicultural value
- Execute the Tier 2 MOU intended to establish formal information sharing efforts within the JLUS AOC (APPENDIX E)
- Develop regular consultation procedures with military planners regarding major residential subdivisions and commercial or industrial uses in the JLUS Area of Concern
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Develop a County Comprehensive Plan that includes a Military Influence Planning District Element (APPENDIX F)
- Consider development of a rural conservation based subdivision ordinance that would permit property owners to cluster homes away from the operational impact areas of the installation and set noise and safety affected areas aside for permanent protection
- Explore full real state disclosure for properties within the JLUS Area of Concern (APPENDIX C)
- Participate in regional sustainability partnerships with Fort Campbell
- Consider establishing preservation plans/programs to protect key open space including prime farmland containing high noise areas adjacent to the installation

Long-Term Actions:

- Explore county zoning as a means to prevent encroachment and promote more efficient, quality growth outcomes, including creation of a Fort Campbell Activity Zone District (APPENDIX H)

CITY OF CLARKSVILLE

Near-term Actions:

- Adopt proposed exterior lighting controls in the form of zoning requirements in the expanded NVD Influence Area (APPENDIX G)
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 79 to shape land use form and commercial sites
- Continue to coordinate annexation, infrastructure, and transportation policies to minimize the public expenditure of funds on projects that may induce incompatible development in the Public Safety Buffer Area around SAH
- Use quality growth tools, such as mixed use activity centers and traditional neighborhood planning to limit development pressures outside of Planned Growth Areas and thus protect the existing rural character of land in the western portion of the county along U.S. Highway 79
- Sign a Tier 1 MOU intended to expand current information sharing efforts within the JLUS AOC (APPENDIX E)
- Continue to participate regularly in the JLUS Partnership forums and continue consultation procedures with military planners
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Revisit the existing lighting ordinance to incorporate the more robust prescriptive measures in the proposed Tier 2 ordinance, including measures to control lighting intensity and light trespass (APPENDIX G)
- Update the Comprehensive Plan to include a Military Influence Planning District Element (APPENDIX F)
- Expand existing real state disclosure requirements to all properties within the JLUS Area of Concern (APPENDIX C)
- Advocate for increased state involvement in promoting land use compatibility around Tennessee's military installations
- Participate in regional sustainability partnerships with Fort Campbell

Long-Term Actions:

- Explore establishing a Transfer of Development Rights program to shift future development into Planned Growth Areas

MONTGOMERY COUNTY

Near-term Actions:

- Extend existing outdoor lighting regulations into the expanded NVD Influence Area
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 79 to shape land use form and commercial sites
- Continue to coordinate annexation, infrastructure, and transportation policies to minimize the public expenditure of funds on projects that may induce incompatible development in the Public Safety Buffer Area around SAH
- Use quality growth tools, such as mixed use activity centers and traditional neighborhood planning to limit development pressures outside of Planned Growth Areas and thus protect the existing rural character of land in the western portion of the county along U.S. Highway 79
- Sign a Tier 1 MOU intended to expand current information sharing efforts within the JLUS AOC (APPENDIX E)
- Continue to participate regularly in the JLUS Partnership forums and continue consultation procedures with military planners
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Revisit the existing lighting ordinance to incorporate the more robust prescriptive measures in the proposed Tier 2 ordinance, including measures to control lighting intensity and light trespass (APPENDIX G)
- Update the Comprehensive Plan to include a Military Influence Planning District Element (APPENDIX F)
- Expand existing real state disclosure requirements to all properties within the JLUS Area of Concern (APPENDIX C)
- Advocate for increased state involvement in promoting land use compatibility around Tennessee's military installations
- Participate in regional sustainability partnerships with Fort Campbell
- Consider establishing preservation plans/programs to protect key open space including prime farmland containing high noise areas adjacent to the installation

STEWART COUNTY

Near-term Actions:

- Identify a point of contact to participate regularly in the JLUS Partnership and to interact with Fort Campbell military planners
- Adopt proposed exterior lighting controls in the form of building permit requirements in the expanded NVD Influence Area (APPENDIX G)
- Execute the Tier 2 MOU intended to establish formal information sharing efforts within the JLUS AOC (APPENDIX E)
- Develop regular consultation procedures with military planners regarding major residential subdivisions and commercial or industrial uses in the JLUS Area of Concern
- Assist in community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts (APPENDIX G)
- Participate in a multi-jurisdictional corridor management study of U.S. Highway 79 to shape land use form and commercial sites
- Coordinate with local utilities and the State Department of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)

Mid-Term Actions:

- Develop a County Comprehensive Plan that includes a Military Influence Planning District Element (APPENDIX F)
- Explore full real state disclosure for properties within the JLUS Area of Concern (APPENDIX C)
- Advocate for increased state involvement in promoting land use compatibility around Tennessee's military installations
- Participate in regional sustainability partnerships with Fort Campbell

Long-Term Actions:

- Explore county zoning as a means to prevent encroachment and promote more efficient, quality growth outcomes, including creation of a Fort Campbell Activity Zone District (APPENDIX H)
- Explore subdivision regulations as a means to control residential lotting and infrastructure and the resulting density of development in the JLUS Area of Concern (residential density should not exceed one dwelling units per acre)
- Consider development of a rural conservation based subdivision ordinance that would permit property owners to cluster homes away from the operational impact areas of the installation and set aside noise and safety affected areas for permanent open space protection

FORT CAMPBELL

Near-term Actions:

- Develop an on-post pilot program to demonstrate recommended exterior lighting applications (APPENDIX G)
- Spearhead community outreach about the JLUS, ACUB, and new lighting standards and disseminate compatibility information in the form of web postings, posters and handouts
- Continue efforts to pursue conservation easements from willing sellers near critical airfields and training areas
- Maintain and improve communication through methods such as publishing planned training schedules (training schedules change day-to-day) and operational guidelines for night training on the post web site
- Support ongoing role for a highly visible Fort Campbell liaison to address noise and other issues in the community
- Continue briefings to the JLUS Partnership
- Facilitate signing of new MOUs with regional partners
- Collaborate with local governments to continue monitoring and mapping subdivision and building permit activity in the JLUS Area of Concern
- Coordinate with local utilities and State Departments of Transportation to sign MOUs that address issues related to public infrastructure improvements and outdoor lighting applications (APPENDIX E)
- Pursue conservation opportunities within the Public Safety Buffer Area utilizing the Army Compatible Use Buffer (ACUB) Program
- Improve/enhance existing on-post procedures for the public to obtain information and report military-related concerns

Mid-Term Actions:

- Establish an advisory role in regional planning bodies such as the MPOs and Area Development Districts for areas such as transportation and capital improvements planning
- Participate in multi-jurisdictional corridor management studies of U.S. Highway 41A and U.S. Highway 79 to shape land use form and commercial sites
- Advocate for increased state involvement in promoting land use compatibility around Tennessee's military installations
- Initiate regional sustainability partnerships with local communities

Fort Campbell
JOINT LAND USE STUDY

FORT CAMPBELL
Joint Land Use Study Update

TECHNICAL APPENDIX

APPENDIX A: ACRONYMS AND GLOSSARY

ACUB	Army Compatible Use Buffer
APZ	Accident Potential Zone
CZ	Clear Zone
dB	Decibels
dBA	A-weighted decibels
dBC	C-weighted decibels
DNL	Day-night sound level
DU	Dwelling Unit
FAA	Federal Aviation Administration
FICUN	Federal Interagency Committee on Urban Noise
CAAF	Campbell Army Airfield
JLUS	Joint Land Use Study
LUPZ	Land Use Planning Zone
MOU	Memorandum of Understanding
NZ	Noise Zone
PAO	Public Affairs Office
SAH	Sabre Army Heliport
TDR	Transfer of Development Rights

Glossary

A-weighting (dBA) – A measure of sound that depicts higher frequency noise caused by small arms firing, aircraft use, and vehicle operations.

Accident Potential Zone I (APZ I) [Class A Runway Accident] - An area just beyond the Clear Zones at each end of the runway. Less critical than the Clear Zone it still possesses significant potential for accidents. Land use compatibility guidelines allow a wide variety of industrial, manufacturing, transportation, communication, utilities, wholesale trade, open space, recreation and agricultural uses. Uses that concentrate people in small areas are not acceptable in APZ I.

Accident Potential Zone II (APZ II) [Class A Runway] - An area extending beyond APZ I. This area is less critical than APZ I but still possesses potential for accidents. Acceptable land uses include those in APZ I, as well as low density, single family residences. Also acceptable are

personal and business services and commercial retail trade uses of low intensity or scale of operation. High-density functions such as multi-story buildings, places of assembly (e.g., theaters, schools, churches, and restaurants) and high-density office uses are not considered appropriate.

Army Compatible Use Buffer (ACUB) - A new Army program which allows an installation to work with partners to encumber land to protect habitat and training without acquiring any new land for Army ownership. Through ACUBs, the Army reaches out to partners to identify mutual objectives of land conservation and to prevent development of critical open areas. The program allows the Army to contribute funds to the partner's purchase of easements or properties from willing landowners. These partnerships preserve high-value habitat and limit incompatible development in the vicinity of military installations. Partners may include states, cities and counties as well as non-governmental conservation organizations.

C-weighting (dBC) – a measure of sound that shows the low frequency noise and vibration associated with the firing of larger weapons systems.

Clear Zone (CZ) [Class A Runway] - An area 1,000 feet wide by 3,000 feet long located at the immediate end of the runway. The accident potential in this area is so high that no building is allowed.

Day-Night Average Sound Level (DNL) - The 24-hour average frequency-weighted sound level, in decibels, from midnight to midnight, obtained after addition of 10 decibels to sound levels in the night from midnight up to 7 a.m. and from 10 p.m. to midnight (0000 up to 0700 and 2200 up to 2400 hours).

Decibels (dB) - The decibel is a logarithmic unit of measure of sound pressure.

Land Use Planning Zone. The Land Use Planning Zone consists of an area where the day-night sound level (DNL) is between 60 and 65 dBA or 57 and 62 dBC. Exposure to noise within this area is considered significant during periods of increased operations. The LUPZ accounts for the variability of noise levels caused by higher daily numbers of operations than the annual average. It shows where levels of annoyance usually associated with Noise Zone II can be found during periods of increased operations. The LUPZ provides the installation with a means to predict possible complaints, and meet the public demand for a description of what will exist during a period of increased operations

Noise Zone I. Noise Zone I (NZ I) includes areas around a noise source in which the DNL is less than 65 dBA and less than 62 dBC. Since the noise exposure in this zone is low enough that it does not trigger compatibility with sensitive uses, maps of the noise environment do not show NZ I contours.

Noise Zone II. Noise Zone II (NZ II) consists of an area where the A-weighted DNL is between 65 and 75 decibels and the C-weighted DNL is between 62 and 70 decibels. Guidance deems noise exposure within this area to be significant and recommends limiting use of land to non-

sensitive activities such as industry, manufacturing, transportation, and agriculture. However, if the community determines that land in NZ II areas must be used for residential purposes, guidance suggests that the design and construction of the buildings incorporate noise level reduction (NLR) features to minimize the annoyance experienced by residents.

Noise Zone III. Noise Zone III (NZ III) consists of the immediate areas around the source of the noise in which the A-weighted DNL (ADNL) is more than 75 decibels, and the C-weighted DNL (CDNL) exceeds 70 decibels. Guidance indicates that noise in this zone is severe enough to cause conflicts with almost all activities, particularly sensitive land uses, such as housing, schools, medical facilities, and places of worship.

APPENDIX B: DETAILED COMPATIBILITY GUIDELINES

DoD COMPATIBLE LAND USE GUIDELINES FOR CLEAR ZONES AND ACCIDENT POTENTIAL ZONES (APZ). (U.S. Army 1981)

LAND USE	CLEAR ZONE	APZ I	APZ II
A. RESIDENTIAL			
Single Family Unit	No	No	Yes[2]
2-4 Family Units	No	No	No
Multifamily Dwellings (Apartments)	No	No	No
Group Quarters	No	No	No
Residential Hotels	No	No	No
Mobile Home Parks or Courts	No	No	No
Other Residential	No	No	No
B. INDUSTRIAL & MANUFACTURING[3]			
Food and Kindred Products	No	No	Yes
Apparel	No	No	No
Lumber and Wood Products	No	Yes	Yes
Furniture and Fixtures	No	Yes	Yes
Printing, Publishing	No	Yes	Yes
Miscellaneous Manufacturing	No	Yes	Yes
C. TRANSPORTATION, COMMUNICATIONS & UTILITIES[4]			
Railroad, Rapid Rail Transit (on-grade)	No	Yes[4]	Yes
Highway and Street Rights-of-Way	Yes[5]	Yes	Yes
Auto Parking	No	Yes	Yes
Communications	Yes[5]	Yes	Yes
Utilities	Yes[5]	Yes[4]	Yes
Other Transportation, Communications and Utilities	Yes[5]	Yes	Yes
D. COMMERCIAL & RETAIL TRADE			
Wholesale Trade	No	Yes	Yes
Building Materials (Retail)	No	Yes	Yes
General Merchandise (Retail)	No	No	Yes
Food (Retail)	No	No	Yes
Automotive, Marine, and Aviation	No	Yes	Yes
Apparel and Accessories (Retail)	No	No	Yes
Furniture, Home Furnishings (Retail)	No	No	Yes
Eating and Drinking Facilities	No	No	No
Other Retail Trade	No	No	Yes
E. PERSONAL & BUSINESS SERVICES[6]			
Finance, Insurance, and Real Estate	No	No	Yes
Personal Services	No	No	Yes

Business Services	No	No	Yes
Repair Services	No	Yes	Yes
Professional Services	No	No	Yes
Contract Construction Services	No	Yes	Yes
Indoor Recreation Services	No	No	Yes
Other Services	No	No	Yes
F. PUBLIC AND QUASI-PUBLIC SERVICES			
Government Services	No	No	Yes[6]
Educational Services	No	No	No
Cultural Activities	No	No	No
Medical and Other Health Services	No	No	No
Cemeteries	No	Yes[7]	Yes[7]
Non-profit Organizations including Churches	No	No	No
Other Public and Quasi-Public Services	No	No	Yes
G. OUTDOOR RECREATION			
Playgrounds and Neighborhood Parks	No	No	Yes
Community and Regional Parks	No	Yes[8]	Yes[8]
Nature Exhibits	No	Yes	Yes
Spectator Sports Including Arenas	No	No	No
Golf Courses[9], Riding Stables[10]	No	Yes	Yes
Water Based Recreational Areas	No	Yes	Yes
Resort and Group Camps	No	No	No
Entertainment Assembly Areas	No	No	No
Other Outdoor Recreation	No	Yes[8]	Yes
H. RESOURCE PRODUCTION & EXTRACTION& OPEN LAND			
Agriculture[11]	Yes	Yes	Yes
Livestock Farming, Animal Breeding[12]	No	Yes	Yes
Forestry Activities	No	Yes	Yes
Fishing Activities and Related Services[13]	No[14]	Yes[13]	Yes
Mining Activities	No	Yes	Yes
Permanent Open Space	Yes	Yes	Yes
Water Areas[13]	Yes	Yes	Yes

Footnotes:

1 A "Yes" or "No" designation for compatible land use is to be used only for gross comparison. Within each, uses exist where further definition may be needed as to whether it is clear or usually acceptable/unacceptable owing to variations in densities of people and structures. For heliports and stagefields, the takeoff safety zone is equivalent to the clear zone and the approach-departure zone is equivalent to APZ I for these land use guidelines.

2 Suggested maximum density 1-2 dwelling units per acre, possibly increased under a Planned Unit Development where maximum lot coverage is less than 20 percent.

3 Factors to be considered: Labor intensity, structural coverage, explosive characteristics, and air pollution.

4 No passenger terminals and no major above ground transmission lines in APZ I.

5 Not permitted in graded area.

6 Low intensity office uses only. Meeting places, auditoriums, etc., not recommended.

7 Excludes chapels.

8 Facilities must be low intensity.
9 Clubhouse not recommended.
10 Concentrated rings with large classes not recommended.
11 Includes livestock grazing but excludes feedlots and intensive animal husbandry.
12 Includes feedlots and intensive animal husbandry.
13 Includes hunting and fishing.
14 Controlled hunting and fishing may be permitted for the purpose of wildlife control.

GUIDELINES FOR CONSIDERING NOISE IN LAND USE PLANNING AND CONTROL. (FICUN 1980)

	NZ I		NZ II		NZ III		
	0-55	55-65	65-70	70-75	75-80	80-85	85+
RESIDENTIAL							
Household Units	Yes	Yes*	25[1]	30[1]	No	No	No
Group Quarters	Yes	Yes*	25[1]	30[1]	No	No	No
Residential Hotels	Yes	Yes*	25[1]	30[1]	No	No	No
Manufactured Housing	Yes	Yes*	No	No	No	No	No
Other Residential	Yes	Yes*	25[1]	30[1]	No	No	No
MANUFACTURING							
Food Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Textile Mill Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Apparel	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Wood Products	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Furniture	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Paper	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Printing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Manufacturing	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
TRANSPORT, COMMS & UTIL							
Railroad	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Motor Vehicle	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Aircraft	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Marine Craft	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Highway & Street	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Parking	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Communications	Yes	Yes	Yes	25[5]	30[5]	No	No
Utilities	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[4]
Other T, C & U	Yes	Yes	Yes	25[5]	30[5]	No	No
TRADE							
Wholesale Trade	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Retail - Building	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Retail - General	Yes	Yes	Yes	25	30	No	No
Retail - Food	Yes	Yes	Yes	25	30	No	No
Retail - Auto	Yes	Yes	Yes	25	30	No	No
Retail - Apparel	Yes	Yes	Yes	25	30	No	No
Retail - Furniture	Yes	Yes	Yes	25	30	No	No
Retail - Eating	Yes	Yes	Yes	25	30	No	No
Other Retail Trade	Yes	Yes	Yes	25	30	No	No
SERVICES							
Finance, Insurance	Yes	Yes	Yes	25	30	No	No
Personal Services	Yes	Yes	Yes	25	30	No	No
Cemeteries[11]	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	Yes[6]

Repair Services	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes[4]	No
Profess Services	Yes	Yes	Yes	25	30	No	No
Hospitals, Nursing	Yes	Yes*	25*	30*	No	No	No
Other Medical Facilities	Yes	Yes	Yes	25	30	No	No
Contract Construction	Yes	Yes	Yes	25	30	No	No
Government Services	Yes	Yes*	Yes*	25*	30*	No	No
Educational Services	Yes	Yes*	25*	30*	No	No	No
Misc Services	Yes	Yes	Yes	25	30	No	No
CULTURAL, ENTERTAINMENT & REC							
Churches	Yes	Yes*	25*	30*	No	No	No
Nature Exhibits	Yes	Yes*	Yes*	No	No	No	No
Public Assembly	Yes	Yes	Yes	No	No	No	No
Auditoriums	Yes	Yes	25	30	No	No	No
Amphitheaters	Yes	Yes*	No	No	No	No	No
Outdoor Sports	Yes	Yes	Yes[7]	Yes[7]	No	No	No
Amusements	Yes	Yes	Yes	Yes	No	No	No
Recreational	Yes	Yes*	Yes*	25*	30*	No	No
Resorts	Yes	Yes*	Yes*	Yes*	No	No	No
Parks	Yes	Yes*	Yes*	Yes*	No	No	No
Other	Yes	Yes*	Yes*	Yes*	No	No	No
RESOURCE PRODUCT							
Agriculture	Yes	Yes	Yes[8]	Yes[9]	Yes[10]	Yes[10]	Yes[10]
Livestock	Yes	Yes	Yes[8]	Yes[9]	No	No	No
Forestry	Yes	Yes	Yes[8]	Yes[9]	Yes[10]	Yes[10]	Yes[10]
Fishing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mining	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Resource	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Legend:

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
NZ	Noise Zone
Yes[x]	(Yes 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; 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.

1 (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 approvals.
(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.

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

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

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

5 If noise-sensitive, use indicated NLR; if not, use is compatible.

6 No buildings.

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

8 Residential buildings require a NLR of 25.

9 Residential buildings require a NLR of 30.

10 Residential buildings not permitted.

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.

APPENDIX C: SAMPLE REAL ESTATE DISCLOSURE FORM LANGUAGE

AREA OF MILITARY IMPACT
REAL ESTATE DISCLOSURE FORM

Property at the following location is situated within the vicinity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. The subject property may therefore be exposed to periodic low-level military aircraft over-flights, large artillery noise, small arms noise, and impacts associated with other such military training activities.

Parcel #: _____ **Deed Book #** _____ **Page #** _____

Address:_____

_____

_____

I, _____, (owner of the subject property) hereby certify that I have informed _____ (prospective purchaser/lessee/renter) that the subject property is located within the vicinity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and may therefore be exposed to periodic low-level military aircraft over-flights, artillery/small arms noise, other such military training activities.

_____ _____
Owner/ Date

I, _____, (prospective purchaser/lessee/renter of the subject property) herby certify that I have been informed by _____ (owner) that the subject property is located in the vicinity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and may therefore be exposed to periodic low-level military aircraft over-flights, artillery/small arms noise, other such impacts of military training activities.

_____
Purchaser/Lessee/Renter Date

Signed before me on this _____ day of _____, 20___, in the
County of _____, Tennessee/Kentucky
_____, Notary Public, State of Tennessee/Kentucky.
My Commission Expires on _____. (SEAL)

APPENDIX C: SAMPLE REAL ESTATE DISCLOSURE ORDINANCE LANGUAGE

NAVAL AIR STATION PENSACOLA, ESCAMBIA COUNTY, FLORIDA

Real Estate Disclosure Area. All real estate transactions within the Pensacola Regional Airport Real Estate Disclosure Area shall include a form disclosing the proximity of the site to the airport. The form shall be affixed to all listing agreements, sales and rental contracts, subdivision plats, and any individual marketing materials, such as brochures, etc. Disclosure is required as soon as practicable, but must be before the execution of a contract, i.e., before the making or acceptance of an offer.

The Pensacola Regional Airport Real Estate Disclosure Area shall be comprised of all properties abutting the Pensacola Regional Airport and all properties within noise zone A, B, or C. The area is depicted on the "Pensacola Regional Airport Real Estate Disclosure Area" map which is adopted by reference, located in the Department of Planning and Zoning offices, and is available for review during normal business hours.

Split parcels. For purposes of regulating parcels split by PNSPD lines, only that portion of a parcel that falls within the PNSPD shall be subject to the conditions of the PNSPD. For parcels located within more than one noise zone inside PNSPD, the more stringent requirements shall apply to the entire parcel.

APPENDIX D: SAMPLE AVIGATION EASEMENT FORM

Parcel _____ County _____

Grantor (s) Name _____

Grantor (s) Address _____

LEGAL DESCRIPTION:
In accordance with section XXXXX of the Land Use Ordinance for XXXXX County, State of XXXXX, approving a permit for residential development on the above described property, and in consideration of such approval, Grantors grant to the owners of all property adjacent to the above described property, a perpetual nonexclusive easement as follows:

1. The Grantors, their heirs, successors, and assigns acknowledge by the granting of this easement that the residential development is situated in an area that may be subjected to conditions resulting from military training at Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. Such conditions include the firing of small and large caliber weapons, the overflight of both fixed-wing and rotary-wing aircraft, the movement of vehicles, the use of generators, and other accepted and customary military training activities. These activities ordinarily and necessarily produce noise, dust, smoke and other conditions that may conflict with Grantors' use of Grantors' property for residential purposes. Grantors hereby waive all common law rights to object to normal and necessary military training activities legally conducted on adjacent Fort Campbell which may conflict with Grantors' use of Grantors' property for residential and other purposes, and Grantors hereby grant an easement to the adjacent Fort Campbell for such activities.

2. Nothing in this easement shall grant a right to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport for ingress or egress upon or across the described property. Nothing in this easement shall prohibit or otherwise restrict the Grantors from enforcing or seeking enforcement of statues or regulations of governmental agencies for activities conducted on adjacent properties.

3. This easement is appurtenant to all property adjacent to the above described property and shall bind to the heirs, successors, and assigns of Grantors and shall endure for the benefit of the adjoining Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. Fort Campbell/Campbell Army Airfield/Sabre Army Heliport is hereby expressly granted the right of third party enforcement of the easement.

IN WITNESS WHEREOF, the Grantors have executed this easement dated this __ day of _____, 20__

_____
Grantor

_____
Grantor

APPENDIX E: MEMORANDA OF UNDERSTANDING

SAMPLE MEMORANDUM OF UNDERSTANDING – TIER 1(ADVANCED)

Between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and

The Counties of _____ and

The Cities of _____

This Memorandum of Understanding between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport, the Counties of _____, and the Cities of _____, is enacted to establish a mutually beneficial process that will ensure timely and consistent notification and cooperation between the parties on projects, policies, and activities. These parties have a mutual interest in the cooperative evaluation, review, and coordination of local plans, programs, and projects in the Counties of _____, the Cities of _____, and on Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

The Cities of _____ and the Counties of _____agree to:

1. Submit information to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport on plans, programs, actions, and projects that may affect Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. This may include, but not be limited to the following:

    - Development proposals
    - Transportation improvements and plans
    - Sanitary waste facilities/wastewater facilities/ water facilities/any infrastructure necessary to support development
    - Open space and recreation
    - Public works projects
    - Land use plans, comprehensive plan, and ordinances
    - Rezonings and variances
    - School facility siting plan
    - Lighting plans for roadways, subdivision developments and major commercial/industrial developments
    - Capital Improvements Plan
    - Demographic data

2. Submit to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities within proximity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport as defined by the established Joint Land Use Study Area of Concern.

3. Consider Army comments as part of local responses or reports.

4. Make information on Joint Land Use Study recommendations, including noise attenuation construction practices and preferred lighting applications readily available to the public.

5. Explore the application of growth management techniques, such as establishing planned growth areas or promoting open space/conservation development to minimize land use incompatibility within the established Joint Land Use Study Area of Concern.

6. Coordinate city/county annexation and public infrastructure extensions to complement the goal of encroachment reduction in established Compatible Use Buffer Areas.

7. Promote compliance with dark-sky approved lighting applications in the Night Vision Device Influence Area

8. Mark all plats in the established JLUS Area of Concern with an "Area of Military Impact Plat Notification" and explore real estate disclosure within the Area of Concern

9. Include Fort Campbell/Campbell Army Airfield/Sabre Army Heliport in the distribution of meeting agendas for, but not limited to:

    - City Council or County Commission Meetings
    - Planning Commission Meetings
    - Zoning Boards of Adjustment
    - Review Board
    - Transportation Studies
    - Public Works Studies

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport agrees to:

1. Submit information to City and County representatives on plans, programs, actions, and projects which may affect the city or county. These may include, but not be limited to, the following:

    - Installation Master Plan
    - Installation Compatible Use Zone Studies
    - Noise Management Studies
    - Changes in existing installation use that may change off-post impacts, such as noise
    - Appropriate data on troop strength and activities for local plans, programs and projects
    - Army Compatible Use Buffer
    - Schedule of training activities when feasible

2. Submit to City and County representatives for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities at Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

3. Make information on Joint Land Use Study recommendations, noise mitigation and encroachment reduction strategies readily available to the public.

This agreement will remain in effect until terminated by any of the parties. Amendments to this memorandum may be made by mutual agreement of all the parties. Review process details and appropriate forms may be developed to facilitate uniform and efficient exchanges of comments.

This understanding will not be construed to obligate the U.S. Army, the Cities of _____, the Counties of _____ to violate existing or future laws or regulations.

This agreement is approved by:

_____

County

_____

City

_____

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport

SAMPLE MEMORANDUM OF UNDERSTANDING – TIER 2 (BASIC)

Between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and

The Counties of _____ and

The Cities of _____

This Memorandum of Understanding between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport, the Counties of _____, and the Cities of _____, is enacted to establish a mutually beneficial process that will ensure timely and consistent notification and cooperation between the parties on projects, policies, and activities. These parties have a mutual interest in the cooperative evaluation, review, and coordination of local plans, programs, and projects in the Counties of _____, the Cities of _____, and on Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

The Cities of _____ and the Counties of

_____agree to:

1. Designate a single point of contact to interact with Fort Campbell planners and participate in JLUS Partnership forums.
2. Submit information to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport on plans, programs, actions, and projects that may affect Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. This may include, but not be limited to the following:
    - Development proposals
    - Transportation improvements and plans
    - Sanitary waste facilities/wastewater facilities/ water facilities/any infrastructure necessary to support development
    - Open space and recreation
    - Public works projects
    - Land use plans, comprehensive plan, and ordinances

- Rezonings and variances
- School facility siting plan
- Lighting plans for roadways, subdivision developments, and major commercial/industrial developments

3. Submit to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities within proximity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport as defined by the established Joint Land Use Study Area of Concern.

4. Consider Army comments as part of local responses or reports.

5. Promote compliance with dark-sky approved lighting applications in the Night Vision Device Influence Area

6. Mark all plats in the established JLUS Area of Concern with an "Area of Military Impact Plat Notification"

7. Include Fort Campbell/Campbell Army Airfield/Sabre Army Heliport in the distribution of meeting agendas for, but not limited to:

    - City Council or County Commission Meetings
    - Planning Commission Meetings
    - Zoning Boards of Adjustment
    - Review Board
    - Transportation Studies

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport agrees to:

1. Submit information to City and County representatives on plans, programs, actions, and projects which may affect the city or county. These may include, but not be limited to, the following:

    - Installation Master Plan
    - Installation Compatible Use Zone Studies
    - Noise Management Studies
    - Changes in existing installation use that may change off-post impacts, such as noise
    - Appropriate data on troop strength and activities for local plans, programs and projects
    - Army Compatible Use Buffer
    - Schedule of training activities when feasible

2. Submit to City and County representatives for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities at Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

3. Make information on Joint Land Use Study recommendations, noise mitigation and encroachment reduction strategies readily available to the public.

This agreement will remain in effect until terminated by any of the parties. Amendments to this memorandum may be made by mutual agreement of all the parties. Review process details and appropriate forms may be developed to facilitate uniform and efficient exchanges of comments.

This understanding will not be construed to obligate the U.S. Army, the Cities of _____,

the Counties of _____ to violate existing or future laws or regulations.

This agreement is approved by:

_____

County

_____

City

_____

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport

SAMPLE MEMORANDUM OF UNDERSTANDING – DOTs/MPOs/ADDs

Between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and

The _____ Department of Transportation and the

_____ Area Development District/MPO

This Memorandum of Understanding between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport, the _____ Department of Transportation is enacted to establish a mutually beneficial process that will ensure timely and consistent notification and cooperation between the parties on projects, policies, and activities. These parties have a mutual interest in the cooperative evaluation, review, and coordination of state, regional, local plans, programs, and projects in the Counties of _____, the Cities of _____, and on Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

The _____ Department of Transportation _____ and the _____ Area Development District/MPO agree to:

1. Designate a single point of contact to interact with Fort Campbell planners and participate in JLUS Partnership forums.
2. Submit information to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport on plans, programs, actions, and projects that may affect Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. This may include, but not be limited to the following:

    - Statewide Transportation Improvement Plans
    - Statewide Transportation Plan
    - Six Year Highway Plans
    - Regional Long-Range Transportation Plans
    - Regional Transportation Improvement Programs
    - Unified Planning Work Program
    - Access Management Plans

- Concept plans for roadway projects
- Lighting plans for roadway projects

3. Submit to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport for review and comment, roadway plans and projects within proximity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport as defined by the established Joint Land Use Study Area of Concern.

4. Consider Army comments as part of local project design or reports.

5. Include Fort Campbell/Campbell Army Airfield/Sabre Army Heliport in the distribution of meeting agendas for, but not limited to:

    - Transportation study meetings
    - Meetings, public hearings, and public comment periods related to state and regional transportation plan development
    - MPO Executive Board and MPO Technical Coordinating Committee meetings
    - Regional Planning Organization board and committee meetings

6. Seek to install fully shielded luminaires for street lighting applications on new roadways or as part of the scheduled replacement of existing street lighting on roadways in the established Night Vision Device Influence Area

7. Coordinate with Fort Campbell military planners on the placement of new roads or projects to enhance the capacity of existing roads in the established JLUS Area of Concern and seek to minimize the expenditure of public funds on roadway projects that may induce incompatible growth in the established Compatible Use Buffer Area and compromise Fort Campbell's function as a strategic deployment platform.

8. Modify Metropolitan Planning Organization to include the Kentucky and Tennessee Military Affairs Commissions and integrate Fort Campbell requirements into their regional transportation planning.

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport agrees to:

1. Submit information to transportation representatives on plans, programs, actions, and projects which may affect surface transportation and regional access. These may include, but not be limited to, the following:

    - Installation Master Plan
    - Changes in existing installation use that may change off-post impacts, such as troop movement on surface roads
    - Appropriate data on troop strength and activities for local plans, programs and projects
    - Transportation plans
    - Changes to gate access

2. Submit to transportation representatives for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities at Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

3. Make information on Joint Land Use Study recommendations, noise mitigation and encroachment reduction strategies readily available to the public.

This agreement will remain in effect until terminated by any of the parties. Amendments to this memorandum may be made by mutual agreement of all the parties. Review process details and appropriate forms may be developed to facilitate uniform and efficient exchanges of comments.

This understanding will not be construed to obligate the U.S. Army, _____ Department of Transportation and the _____ Area Development District or MPO to violate existing or future laws or regulations.

This agreement is approved by:

_____
Department of Transportation

_____
ADD/MPO

_____
Fort Campbell/Campbell Army Airfield/Sabre Army Heliport

SAMPLE MEMORANDUM OF UNDERSTANDING – UTILTIES

Between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport and

The _____ (Name of Utility)

This Memorandum of Understanding between Fort Campbell/Campbell Army Airfield/Sabre Army Heliport, the _____ (Name of Utility) is enacted to establish a mutually beneficial process that will ensure timely and consistent notification and cooperation between the parties on projects, policies, and activities. These parties have a mutual interest in the cooperative evaluation, review, and coordination of state, regional, local plans, programs, and projects in the Counties of _____, the Cities of _____, and on Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

The _____ (Name of Utility) agrees to:

1. Designate a single point of contact to interact with Fort Campbell planners and participate in JLUS Partnership forums.

2. Submit information to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport on plans, programs, actions, and projects that may affect Fort Campbell/Campbell Army Airfield/Sabre Army Heliport. This may include, but not be limited to the following:

    - Capital Improvement Plans
    - Master Plans and Service Area Plans
    - Information on treatment capacities

3. Submit to Fort Campbell/Campbell Army Airfield/Sabre Army Heliport for review and comment, infrastructure and utility plans and projects within proximity of Fort Campbell/Campbell Army Airfield/Sabre Army Heliport as defined by the established Joint Land Use Study Area of Concern.

4. Consider Army comments as part of local project design or reports.

5. Include Fort Campbell/Campbell Army Airfield/Sabre Army Heliport in the distribution of meeting agendas for, but not limited to:

    - Utility Authority meetings
    - Meetings, public hearings, and public comment periods related to regional and utility plan development

6. Promote the use of fully shielded light fixtures for customers seeking security/agricultural lighting in the four county area of Christian, Clarksville-Montgomery, Trigg and Stewart Counties.

7. Coordinate with Fort Campbell military planners on the placement of new infrastructure, particularly wastewater treatment, and plans to enhance the capacity of existing facilities in the established JLUS Area of Concern and seek to minimize the expenditure of public funds on infrastructure projects that may induce incompatible growth in the established Compatible Use Buffer Area.

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport agrees to:

1. Submit information to transportation representatives on plans, programs, actions, and projects which may affect public service demand. These may include, but not be limited to, the following:

    - Installation Master Plan
    - Appropriate data on troop strength and activities for local plans, programs and projects

2. Submit to utility representatives for review and comment, project notification, policies, plans, reports, studies and similar information on development, infrastructure and environmental activities at Fort Campbell/Campbell Army Airfield/Sabre Army Heliport.

3. Make information on Joint Land Use Study recommendations, noise mitigation and encroachment reduction strategies readily available to the public.

This agreement will remain in effect until terminated by any of the parties. Amendments to this memorandum may be made by mutual agreement of all the parties. Review process details and appropriate forms may be developed to facilitate uniform and efficient exchanges of comments.

This understanding will not be construed to obligate the U.S. Army, _____

_____ (Name of Utility) to violate existing or future laws or regulations.

This agreement is approved by:

_____

Utility

_____

Fort Campbell/Campbell Army Airfield/Sabre Army Heliport

APPENDIX F: SAMPLE COMPREHENSIVE PLAN LANGUAGE

Marion County, GA

COMMUNITY ASSESSMENT: POTENTIAL ISSUES AND OPPORTUNITIES 110-12-1-.03(2)(a)
The following is a list of issues and opportunities based on the State Planning Goals and Objectives that are pertinent to Marion County:

Economic Development Opportunities
Fort Benning, which shares the western boundary for a portion of Marion County, is of significant economic value to the County and the region. As a result of the Base Realignment and Closure process and other military re-organization efforts, Fort Benning will expand, resulting in approximately 30,000 additional military personnel and supporting civilian jobs relocating to the region. Especially during construction phases, Marion County and the Valley Partnership have the opportunity to work closely with Fort Benning and civilian contractors to locate offices and other construction services within Marion County.

Land Use Issues
Noise, dust and other impacts generated by training activities on Fort Benning will affect properties in Marion County within close proximity to the military installation. Concomitantly protecting the health safety and welfare of County as well as the military readiness mission requires that the development of incompatible land uses be prevented. The County will incorporate the Fort Benning Areas of Concerns as established in the Fort Benning Joint Land Use Study into the Community Agenda of the Comprehensive Plan, the zoning ordinance, the subdivision ordinance, and all capital improvement plans.

In addition, the County will evaluate all development proposals for property located within the Fort Benning Areas of Concerns to ensure compatibility and to protect the military installation from encroachment of incompatible land uses.

Intergovernmental Issues
Communication between the County and Fort Benning needs to be strengthened to offer residents of the County optimal opportunities to understand potential noise and prescribed burning events on the military installation. The County will post all communications from Fort Benning prominently in the County main offices and on the County website.

Coordination and consultation between the County and Fort Benning needs to occur on all rezoning and subdivision activities within the Fort Benning Areas of Concern, as described in the Fort Benning Joint Land Use Study. The County will request Fort Benning to review and make recommendations on all rezoning and subdivisions for properties within the Areas of Concern. In addition, the County will consult with military command for any future land use changes within the Areas of Concern for potential negative impacts on the military installation.

COMMUNITY ASSESSMENT: ANALYSIS OF EXISTING DEVELOPMENT PATTERNS, AREAS REQUIRING SPECIAL ATTENTION 110-12-1-.03(2)(b)(ii)
This component consists of an evaluation of existing land use patterns and trends for the purpose of identifying areas requiring special attention.

Areas with other unique pressures

Fort Benning military reservation abuts the County's western boundary. Noise, dust and other impacts generated by training activities on Fort Benning will be experienced on properties nearest to the military installation. Marion County participated in the Fort Benning Joint Land Use Study to address encroachment and identify Areas of Concern, land which will feel the greatest impact from the expanded military activities. The northwestern and western portions of the County are located within several Areas of Concern including the Primary Protection, Secondary Protection, Influence Area, Conservation Area, and Benning Land Use Planning Zone (LUPZ). Furthermore, these are the areas that have historically seen the most development and subdivision of property, aggravating the encroachment of incompatible land uses.

The Fort Benning Joint Land Use Study recommended various encroachment reduction and mitigation tools such as the adoption of land use guidelines, a military planning zoning overlay district, consultation with Fort Benning on development activities for properties within the Areas of Concern, and mandatory real estate disclosures to potential land buyers and renters. As part of the Comprehensive Plan, Marion County will review and adopt those recommendations that are most appropriate for the County.

COMMUNITY ASSESSMENT: ANALYSIS OF EXISTING DEVELOPMENT PATTERNS, RECOMMENDED CHARACTER AREAS 110-12-1-.03(2)(b)(iii)
A Character Area is a specific geographic area within the community that, among other options, requires special attention due to unique development issues. The County may wish to update their Character Area Map with the Areas of Concern, as mapped in the Fort Benning Joint Land Use Study.

COMMUNITY ASSESSMENT: ANALYSIS OF CONSISTENCY WITH QUALITY COMMUNITY OBJECTIVES 110-12-1-.03(2)(c)
The following text describing the Quality Community Objectives is a statement of the development patterns and options that will help preserve unique cultural natural and historic resources while looking simultaneously to maximize future development potential. This assessment is intended to serve as a tool to evaluate progress towards sustaining a livable community, much like a more detailed and conventional demographic analysis or land use map.

Regional Identity
Fort Benning is a major economic engine for the surrounding region including Marion County. The operations at Fort Benning generate substantial revenues to the local economy through salary payments to military and civilian employees, construction contractor payments, operating costs and non-construction contracts. During Fiscal Year (FY) 2005 (Oct. '04 – Sept. '05) the installation circulated over $2.2 billion through the local economy. Though the installation is self-sustaining, personnel and their dependents make considerable use of the retail and service facilities in the surrounding communities. Purchases in the area by the more than 32,000 military personnel assigned to Fort Benning and their family members contribute significantly to local retail and service segments. During FY 2005 direct payroll disbursed to active duty military personnel exceeded $798,925,000. Contract and civilian employees on the installation brought in over $255,289,000 in gross pay. By FY 2012, when BRAC is fully implemented, direct payroll to military personnel is expected to reach $1.3 billion annually and contract and civilian payroll will reach a yearly total of $500 million.

Appropriate Businesses
The existing industries in Marion County do not offer the community much in terms of higher-skilled employment opportunities. The community has joined forces with a consortium of counties with the intended purpose of increasing economic development activity around Columbus-Muscogee County and Fort Benning, called the Valley Partnership. County representatives will continue to work with the

Valley Partnership to encourage the relocation of construction jobs and other military related employment centers into Marion County.

Environmental Protection
In addition to the efforts made by the county in the area of stormwater and watershed protection ordinances, Marion County also recognizes the Army Compatible Use Buffer (ACUB) program as a tool to protect the concentration of plant and animal species of special concern as mapped and documented in the *Areas Requiring Special Attention* section of this plan on page 10. The County will continue to support the Nature Conservancy in its implementation of the ACUB as necessary.

COMMUNITY AGENDA: COMMUNITY VISION, DEFINING NARRATIVE 110-12-1-.05(2)(a)(iii)
Within the Benning Area of Concern Character Area, only low intensity uses shall be encouraged. Open spaces, environmentally protected lands, and timber uses dominate the area. Low density residential, typically at one dwelling unit per five acres or greater, is the typical residential development pattern that characterizes this area. The purpose of establishing this character area is to discourage encroachment to Fort Benning and threatening the military mission while simultaneously protecting the health safety and welfare of Marion County residents. The following narrative illustrates the land uses, intensities and patterns of development that are encouraged in the Benning Areas of Concern Character Area as shown on the Marion County Future Land Use and Character Area Map.

Specific Land Uses allowed within the Fort Benning Character Area

Primary Protection Area
- Utilities and roads
- Mining
- Manufacturing and Warehouse uses
- Wholesale trades
- Vehicle repair services and heavy commercial uses
- Forestry and Timber
- Agriculture, but not livestock
- Cemeteries

Secondary Protection Area
- Utilities and roads
- Mining
- Manufacturing and Warehouse uses
- Wholesale trades
- Vehicle repair services and heavy commercial uses
- General retail
- General services, but not hospitals or clinics
- General government uses, but not schools
- Outdoor sporting fields
- Forestry and Timber
- Agriculture
- Cemeteries
- Low density residential at densities of no more than 1 dwelling unit per 5 acres

Influence Area and Benning Land Use Planning Zone (LUPZ)

- All land uses except noise-sensitive uses such as schools, churches and hospitals. These uses should be evaluated on a case-by-case basis
- Low and medium density residential, but multi-family uses are not recommended

APPENDIX G: MODEL LIGHTING ORDINANCE/TECHNICAL GUIDELINES

Sample Lighting Ordinance - Tier 2 (Basic)

"Chapter xx OUTDOOR LIGHTING

xx.1. Title.
This chapter is entitled Outdoor Lighting Code of the (governing unit).

xx.2 Purpose.
The purpose of this Code is to provide regulations for outdoor lighting that will:

1. Minimize the impact of lighting on night aircraft operations;
2. Permit reasonable uses of outdoor lighting for nighttime safety, utility, security, productivity, enjoyment and commerce; and
3. Minimize discomfort and disability glare

xx.3 Applicability
1. This article is applicable to:

    a. Installation of new lighting systems,
    b. Modifications of existing lighting systems;
    c. Replacement of lighting fixtures, or
    d. Installation or replacement of any other lighting equipment, whether attached to structures, poles, the earth, or any other location, including lighting systems installed on private or public property by any third party such as an electric utility.

2. Exemption. The following lighting systems are EXEMPT from these requirements.

    a. Interior lighting.
    b. Internally illuminated signs.
    c. Externally illuminated signs.
    d. Temporary lighting for theatrical, television, and performance areas.
    e. Lighting in swimming pools and other water features governed by Article 680 of the National Electrical Code.
    f. Code required exit signs.
    g. Lighting specifically for stairs and ramps.
    h. Temporary and seasonal lighting provided that individual lamps are 10 watts or less.
    i. Lighting required and regulated by the Federal Aviation Administration, U.S. Coast Guard, or other federal or state agency.
    j. Single-family and two-family dwelling uses are encouraged but not required to comply with this ordinance, with the exception that all exterior pole lighting shall use full-cutoff lighting fixtures.
    k. Agricultural uses outside of the Night Vision Device Influence Area are encouraged but not required to comply with this ordinance

xx.4 Definitions.

For the purposes of this Code certain terms and words are defined as follows: the words "used for" include "designed for" and vice-versa; words used in the present tense include the future, the singular tense includes the plural and vice-versa; the word "shall" is always mandatory; the word "may" is discretionary; the masculine gender includes the feminine gender, except as otherwise provided. If a term is not defined herein, but is defined by the IESNA, the IESNA definition shall be utilized, unless the context of the word indicates otherwise. The following terms shall mean:

Artificial Sky Glow. The brightening of the night sky attributable to man made sources of light.

Authority. The person(s) holding the position of (designees).

Canopy. A roof-like covering over an area, in or under which a lighting fixture is mounted.

Common Residential Areas.

- Areas shared in common by residents of two or more dwelling units, i.e. common open space, play area, trash receptacle area, "common property" under a subdivision or partition declaration, etc.
- Two or more open parking spaces, either abutting or within 10 feet of each other and not separated by a wall or other physical barrier between the two parking spaces, designated or set aside for use by the two or more dwelling units, regardless whether the parking space is assigned for exclusive use of each dwelling unit or non-exclusively used by two or more dwelling units, and are either commonly owned or were developed for the purpose of serving the parking needs of "multiple dwellings" or multiple attached single-family dwellings, as defined in the Community Development Code.

Code or Lighting Code. The provisions of this Chapter xx.

Duplex. A building on a lot designed to contain two dwelling units and used for residential purposes.

Dwelling, Multiple - A building on one or more lots designed to contain three or more dwelling units that share common walls or floor/ceilings with one or more units. The land underneath the structure is not divided into separate lots. Multiple dwelling includes structures commonly called garden apartments, apartments and condominiums.

Dwelling, Single-Family - A detached dwelling unit designed and used for that purpose or an attached dwelling unit, located on its own lot, that shares one or more common or abutting walls with one or more dwelling units. The common or abutting wall shall consist of a structural wall which shared for at least 25 percent of the length of the side of the dwelling. An attached house does not share common floor/ceilings with other dwelling units. An attached house is also called a rowhouse, townhouse, or a common-wall house.

Façade. The exterior wall or elevation of a building.

Glare. Light that causes visual discomfort or disability, and the wattage and/or light distribution is excessive for the purposes for which the illumination is necessary.

Intersection. A place where two or more public or private rights-of-way (serving vehicular and/or pedestrian traffic) cross. For purposes of this Code, an "intersection" requires the presence of a street name sign and traffic control sign.

Landscape Lighting. Luminaires attached to structures, mounted on poles or otherwise, or at grade (luminare not to exceed 3 feet above grade) and used for solely for landscape rather than area lighting.

LED means Light Emitting Diodes.

Light Source: The actual bulb or lamp that emits the light.

Lighting System. One or more luminares, together with associated wires, conduits, poles, etc that constitute the illumination system on the parcel.

Mounting Height. The vertical distance between the lowest part of the luminaire and the ground surface directly below the luminaire.

Non-residential Use: Commercial, Industrial, or any other non-residential use defined in the (name applicable document).

Obtrusive Light. Glare and light trespass.

Ornamental or Accent Lighting. Outdoor lighting that is installed mainly or entirely for its decorative effect or to accent an object or a feature, rather than as an aid to visibility.

Shielding.

- Directional. A luminaire designed to be aimed or pointed.
- Fully Shielded. A luminaire emitting no more than 0.5 percent of its luminous flux above the horizontal plane, including any luminaire rated "full cut off" according to IESNA RP-8-01.
- Partly Shielded. A luminaire emitting no more than 10 percent of its total luminous flux above the horizontal plane, including any luminaire rated "semi-cutoff" according to IESNA RP-8-01.
- Shielded. A luminaire emitting no more than 2 percent of its total luminous flux above the horizontal plane, including any luminaire rated "cutoff" according to IESNA RP-8-01.
- Unshielded. A luminaire that may emit its flux in any direction.

Temporary Lighting. Lighting installed with temporary wiring and operated for less than 60 days in any calendar year.

xx.5. Lighting Systems Standards for Approval.

1. Non-residential Uses and Common Residential Areas shall meet all of the following requirements.

    a. The light source of outdoor lighting fixtures shall be fully shielded and downward facing so as not to allow any light above the horizontal, as measured at the luminaire.

    b. Outdoor lighting fixtures shall be placed so as to not cause excessive glare or light trespass.

    c. On-site parking areas shall be constructed of asphalt, dyed concrete or other non-reflective paving surfaces.

    d. All light fixtures that are required to be shielded shall be installed and maintained in such a manner that the shielding is effective

    e. Gas station canopy lighting shall be designed to conceal the illumination source and the lighting fixture shall not extend below the canopy skirt.

    f. Exterior sign lights shall be shielded and oriented downward with respect to the sign.

2. Special Permit for Specific Lighting Fixtures and Systems and When Exceeding Lighting Requirements.

    a. Upon special permit issued by the (Authority), lighting systems not complying with the technical requirements of this ordinance may be installed, maintained, and replaced.

    b. The (Authority) shall review each such application. A permit may be granted if, upon review, the (Authority) finds that the proposed lighting will not create excessive glare, sky glow, or light trespass beyond that which can be reasonably expected by application of best lighting practices, available technology. The (Authority) may impose conditions of approval to mitigate any negative impacts resulting to the abutting parcel, based on best lighting practices and available lighting technology. The (Authority) may charge a review fee and may, at the (Authority)'s option, employ the services of a qualified professional civil or electrical engineer to review such submittals, and the cost thereof shall be an additional fee charged to the applicant.

xx.6 Non-Conforming Uses.

Outdoor lighting fixtures lawfully existing prior to the adoption of this Ordinance that do not conform to the provisions of this Ordinance shall be deemed to be a lawful nonconforming use and may remain.

1. New or Changed Uses, New Structures, Major Additions or Modifications.

    a. New Uses or Structures, or Change of Use. Whenever there is a new use or upon a property or the use on the property is changed after [effective date of this Ordinance], all outdoor lighting on the property shall be brought into compliance with this Code before the new or changed use commences.

    b. Major Additions. If a major addition occurs on a property, the entire property shall comply with the requirements of this Code. For purposes of this section, the following are considered to be major additions:

    c. Additions of 25 percent or more in terms of additional dwelling units, gross floor area, seating capacity, or parking spaces, either with a single addition or with cumulative additions after [effective date of this Ordinance].

    d. Single or cumulative additions, modification or replacement of 25 percent or more to installed outdoor lighting luminares existing as of [effective date of this Ordinance].

2. Minor Modifications, Additions, or New Lighting Fixtures for Non-residential and Multiple Dwellings

    a. For non-residential and multiple dwellings, all additions, modifications, or replacement of less than 25% of outdoor lighting fixtures existing as of [effective date of this Ordinance] shall require the submission of a complete inventory and site plan detailing all existing and any proposed new outdoor lighting.

    b. Any new lighting on the site shall meet the requirements of this Code.

3. Resumption of Use after Abandonment.

If a property or use with non-conforming lighting is abandoned for a period of six months or more, then all outdoor lighting shall be brought into compliance with this Code before any further use of the property occurs.

4. Repair of Existing Lighting.

When existing lighting equipment requires any repairs other than relamping, it shall be modified so as to comply with the shielding requirements of this Ordinance.

xx.7 Submittal Requirements

The owner or owners of a tract of land within the lighting review area shall submit to the Authority Planning Office a site plan for the development and use of such tract meeting the requirements set forth in Authority Zoning Ordinance. Subdivisions shall comply with the Authority Subdivision Guidelines.

1. A lighting plan shall be included as part of the required site plan submittal or subdivision construction drawings which shall contain but not be limited to the following:

    a. The location of the site where the outdoor light fixtures will be installed;

    b. Plans indicating the location on the premises of each outdoor light fixture, both proposed and any already existing on the site, and the types of outdoor light fixtures;

    c. A description of the outdoor light fixtures including but not limited to manufacturer's catalog cuts and drawings;

    d. If any subdivision proposes to have installed street or other common or public area outdoor lighting, a lighting plan shall also be submitted for all such lighting.

    e. For any property that contains restrictive avigational easements owned by the United States of America, the owner or owners shall also submit a copy of the lighting plan to Fort Campbell, or its agent, and obtain their written approval before any building permits shall be issued by the Authority.

Sample Interim National Model Lighting Ordinance - Tier 1 (Advanced)

LIGHTING ORDINANCE
This ordinance is intended for use by communities anticipating the National Model Lighting Ordinance (MLO) now being developed jointly by the Illuminating Engineering Society and the International Dark Sky Association. Adaption of the MLO is recommended when available.

"Chapter xx OUTDOOR LIGHTING

xx.1. Title.
This chapter is entitled Outdoor Lighting Code of the (governing unit).

xx.2 Purpose.
The purpose of this Code is to provide regulations for outdoor lighting that will:

4. Minimize the impact of lighting on night aircraft operations;
5. Permit reasonable uses of outdoor lighting for nighttime safety, utility, security, productivity, enjoyment and commerce; and
6. Minimize discomfort and disability glare

xx.3 Applicability
3. This article is applicable to:

    a. Installation of new lighting systems,
    b. Modifications of existing lighting systems;
    c. Replacement of lighting fixtures, or
    d. Installation or replacement of any other lighting equipment, whether attached to structures, poles, the earth, or any other location, including lighting systems installed on private or public property by any third party such as an electric utility.

4. Exemption. The following luminaires and lighting systems are EXEMPT from these requirements.

    a. Interior lighting.
    b. Internally illuminated signs.
    c. Externally illuminated signs.
    d. Temporary lighting for theatrical, television, and performance areas.
    e. Lighting in swimming pools and other water features governed by Article 680 of the National Electrical Code.
    f. Code required exit signs.
    g. Lighting specifically for stairs and ramps.
    h. Temporary and seasonal lighting provided that individual lamps are 10 watts or less.
    i. Lighting required and regulated by the Federal Aviation Administration, U.S. Coast Guard, or other federal or state agency.
    j. Single-family and two-family dwelling uses are encouraged but not required to comply with this ordinance, with the exception that all exterior pole lighting shall use full-cutoff lighting fixtures.

k. Agricultural uses outside of the Night Vision Device Influence Area are encouraged but not required to comply with this ordinance

Cross-reference: See the Sign Code for illumination requirements relating to permanent signs.

xx.4 Definitions.

For the purposes of this Code certain terms and words are defined as follows: the words "used for" include "designed for" and vice-versa; words used in the present tense include the future, the singular tense includes the plural and vice-versa; the word "shall" is always mandatory; the word "may" is discretionary; the masculine gender includes the feminine gender, except as otherwise provided. If a term is not defined herein, but is defined by the IESNA, the IESNA definition shall be utilized, unless the context of the word indicates otherwise. The following terms shall mean:

Artificial Sky Glow. The brightening of the night sky attributable to man made sources of light.

Authority. The person(s) holding the position of (designees).

BUG. A luminaire classification system that is used in the Prescriptive method for evaluating optical distribution of outdoor luminaires that denotes levels of backlight (B), uplight (U) and glare (G).

Candela. The unit of luminous intensity of a lighting source emitted into a given direction.

Canopy. A roof-like covering over an area, in or under which a lighting fixture is mounted.

Canopy (structure). A canopy under which a business provides some service to a customer, such as food service, a bank transaction, or the like.

Common Residential Areas.

- Areas shared in common by residents of two or more dwelling units, i.e. common open space, play area, trash receptacle area, "common property" under a subdivision or partition declaration, etc.
- Two or more open parking spaces, either abutting or within 10 feet of each other and not separated by a wall or other physical barrier between the two parking spaces, designated or set aside for use by the two or more dwelling units, regardless whether the parking space is assigned for exclusive use of each dwelling unit or non-exclusively used by two or more dwelling units, and are either commonly owned or were developed for the purpose of serving the parking needs of "multiple dwellings" or multiple attached single-family dwellings, as defined in the Community Development Code.

Code or Lighting Code. The provisions of this Chapter xx.

Drip Line Area. The area on the ground enclosed by vertical planes extending downward from the outer solid edge of a structure's canopy.

Duplex. A building on a lot designed to contain two dwelling units and used for residential purposes.

Dwelling, Multiple - A building on one or more lots designed to contain three or more dwelling units that share common walls or floor/ceilings with one or more units. The land underneath the structure is not divided into separate lots. Multiple dwelling includes structures commonly called garden apartments, apartments and condominiums.

Dwelling, Single-Family - A detached dwelling unit designed and used for that purpose or an attached dwelling unit, located on its own lot, that shares one or more common or abutting walls with one or more dwelling units. The common or abutting wall shall consist of a structural wall which shared for at least 25 percent of the length of the side of the dwelling. An attached house does not share common floor/ceilings with other dwelling units. An attached house is also called a rowhouse, townhouse, or a common-wall house.

Façade. The exterior wall or elevation of a building.

Glare. Light that causes visual discomfort or disability, and the wattage and/or light distribution is excessive for the purposes for which the illumination is necessary..

Hardscape Permanent improvements to a site, including but not limited to, parking lots, driveways, streets, plazas, sidewalks, walkways, bikeways, abutments, stairs, ramps, and architectural features, such as fountains, sculptures, and the like.

House Side Shield. For fully shielded luminaires only, an internal shield designed and installed by the luminaire manufacturer that significantly attenuates candlepower in the back photometric hemisphere at all angles greater than 30 degrees relative to nadir.

IESNA. The Illuminating Engineering Society of North America (see www.iesna.com).

Intersection. A place where two or more public or private rights-of-way (serving vehicular and/or pedestrian traffic) cross. For purposes of this Code, an "intersection" requires the presence of a street name sign and traffic control sign.

Landscape Lighting. Luminaires attached to structures, mounted on poles or otherwise, or at grade (luminare not to exceed 3 feet above grade) and used for solely for landscape rather than area lighting.

LED means Light Emitting Diodes.

Light Source: The actual bulb or lamp that emits the light.

Light Trespass. Spill light that because of quantitative, directional, or spectral content causes light level at the property line that is greater than as provided on Table 4 of this Code.

Lighting System. One or more luminares, together with associated wires, conduits, poles, etc that constitute the illumination system on the parcel.

Lighting Zone. An area established by the (governing body), pursuant to Code xx.5. A description and boundaries of these five lighting zones is given in Appendix xx

Lumen. The unit of luminous flux: a measure of the amount of light emitted by a lamp.

Luminaire (or "Light Fixture"). A complete lighting unit consisting of one or more electric lamps, the lamp holder, reflector, lens, ballast, and/or other components and accessories.

Luminance. The amount of light emitted in a given direction from a surface by the light source or by reflection from a surface. The unit is candela per square meter.

Luminous Flux. A measure of the total light output from a source, the unit being the lumen.

Mounting Height. The vertical distance between the lowest part of the luminaire and the ground surface directly below the luminaire.

Nadir. The downward direction; exactly vertical, directly below a luminaire.

NITS. A measurement of the intensity for LED signs as expressed in candelas per square meter,

Non-residential Use: Commercial, Industrial, or any other non-residential use defined in the (name applicable document).

Obtrusive Light. Glare and light trespass.

Ornamental or Accent Lighting. Outdoor lighting that is installed mainly or entirely for its decorative effect or to accent an object or a feature, rather than as an aid to visibility.

Shielding.

- Directional. A luminaire designed to be aimed or pointed.
- Fully Shielded. A luminaire emitting no more than 0.5 percent of its luminous flux above the horizontal plane, including any luminaire rated "full cut off" according to IESNA RP-8-01.
- Partly Shielded. A luminaire emitting no more than 10 percent of its total luminous flux above the horizontal plane, including any luminaire rated "semi-cutoff" according to IESNA RP-8-01.
- Shielded. A luminaire emitting no more than 2 percent of its total luminous flux above the horizontal plane, including any luminaire rated "cutoff" according to IESNA RP-8-01.
- Unshielded. A luminaire that may emit its flux in any direction.

Sports Lighting. Lighting installed specifically for lighting of athletic fields for play at levels exceeding 5 footcandles, average, including but not limited to lighting for baseball, softball, football, soccer, tennis, and golf .

Temporary Lighting. Lighting installed with temporary wiring and operated for less than 60 days in any calendar year.

xx.5. Lighting Zones.

1. The designated Lighting Zone for a parcel or project shall determine the limitations for lighting systems and fixtures as specified in this ordinance.

2. Establishing Lighting Zones. The (Authority) shall recommend to the (governing body), and the (governing body) shall establish by resolution Lighting Zones (LZ) within the boundaries of the Night Vision Device Influence Area.

3. The Lighting Zones shall be:

    a. *LZ 2*. Low-density suburban and urban neighborhoods and suburban commercial districts. This zone is intended to be the default condition for urban and suburban areas.

    b. *LZ 3*. Medium to high-density urban neighborhoods and districts, shopping and commercial districts, industrial parks and districts. This zone is intended to apply only to Central Business District(s) and areas having unique character such as auto malls.

4. Modification of Lighting Zones.
   Upon recommendation of the (who) the (governing body) may modify the designated Lighting Zones of one or more parcels if the (governing body) finds that the original Lighting Zone was in error or a change in circumstances has occurred since the existing designation was established .

5. The (Authority) shall maintain the current Lighting Zone map and provide public access to the map upon request.

xx.6 Lighting Systems Standards for Approval.

3. Non-residential Uses and Common Residential Areas.

a. All outdoor lighting shall meet all of the following requirements according to Lighting Zone.

b. The maximum luminaire lamp wattage and shielding shall comply with Table 1.

c. The maximum pole or mounting height shall be consistent with Table 2.

d. All luminaires for non-residential Uses shall be rated and installed according to Table 3, (Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings).

e. On-site parking areas shall be constructed of asphalt, dyed concrete or other non-reflective paving surfaces.

g. Gas station canopy lighting shall be designed to conceal the illumination source and the lighting fixture shall not extend below the canopy skirt.

h. Lighting at publicly owned and privately owned outdoor sports facilities shall be shielded to reduce glare, safety hazards, light trespass and light pollution, and shall provide levels of illuminance consistent with nationally recognized standards such as the Illuminating Engineering Society of North America (IESNA).

i. Exterior sign lights shall be shielded and downward facing. No more than 6 exterior sign lights shall be used as part of the lighting application.

EXCEPTION: upward-facing lighting exclusively for signs and not exceeding 50 rated lamp watts per luminaire. Light sources shall be shielded by orientation with respect to the sign, luminaire construction, and/or louvers or other means of preventing glare.

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Additional Provision: intended to minimize light trespass on adjacent properties

Each luminaire shall be set back from all property lines shall be at least 3 times the mounting height of the luminaire.

EXCEPTION 1: If the subject property is abutting a parcel which is zoned "Commercial" or "Industrial" by the Community Development Code, no setback from the common lot lines of the commercial or industrial property is required.

EXCEPTION 2: If the subject property is abutting a parcel which is zoned other than "Commercial" or "Industrial," the luminaire shall be setback three times the mounting height of the luminaire, measured from the abutting parcel's side yard setback. (Any variance, adjustment, of exception to the abutting parcel's side yard setback shall not be considered in the distance calculation.)

EXCEPTION 3: If the luminaire is used for the purpose of street, parking lot or public utility easement illumination purposes and is located less than 3 mounting heights from the property line, the luminaire shall employ a house side shield (opposite the direction of any public right-of-way nearest the luminaire)

EXCEPTION 4: If the subject property includes an exterior column, wall or abutment within 25 feet of the property line, a luminaire partly shielded or better and not exceeding 60 lamp watts may be mounted onto the building façade or under or within an overhang or canopy attached thereto.

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4. Special Permit for Specific Lighting Fixtures and Systems, Portable Installations and When Exceeding Lighting Requirements.

Upon special permit issued by the (Authority), lighting systems not complying with the technical requirements of this ordinance may be installed, maintained, and replaced for lighting that exceeds the maximums permitted by this Code, e.g., Aerial Lasers, Searchlights, Sports lighting systems (including but not limited to, sport fields and stadiums, such as baseball field and football field lighting, tennis court lighting, and swimming pool area lighting), other very intense lighting defined as having a light source exceeding 200,000 lumens or an intensity in any direction of more than 2,000,000 candelas, construction lighting for public infrastructure and similar projects, emergency construction project that require construction at night, bridges, building façade lighting to light portions of buildings over two stories high, and public monuments.

To obtain such a permit, applicants shall demonstrate that the proposed lighting installation:

a. Has received every reasonable effort to mitigate obtrusive light and artificial sky glow, supported by a signed statement from a registered civil or electrical engineer describing the mitigation measures. Such statement shall be accompanied by calculations indicating the light trespass levels (horizontal and vertical at ground level) at the property line.

b. The (Authority) shall review each such application. A permit may be granted if, upon review, the (Authority) finds that the proposed lighting will not create excessive glare, sky glow, or light trespass beyond that which can be reasonably expected by application of best lighting practices, available technology. The (Authority) may impose conditions of approval to mitigate any negative impacts resulting to the abutting parcel, based on best lighting practices and available lighting technology. The (Authority) may charge a review fee and may, at the (Authority)'s option, employ the services of a qualified professional civil or electrical engineer to review such submittals, and the cost thereof shall be an additional fee charged to the applicant.

c. A portable sign may be permitted for a period not to exceed three (3) weeks total in any six (6) month period. The user shall notify the (Authority) of how long the portable sign is to be utilized and when it will be removed.

TABLE 1

MAXIMUM WATTAGE AND REQUIRED SHIELDING

Lighting Zone	Fully Shielded	Shielded	Partly Shielded	Unshielded
LZ 2	100	35	39	Low voltage landscape lighting 50 watts or less
LZ 3	250	100	70	Landscape and façade lighting 100 watts or less; ornamental lighting on private streets of 39 watts and less

TABLE 2
MAXIMUM LIGHTING MOUNTING HEIGHT IN FEET

Lighting Zone	Lighting for Private Roads, Driveways, Parking, Bus Stops and other Transit Facilities	Lighting for Walkways, Bikeways, Plazas and other Pedestrian Areas	All Other Lighting
LZ 2	40	18	8
LZ 3	40	18	16

Lighting mounted onto buildings or other structures shall not exceed a mounting height greater than 4 feet higher than the tallest part of the building or structure at the place where the lighting is installed, nor higher than 33.33 percent of the horizontal distance of the light from the nearest property line, whichever is less.

TABLE 3
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS

	LZ 2	LZ 3
Allowed Backlight Rating		
>2 mounting heights from property line	B2	B3
1 to 2 mounting heights from property line and properly oriented*	B2	B3
0.5 to 1 mounting height to property line and properly oriented*	B1	B2
<0.5 mounting height to property line adjacent to a street and properly oriented*	B1	B2
<0.5 mounting height to property line and properly oriented*	B0	B1
Allowed Uplight Rating	U2	U3
Allowed Glare Rating	G2	G3

*A luminaire may be used if it is rated as follows according to the Lighting Zone of the site. If the luminaire is installed in other than the intended manner, the rating shall be determined to account for the actual photometric geometry. Luminaires equipped with adjustable mounting devices permitting alteration of luminaire aiming in the field shall not be permitted.*LED Signs

5. LED signs are allowed with the following standards:

    a. The maximum brightness of electronic signs shall not exceed 5,000 nits (candelas per square meter) during daylight hours, or of 500 nits (candelas per square meter) between dusk to dawn. The sign must have an automatic dimmer control which produces a distinct illumination change from a higher allowed illumination level to a lower allowed level for the time period between one half hour before sunset and one half hour after sunrise.

    b. Any image or message or portion thereof displayed on the sign shall have a minimum duration of fifteen seconds and shall be static display.

    c. LED signs are prohibited within the Accident Potential Zones and approach/departure zones of Campbell Army Airfield and Sabre Army Heliport.

6. Street Lighting.

    a. Luminaires shall be fully shielded.

    b. Luminaires shall employ internal house side shields unless located in plan at least 3 mounting heights from the any building, structure, or site upon which a building or structure may legally be located within 3 mounting heights of any luminaire.

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Additional Provisions: intended to regulate the luminescence of street lighting applications

c. Street lighting installations shall achieve criterion values listed in Table 4.

   Exception: Federal or State requirements that require a higher illumination value than required by this Code.

d. Unless otherwise approved by the (Authority) street lighting systems shall be designed using the IESNA "Classical" horizontal footcandle method per IESNA/ANSI RP-8-01, and as described below.

e. The applicant shall submit to (Authority) for approval point-by-point calculations assuming 65 percent light loss factor for metal halide and LED and 80 percent for high pressure sodium, tungsten, fluorescent and induction lamp sources. Submitted street lighting plans shall indicate luminaire types and locations and provide isocandle plots including statistical summaries of roadway lighting.

TABLE 4

STANDARD CRITERIA FOR STREET AND ROADWAY LIGHTING
(footcandles – fc)

	LZ 2	LZ 3
Local streets	Intersections only*	
Avg: Light Level		0.4 fc
Avg: Min Uniformity	0.3 fc	6:1
Max: Min Uniformity	6:1	40:1
	40:1	
Neighborhood Collectors	Intersections only*	
Avg: Light Level		0.6 fc
Avg: Min Uniformity	0.4 fc	4:1
Max: Min Uniformity	4:1	20:1
	20:1	
Major Collector / Minor Arterial		
Avg: Light Level	0.4 fc	0.6 fc
Avg: Min Uniformity	4:1	4:1
Max: Min Uniformity	20:1	20:1
Major Arterials		
	1.0 fc	1.5 fc
Avg: Light Level	4:1	3:1
Avg: Min Uniformity	20:1	10:1
Max: Min Uniformity		

** Luminaires only within 150 feet of the centerpoint of an intersection. Intersections may include significant driveways or site roads as permitted by the Authority.*

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xx.7 Non-Conforming Uses.

Outdoor lighting fixtures lawfully existing prior to the adoption of this Ordinance that do not conform to the provisions of this Ordinance shall be deemed to be a lawful nonconforming use and may remain.

5. New or Changed Uses, New Structures, Major Additions or Modifications.

a. New Uses or Structures, or Change of Use. Whenever there is a new use or upon a property or the use on the property is changed after [effective date of this Ordinance], all outdoor

lighting on the property shall be brought into compliance with this Code before the new or changed use commences.

b. Major Additions. If a major addition occurs on a property, the entire property shall comply with the requirements of this Code. For purposes of this section, the following are considered to be major additions:

c. Additions of 25 percent or more in terms of additional dwelling units, gross floor area, seating capacity, or parking spaces, either with a single addition or with cumulative additions after [effective date of this Ordinance].

d. Single or cumulative additions, modification or replacement of 25 percent or more to installed outdoor lighting luminares existing as of [effective date of this Ordinance].

6. Minor Modifications, Additions, or New Lighting Fixtures for Non-residential and Multiple Dwellings

a. For non-residential and multiple dwellings, all additions, modifications, or replacement of less than 25% of outdoor lighting fixtures existing as of [effective date of this Ordinance] shall require the submission of a complete inventory and site plan detailing all existing and any proposed new outdoor lighting.

b. Any new lighting on the site shall meet the requirements of this Code.

7. Resumption of Use after Abandonment.

If a property or use with non-conforming lighting is abandoned for a period of six months or more, then all outdoor lighting shall be brought into compliance with this Code before any further use of the property occurs.

8. Repair of Existing Lighting.

When existing lighting equipment requires any repairs other than relamping, it shall be modified so as to comply with the shielding requirements of this Ordinance.

xx.8 Submittal Requirements

The owner or owners of a tract of land within the lighting review area shall submit to the Authority Planning Office a site plan for the development and use of such tract meeting the requirements set forth in Authority Zoning Ordinance. Subdivisions shall comply with the Authority Subdivision Guidelines.

2. A lighting plan shall be included as part of the required site plan submittal or subdivision construction drawings which shall contain but not be limited to the following:

a. The location of the site where the outdoor light fixtures will be installed;

b. Plans indicating the location on the premises of each outdoor light fixture, both proposed and any already existing on the site, and the types of outdoor light fixtures;

c. A description of the outdoor light fixtures including but not limited to manufacturer's catalog cuts and drawings;

d. If any subdivision proposes to have installed street or other common or public area outdoor lighting, a lighting plan shall also be submitted for all such lighting.

e. For any property that contains restrictive avigational easements owned by the United States of America, the owner or owners shall also submit a copy of the lighting plan to Fort Campbell, or its agent, and obtain their written approval before any building permits shall be issued by the Authority.

Sample Lighting Nuisance Ordinance

PUBLIC NUISANCES

LIGHTING STANDARDS.

Purpose. The purpose of this section is to protect the health, safety and welfare of the public by encouraging lighting practices and systems that will minimize glare, light trespass, and light pollution, while maintaining nighttime safety, utility, security and productivity, curtailing the degradation of the nighttime visual environment, and minimizing the impact of lighting on night aircraft operations.

Applicability.

New Uses, Buildings and Major Additions or Modifications. For all proposed new land uses, developments, buildings, and structures that require a building permit or other authorization from the County, all outdoor lighting fixtures shall meet the requirements of this Ordinance. All building additions or modifications of twenty (25) percent or more in terms of additional dwelling units, gross floor area, or parking spaces, either with a single addition or with cumulative additions subsequent to the effective date of this provision, shall be subject to the requirements of this Ordinance for the entire property, including previously installed and any new outdoor lighting.

Existing Uses. Existing uses shall be exempted from the provisions of this Ordinance. Existing uses and lighting which substantially deviate from the Purpose and Intent set forth above, and which are brought to the attention of the Town Board by an aggrieved party, may constitute a public nuisance under Sec. X-X, and subject to abatement or other relief.

Resumption of Use after Abandonment. If a property or use with non-conforming lighting is abandoned as defined below, then all outdoor lighting shall be reviewed and brought into compliance with this Ordinance before any use is resumed.

Roadways. Lighting for public roadways is exempt from the provisions of this Ordinance.

Definitions.
As used in this Ordinance unless the context clearly indicates otherwise, certain words and phrases shall mean the following:

(1) Development project. Any residential, commercial, industrial or mixed use subdivision plan of development plan which is submitted to the County for approval.

(2) Diffuse. To spread or scatter widely, or thinly.

(3) Direct illumination. Illumination resulting from light emitted directly from a lamp or luminaire, not light diffused through translucent signs or reflected from other surfaces such as the ground or building surfaces.

(4) Fully Shielded Light Fixture. A lighting fixture constructed in such a manner that all light emitted by the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the luminaire, is projected below the horizontal as determined by a photometric test or certified by the manufacturer. Any structural part of the light fixture providing this shielding must be permanently affixed.

(5) Glare. The sensation produced by a bright source within the visual field that is sufficiently brighter than the level to which the eyes have adapted to cause annoyance, discomfort, or loss in visual performance and visibility. The magnitude of glare depends on such factors as the size, position, brightness of the source, and on the brightness level to which the eyes have become adapted.

(6) Installed. The attachment, or assembly fixed in place, whether or not connected to a power source, of any outdoor light fixture.

(7) Light Pollution. Any adverse effect of manmade light.

(8) Light Trespass. Light from an outdoor luminaire falling on an adjacent property as observed at four feet above ground at the property line.

(9) Lumen per Acre Cap. The upper limit, or most light allowed. Lower lighting levels are encouraged.

(10) Luminaire. The complete lighting assembly, less the support assembly.

(11) Outdoor Light Fixture. An outdoor illuminating device, outdoor lighting or reflective surface, lamp or similar device, permanently installed or portable, used for illumination or advertisement. Such devices shall include, but are not limited to lights used for:

- Parking lot lighting;
- Buildings and structures;
- Recreational areas;
- Landscape lighting;
- Billboards and other signs (advertising or other);
- Product display area lighting;
- Illuminating building overhangs and open canopies.

(12) Outdoor Recreation Facility. An area designed for active recreation, whether publicly or privately owned, including, but not limited to, baseball diamonds, soccer and football fields, golf courses, tennis courts and swimming pools.

(13) Person. Any individual, tenant, lessee, owner, or any commercial entity including but not limited to firm, business, partnership, joint venture, corporation, or limited liability company.

(14) Sign, Externally Illuminated. A sign illuminated by light sources from outside the sign surface.

(15) Sign, Internally Illuminated. A sign illuminated by light sources enclosed entirely within the sign cabinet and not directly visible from outside the sign.

(16) Sign, LED. A sign that uses light-emitting diodes that emit light when an electrical current is applied in the forward direction of the device

(17) Sign, Neon. A sign including luminous gas-filled tubes formed into text, symbols or decorative elements and directly visible from the outside of the sign cabinet.

(18) Sky Glow. The brightening of the night sky that results from the scattering of artificial visible radiation by the constituents of the atmosphere.

(19) Temporary Lighting. Lighting which does not conform to the provisions of this Ordinance and which will not be used for more than one consecutive thirty day period within a calendar year, with one consecutive thirty-day extension. Temporary lighting is intended for uses which by their nature are of a limited duration; for example holiday lighting decorations, civic events, or construction projects.

(20) Translucent. Permitting light to pass through but diffusing it so that persons, objects, etc., on the opposite side are not clearly visible.

(21) Use, Abandonment of. The relinquishment of a property, or the cessation of a use or activity by the owner or tenant for a continuous period of twelve months, excluding temporary or short term interruptions for the purpose of remodeling, maintaining or rearranging a facility. A use shall be deemed abandoned when such use is suspended as evidenced by the cessation of activities or conditions which constitute the principal use of the property.

Shielding and Outdoor Lighting Standards.
The following lighting standards are hereby imposed:

(1) All nonexempt outdoor lighting fixtures shall be fully shielded.

(2) All nonexempt outdoor lighting fixtures shall be placed so as to not cause light trespass, or light glare.

(3) All nonexempt outdoor lighting fixtures shall be of a type and placed so as to not allow any light above the horizontal, as measured at the luminaire.

(4) All light fixtures that are required to be shielded shall be installed and maintained in such a manner that the shielding is effective.

(5) Residential uses shall not exceed 5500 lumens per acre. Commercial or business zoned uses shall not exceed 70,000 lumens per property.

(f) Outdoor Advertising Signs.
External illumination for signs shall conform to all provisions of this Ordinance. All upward directed lighting is prohibited.

Exemptions.

1. Single-family and two-family dwelling uses
2. Agricultural uses

3. State and Federal Facilities
4. Emergency Lighting
5. Swimming Pool and Fountain Lighting
6. Flags, Lighted
7. Holiday lighting

Appeals.
Any person substantially aggrieved by any decision of the designated official made in administration of this Ordinance has the right and responsibilities of appeal to the County Board.

Law Governing Conflicts.
Where any provision of federal, state, county, township, or city statutes, codes, or laws conflict with any provision of this Ordinance, the more restrictive shall govern unless otherwise regulated by law.

Violation and Penalty.
It shall be a civil infraction for any person to violate any of the provisions of this Ordinance. Each and every day or night during which the violation continues shall constitute a separate offense. A fine shall be imposed of not less than fifty dollars nor more than seven hundred dollars for any individual or not less than 100 dollars nor more than ten thousand dollars for any corporation, association, or other legal entity for each offense. The imposition of a fine under this Ordinance shall not be suspended.

Severability.
If any of the provisions of this Ordinance or the application thereof are held invalid, such invalidity shall not affect other provisions or applications of this Ordinance which can be given effect, and to this end, the provisions of this Ordinance are declared to be severable.

Lighting Regulation Narrative

(Adopting Agency or Community Name)
Outdoor Lighting Ordinance

On xxx, the (adopting agency) passed into law a new, state of the art lighting ordinance. Its goals are to permit all necessary and reasonable uses of outdoor lighting, while reducing wasted energy and light pollution. A key consideration is preserving the nighttime visual environment for Night Vision Device training activity at Campbell Army Airfield and Sabre Army Heliport.

The law applies to all new outdoor lighting, including new lighting, replacement lighting and additions to new lighting. Single-family houses and two-family dwelling units are among the exempted uses. The ordinance only governs lighting applications within the established Night Vision Device Influence Area in proximity to Fort Campbell and its airfields.

Basic Principles
Light pollution is a broad term describing the undesirable side effects of outdoor lighting. The most negative effects of outdoor lighting include:

- *Artificial sky glow*, the illumination of clouds and airborne particles, causing the sky to glow and preventing astronomy and star gazing;
- *Light trespass*, the unwanted illumination caused by light from neighboring properties.
- *Glare,* when lighting causes discomfort or visual disability
- *Circadian Interruption,* when lighting causes unwanted changes in the circadian cycles of living organisms
- Other impacts to flora and fauna, particularly those causing changes in habitat or behavior

Most light pollution is the result of carelessly applied lighting. This Ordinance helps prevent most light pollution by limiting the wattage of lighting that can be used, by requiring most lighting to be shielded, and requiring lighting to be installed thoughtfully with respect to mounting height, setback, and in some critical cases, additional shielding. In addition, while the Ordinance does not absolutely prohibit incandescent lighting, preference is given for energy efficient lighting, and for most installations, the use of energy efficient sources is strongly urged.

Demonstrating Compliance with the Ordinance

Lighting for Homes Multi-family buildings with common areas such as parking garages or lots will be treated as commercial buildings for purposes of lighting standards.

Private Non-Residential Uses The Ordinance governs all new lighting as well as replacement lighting and expansions of existing lighting systems. The law is strict; even if a

luminaire is broken, it must be replaced with a complying luminaire. For new installations including major additions and alterations, lighting plans including schedules and cutsheets must be supplied complete with calculations showing compliance. Lighting plans with fixture schedules and calculations must be submitted for approval, along with compliance documentation forms (*compliance documentation forms can be downloaded from the _____ website*).

Special Permit Applications Some lighting systems, such as sports lighting or searchlights, cannot comply with the Ordinance. A special permit will be required. Applicants may be required to submit detailed calculations and to pay for an independent engineering review.

Street Lighting Applications In addition to demonstrating compliance with the Ordinance's power and shielding requirements, plans for street lighting systems must be submitted using point-by-point calculations to demonstrate compliance with street lighting criteria contained in the Ordinance.

Multi-Family Residential Lighting Requirements
In general, lighting for homes must be:

- Limited to 40 watts per luminaire (light fixture) and designed so that the lamp (light bulb) can't be seen from a neighboring property. Examples of appropriate luminaires are posted on the (fill in) website. Also check the International Dark Sky Association website (www.darksky.org) for appropriate luminaires. Luminaires don't have to be fully shielded, but they must hide the lamp sufficiently to prevent glare and obtrusive light onto adjacent properties
- *Energy Star* rated, which generally means uses compact fluorescent lamp(s).
- Mounted at or lower than the eave line, or 12 feet above the ground, whichever is *lower*.

A fully shielded wall lantern

There are three *exceptions*.

- You can use PAR-lamp directional luminaires with halogen PAR lamps up to 100 watts. But they must be aimed away from neighboring properties. These fixtures are commonly used for residential security lighting.
- You can use fully shielded luminaires up to 100 watts, and they can be mounted up to 25' feet above grade as long as they are at least 3 times the mounting height away from the property line. These fixtures are generally used for dusk-to-dawn area lighting, especially for rural and agricultural sites.
- You can install low voltage landscape lighting, except in lighting zone 0 and 1A.

A fully shielded dusk to dawn luminaire

Non-Residential Lighting Requirements
Most community complaints about lighting involve commercial or industrial sites. Poorly designed and/or wasteful lighting causes off-site glare and detracts from the night time beauty of the community. For this reason, all new and replacement lighting from now on must meet the following rules:

Lighting Zones
For lighting, the Night Vision Device Influence Area is divided into two zones. A current map of the lighting zones is available from the (fill in) website. Zones are set by the (Authority).

Lighting Zone	**Condition**	**Typical Parts of the (Area)**
LZ2	Areas where man-made lighting is used in modest amounts for safety, security and traditional uses	Urban neighborhoods and most commercial districts
LZ3	Areas where man-made lighting is an important aspect of a district of night activity, or where security or safety are especially important	Central Business District

Mounting Height
The mounting height of luminaires is limited according to Table 1 below. If luminaires are mounted to poles, the pole height may be taller as long as the highest part of the luminaire's optics is mounted at or below the appropriate value from the table below. These mounting height limits apply whether the luminaire is mounted to a pole, building or other structure and is measured relative to the grade directly below the luminaire. If there are excessive changes in grade on the site, be sure to adjust the design to prevent off site impacts for lower adjacent properties.

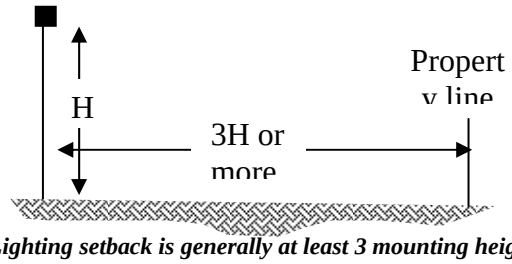
Table 1
MAXIMUM LIGHTING MOUNTING HEIGHT IN FEET

Lighting Zone	Lighting for Private Roads, Driveways, Parking, Bus Stops and other Transit Facilities	Lighting for Walkways, Bikeways, Plazas and other Pedestrian Areas	All Other Lighting
LZ 0	20	8	4
LZ 1	25	12	4
LZ 2	40	18	8
LZ 3	40	18	16
LZ 4	Height limit to be determined by Special Use Permit Only		

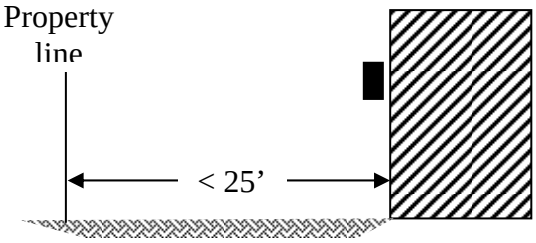
The Prescriptive Method
This method requires simple hand calculations and installations must follow specific rules, but detailed lighting calculations are not required. This method is recommended for most outdoor lighting installations, especially those undertaken by persons with little or no lighting expertise.

Prescriptive Method Setback Requirements (Note this provision is identified as optional in the Ordinance)
Setback, when combined with other prescriptive requirements, helps minimize off-site impacts. The setback requirements are fairly simple:

- As a general rule, luminaires must be at least 3 times their mounting height from the property line.
- If your property abuts a property zoned "industrial", then luminaires can be mounted anywhere on your property relative to that property line.
- If your property abuts a property zoned other than industrial or commercial, then luminaires must be mounted at least 3 times their mounting height from the abutting property's side yard setback line.
- If a luminaire on your property is used for the purpose of street, parking lot or public utility easement illumination purposes, it can be located less than 3



Lighting setback is generally at least 3 mounting heights



A light can be mounted up to 8' high on the wall of a building within 25' of the property line

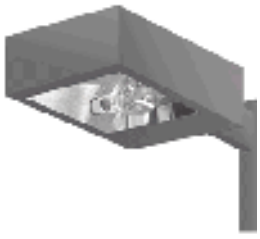
mounting heights from the property line, but it must employ a house side shield and the luminaire must be aimed away from the property line. A house side shield is an internal component available for most suitable luminaires. External shields added after the fact are not permitted.

- If a building or structure is mounted within 25 feet of the property line, then shielded or fully shielded luminaire(s) can be mounted onto the structure at a mounting height not to exceed 8 feet above grade at the foundation. Lighting recessed into a canopy or enclosed by an awning or similar structure can also be used,

Prescriptive Method Luminaire Requirements
In order to prevent luminaires from being too bright and causing glare, the rated wattage is limited according to lighting zone and shielding by Table 2. Better shielding allows more power per luminaire, within the limits for each lighting zone.

Table 2
MAXIMUM WATTAGE AND REQUIRED SHIELDING

Lighting Zone	Fully Shielded	Shielded	Partly Shielded	Unshielded
LZ 2	100	35	39	Low voltage landscape lighting 50 watts or less
LZ 3	250	100	70	Landscape and façade lighting 100 watts or less; ornamental lighting on private streets of 39 watts and less



Fully shielded means that light is not emitted above the horizontal plane, and that the amount of light emitted at high angles is limited.

Shielded means that a small amount of light may be emitted above the horizontal plane, but that the source is still shielded and most of the light is downward.

Partly shielded means that the light source is hidden and that there is a solid top to prevent upward light; but light is radiated sideways as well as downward.

Unshielded means that light is emitted indiscriminately, or is purposely aimed upwards.

Prescriptive Method Total Lighting Limits

The primary cause of light pollution is the *amount* of electric light, as light from even the most shielded light sources bounces up when it hits the ground. For non-residential sites (including multiple residences with common areas) calculate the maximum allowed lighting power as follows:

1. Refer to Table 3.
2. Note which lighting that is EXEMPT. You do not have to include exempt lighting in any way. It is unregulated and you can use as much as you want.
3. With the exception of building entrances, determine the allowed lighting power for each application by multiplying the area in plan by the allowed lighting power density for the lighting zone of the property. Only one lighting power allowance can be claimed for any area.
4. Count up the number of building entrances and multiply by the allowance per entrance.
5. Add all of the values calculated in (3.) and (4.). The actual lighting rated lamp watts must be equal to or less than this sum.

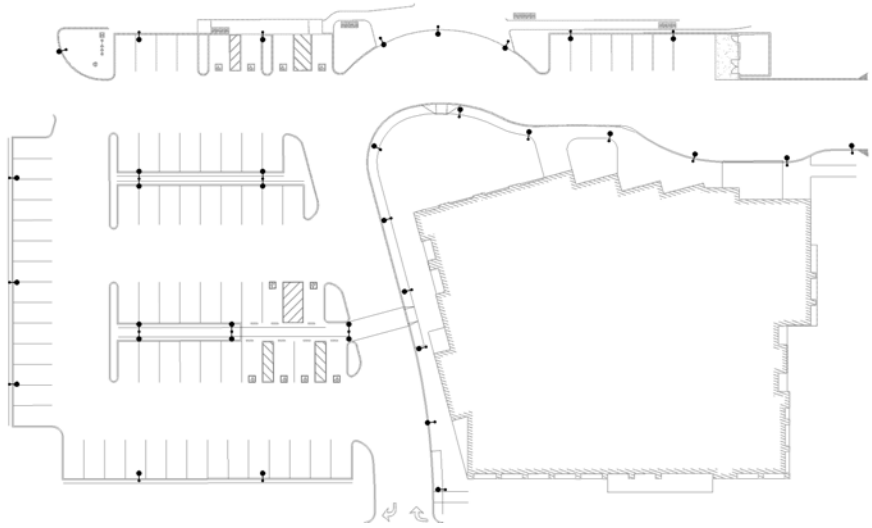
Table 3
ALLOWED LIGHTING POWER
(watts per square foot (w/ft²) unless otherwise noted)

Lighting Application	Allowed Area	LZ 0	LZ 1	LZ 2	LZ 3	**LZ 4**
Hardscape	Watts per square foot of paved or improved area	0.04	0.06	0.08	0.1	**0.2**
Building entrances	Per Door (stated values are watts, not watts per square foot).	13	18	26	32	**70**
Building entry, drive-up sales, and general use canopies	Drip line area under canopy.	0	0.1	0.2	0.4	**0.7**
Vehicle Service Station Canopy	Drip line area under canopy	0	0.30	0.60	1.2	**2.4**
Outdoor Sales, Service or Industrial Lot	Portion of uncovered hardscape used exclusively for display of vehicles or other merchandise for sale, for the service of vehicles, aircraft or watercraft, or for exterior manufacturing.	0	0.25	0.45	0.9	**1.8**
Ornamental Lighting	Entire site	0	0	0.01	0.02	**0.04**
Landscape Lighting	Landscaped area	Exempt	Exempt	Exempt	Exempt	**Exempt**
Building Façade Lighting	Non-Residential and Multiple Dwelling	Exempt	Exempt	Exempt	Exempt	**Exempt**
ATM Security Lighting	Within 5 feet of ATM facility	Exempt	Exempt	Exempt	Exempt	**Exempt**
Flagpole lighting	**Illuminating flags on flagpole**	**Exempt**	**Exempt**	**Exempt**	**Exempt**	**Exempt**

Example
An office building in LZ3 has a parking lot, driveways and sidewalks with two main entrances (4 doors each), a loading dock with door and two emergency exits.
Using AutoCAD, the paved area is 48,000 square feet.

The allowed power is
48,000 sf x .1 w/sf = 4,800 watts
11 x 32 = 352 watts
Total Allowed = 5,152 watts

The design has (35) 100 watt pole lights and (16) 26 watt wall lights. The design is 3,916 and meets the ordinance.
Exempt Lighting and Street Lighting
Most lighting can be designed and implemented within the explicit terms of the Ordinance. But there are a few special cases that can't, and need to be addressed in special ways.



Exempt Lighting
The following lighting systems are generally not regulated. However, if they are used in lieu of regulated lighting to circumvent the ordinance, there may be ramifications:

a. Interior lighting.
b. Temporary lighting for theatrical, television, and performance areas.
c. Lighting in swimming pools and other water features governed by Article 680 of the National Electrical Code.
d. Code required exit signs.
e. Lighting specifically for stairs and ramps.

f. Temporary and seasonal lighting provided that individual lamps are 10 watts or less.
g. Lighting required and regulated by the Federal Aviation Administration, U.S. Coast Guard or other federal or state agency.

In addition, sign lighting is not regulated in this section, but it regulated under the Sign Ordinance.

Street Lighting
Developers are generally responsible for installing street lighting before turning streets over to the (authority). New Street Lighting systems are required to meet the requirements of the Ordinance. In general:

- In Lighting Zone 2 and above, lighting is provided for all streets and roads

Lighting levels in all applications must meet requirements contained in Table 3 of the Ordinance. Note that these lighting levels are much lower than many current installations, and will require lower wattage lamps than in the past. In addition, fully shielded luminaires are required with internal house side shielding in most situations.

The BUG System

BUG stands for "Backlight", "Uplight" and "Glare." The acronym describes the types of stray light escaping from an outdoor lighting luminaire. "B" stands for backlight, or the light directed in back of the mounting pole. "U" stands for uplight, or the light directed above the horizontal plane of the luminaire, and "G" stands for glare, or the amount of light emitted from the luminaire at angles known to cause glare. These additional measurements provide a much more accurate picture of lumen distribution and the overall efficiency of a luminaire.

It is expected that BUG values will be published by luminaire manufacturers so lighting specifiers, designers or purchasers can tell at a glance how well a certain luminaire controls stray light or compares with other luminaires under consideration for an installation.

The BUG system was developed by the Illuminating Engineering Society (IES) to make comparing and evaluating outdoor luminaires fast, easy and more complete than older systems.

This system divides the sphere around a luminaire into zones assigning values according to expected environmental impact. This rating system offers the most complete evaluation of the total light emitted from luminaires to date.

Refer to Table 4 for maximum allowable backlight, uplight and glare (BUG) ratings.

Backlight, which creates light trespass onto adjacent sites. The B rating takes into account the amount of light in the BL, BM, BH and BVH zones, which are direction of the luminaire OPPOSITE from the area intended to be lighted.

Uplight, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects professional and academic astronomy. Upper uplight (UH) is mostly energy waste. The U rating accounts the amount of light into the upper hemisphere with greater concern for the lower uplight angles in UL.

Glare, which can be annoying or visually disabling. The G rating takes into account the amount of frontlight in the FH and FVH zones as well as BH and BVH zones.

TABLE 4
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS

	LZ 2	LZ 3
Allowed Backlight Rating		
>2 mounting heights from property line	B2	B3
1 to 2 mounting heights from property line and properly oriented*	B2	B3
0.5 to 1 mounting height to property line and properly oriented*	B1	B2
<0.5 mounting height to property line adjacent to a street and properly oriented*	B1	B2
<0.5 mounting height to property line and properly oriented*	B0	B1
Allowed Uplight Rating	U2	U3
Allowed Glare Rating	G2	G3

Sample Lighting Applications

Sample Compliant Lighting Applications for the Night Vision Device Influence Area
Gas Stations

In lighting a gas station, there are three main areas to be considered; lighting under the pump canopy, lighting around the convenience store or office, and lighting for the apron areas including drives, parking and service areas that aren't under the canopy, such as air or water stations. For lighting under the canopy, the most basic design is a grid of metal halide downlights. Use flat lens fixtures, evenly spaced, with the maximum allowed "fully shielded" lamp watts. Employ 2 luminaires per car to meet IESNA recommended light levels, but fewer fixtures may be considered for conservation purposes. Apron lighting should be performed using fully shielded pole luminaires, with the mounting height generally 20 feet or less. Lighting "in" from the perimeter is normally used to keep poles away from the drive areas. Using the maximum lamp watts allowed for fully shielded luminaires, lay-out type III distribution luminaires with a least 300-500 square feet of apron (not under canopy) per fixture.

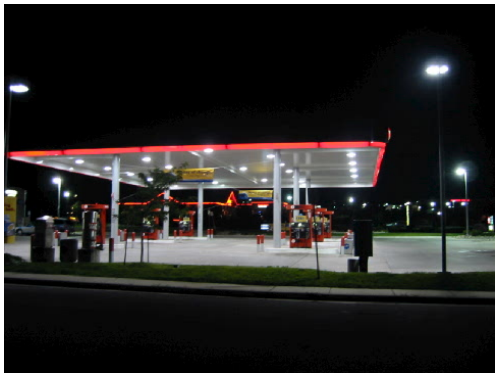


Figure 1 -(*Left*) Gas station with fully shielded lighting and (*right*) with ordinary drop lens lighting. The reduced glare and light pollution of fully shielded lighting is required by the Ordinance (*Benya Lighting Design*)

Note: because recommended light levels for service areas are much higher than for ordinary parking, it may be necessary to put two or more fixtures on each pole to reduce the number of poles.

Figure 2 - detail of fully shielded canopy lighting (*Monrad Engineering, Inc.*)

Lighting for the building needs to be coordinated with lighting for the apron. In general, the apron lighting will meet the safety and security needs of the building, so additional lighting will generally be limited to a compact fluorescent fixture at each door. Special lighting should be provided for ATMs on site.

Figure 3 – Sample Canopy Design

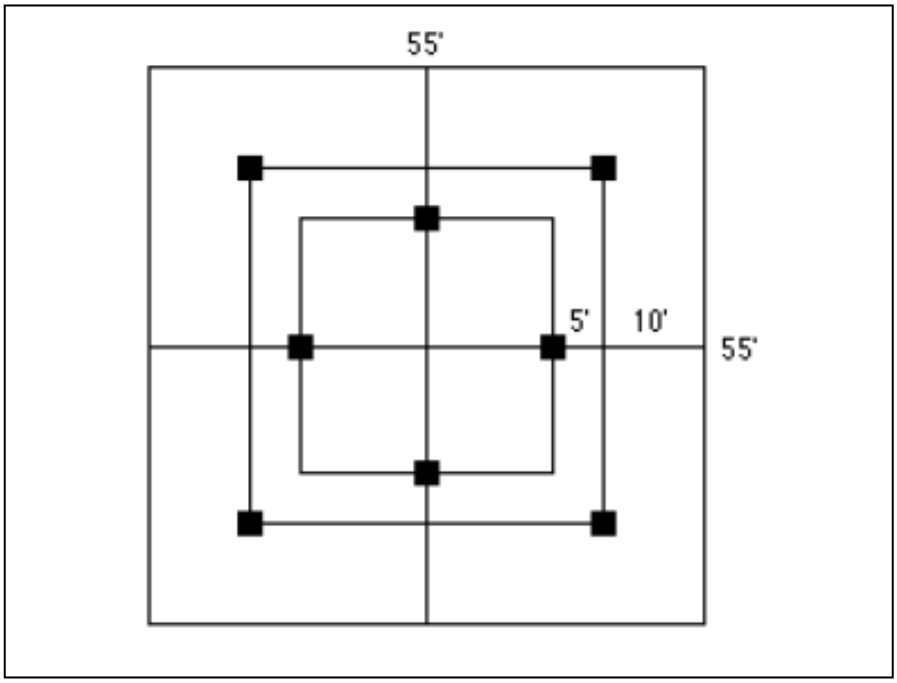


Figure 4 - Every Other Row Option Parking Lot with Fully Shielded Luminaires (*Monrad Engineering, Inc.***)**

Large area - pole mounted

To light a large area such as a parking lot, there are two very important "rules of thumb" design options:

- **All Rows Option** Luminaires atop 17-20 foot poles must be mounted at every bumper line (about 65-70 feet across) and 50-80 feet on center. Single-headed luminaires should be used around the edge of the lot with double-headed luminaires in the center. Employ flat lens fixtures with type III distribution and use the maximum allowed lamp watts.

- **Every Other Row Option** Luminaires atop 35 foot poles should be mounted at every other bumper line (about 120-130 feet) and 80-100 feet on center. Employ 2 luminaires per pole at the edge and use four luminaires per pole in the center. Employ flat lens fixtures with type III distribution and use the maximum allowed lamp watts.

High pressure sodium lamps produce more lumens per watt than metal halide, and have better lumen maintenance. However, metal halide lamps have superior color and appear brighter. Choose between these lamps depending on project conditions.

Decorative Lighting

Figure 3 - Fully shielded high performance decorative lighting. *Top,* **flat lens wall lanterns (Lumec);** *Bottom*, **post luminaire (GE)**

Lanterns, sconces and other types of luminaires are often mounted on buildings to light doorway areas as well as to reinforce an architectural style. In other cases, traditionally styled globes and "acorns" are mounted atop poles or posts. Unfortunately, most traditional luminaires are unshielded and create a great deal of glare and light pollution. The Ordinance restrictions permit traditional luminaires but depending on shielding, the lamp watts are often very restricted. For this reason, it's probably best to avoid using unshielded or semi shielded decorative lighting, especially for area lighting on posts or poles.

If decorative lighting is very important to the design, investigate the new generation of fully shielded decorative lighting. The lamp is hidden in the top of the luminaire and casts light downward, but the shape of the luminaire is still traditional. There are a number of styles and periods available, making good lighting for these projects possible while maintaining a traditional or historic daytime appearance. Using pole lights of this type, follow the design suggestions for street lights or parking lots.

Source: Architectural Area Lighting

Figure 4 - Anatomy of a high performance decorative "fully shielded" luminaire

Externally lighted billboards and signs

To minimize impacts to the environment, it is necessary to light billboards and signs "top down" with full shielding. Good results can be obtained with either linear fluorescent or several HID luminaires designed with the special wide throw needed for signs. Most manufacturers provide good information on how to use their products. However, maximum lamp watts are regulated, which will tend to favor fluorescent systems in Zones 1 and 2.

Figure 5 - Several luminaires for top lighting of building signs

Figure 6 - Top Mounted, fully shielded sign luminaires. Note shielding in the direction of the viewer is critical as well as shielding for potential spill light over the top of the sign (*Monrad Engineering Inc.*)

Sports Lighting

Sports lighting causes such significant light pollution that extra care must be taken in designing, installing, aiming and maintaining sports lighting systems. Sports lighting should use the tallest practical poles and luminaires should be aimed mostly downward. Because high light levels must be used even in the most sensitive lighting zones, there are no lamp wattage limits, and most systems will use metal halide lamps up to 2000 watts. Instead, the use of sports lighting will be limited to sports applications, and hours will be strictly limited.

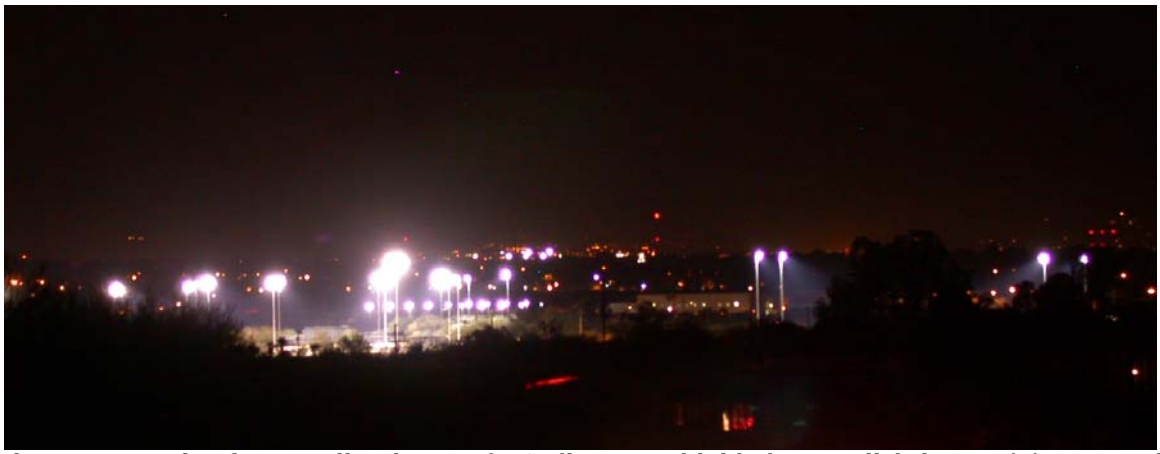


Figure 7 - A Tale of Two Ballparks. *Left* **Ordinary unshielded sports lighting** *Right* **State of the art sports lighting (***Monrad Engineering, Inc.***)**

In addition, designers should seek modern sports systems with sophisticated shielding and avoid low cost systems that tend to be extremely glaring. A simple top shield does not do much. A new generation of extremely well shielded sports products is now available, and to meet the intent of the Ordinance, their use is required.

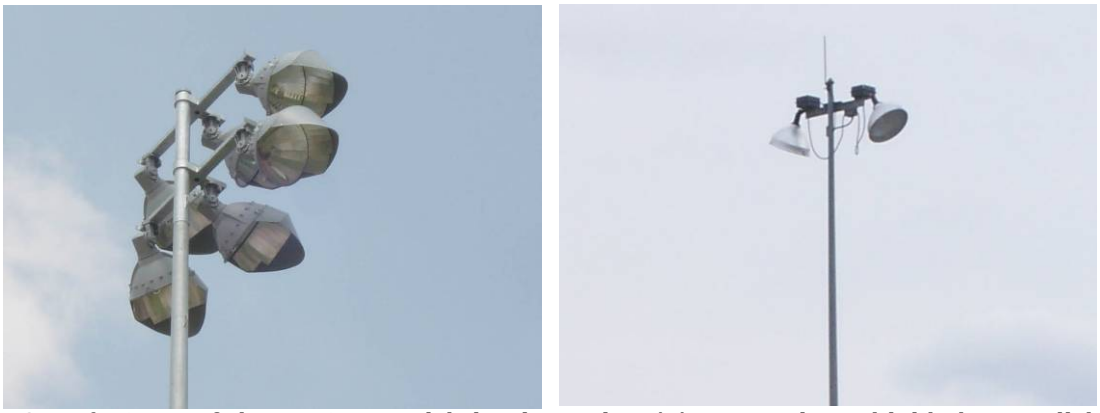


Figure 8 -*Left* **State of the Art Sports Lighting (Musco)** *Right* **generic unshielded sports lighting (***Musco and Benya Lighting Design***)**

Roadway/Highway

Figure 9 - Street and Roadway lighting systems (*Monrad Engineering, Inc. and AAL***)**

The largest cause of light pollution is roadway lighting. Even if the light is properly shielded, the light reflected by pavement and cars is significant. So as a preliminary consideration, always ask the question whether lighting is really required. There are many streets and roads that don't require lighting; there are others that require lighting at intersections but not continuously. The Ordinance includes regulations for new developments and streets, including "when to light" and appropriate light levels.

It is common for municipalities and utility companies to have "standard" lighting systems and performance requirements. Many of these employ improperly shielded lighting and/or overly high wattage lighting. These standards should be revised as quickly as possible to meet the Ordinance. For existing street lighting, there is huge potential to reduce overall light pollution by changing existing systems to conform with the Ordinance, especially if light level and watts are reduced.

Note that street light design using "full cut off" luminaires is required by the Ordinance. For maximum energy efficiency and minimum maintenance, high pressure sodium lighting is generally preferred. Pole height is not restricted, but as a general rule street lights should be between 20 and 35 feet above grade. Poles are generally mounted 5-6 mounting heights apart along the roadway.

For reasons of cost and maintenance, the most common street lights are "cobra head" style, and both traditional and upscale designs are available in fully shielded flat lens types. For downtown streets and historic districts, consider using decorative fully shielded luminaires as their performance is similar.

Landscape and Façade Lighting

The ordinance treats theses two types of lighting similarly. Both generally are mounted on the ground and light upwards, an obvious concern for controlling light pollution. Neither façade lighting nor landscape lighting are permitted in lighting zones LZ0 and LZ1a, but in all other zones the use of low voltage landscape lighting up to 50 watts is not restricted. For most applications, this is plenty of lighting for trees and landscape features, as well as being affordable and attractive. Also note that path lighting can use fully shielded lights, even though they are not required. High wattage landscape lighting and façade lighting is only permitted in lighting zones 3 and 4, limited to 100 watts in lighting zone 3 and 250 watts in lighting zone 4.

Figure 10- Installations using high wattage floodlights are only allowed in lighting zones 3 and 4. (*Left*) building façade lighting and (*right*) commercial landscape lighting (Kim Lighting)

Figure 11 - Lighting equipment for accent lighting (*left*) above grade PAR (*center*) above grade low voltage MR16 (*right*) high wattage HID (*Hydrel*)

Pedestrian and Walkway Lighting

Like street lighting, there are many situations where no lighting or only occasional lighting is required. As a general rule, first evaluate whether continuous lighting is actually required. Once lighting is determined to be needed, use pole lights or bollards meeting the design conditions. Note that the height of pole lights is limited and for all luminaires, lamp watts are limited by lighting zone and shielding.

Figure 12- Walkway lighting with (*left*) bollards and (*right*) short pole lights (AAL)

The most common choice is often between bollards and short poles (<12'). With current technology, a wide variety of fixture choices are available meeting the Ordinance's "fully shielded" and "shielded" requirements. In lighting zones 3 and 4 it may also be possible to provide some lighting using ornamental, unshielded luminaires, although the watts are restricted.

Lighting for Monuments, Flagpoles, and Public Art

There are a number of special cases where the basic lighting regulations don't work. In the case of poles flying the Flag of the United States, when the Flag flies at night it is to be lighted. Such lighting is not permitted in Lighting Zone 0, but is permitted in all other lighting zones. Because only a small amount of the light actually illuminates the Flag, the amount of power is limited to 40 watts in lighting zone 1A and to 70 watts in zones 1-4. There are other exemptions such as lighting for ATM machines, because lighting for these machines is frequently controlled by banking laws.

Figure 13 - Lighting for Public Art, Monuments, and Statuary is allowed but a special permit is required to ensure that the lighting is designed to mitigate light pollution (*Hydrel*)

Monuments and public art including statuary, bridges and other important community structures are among a number of lighting situations where lighting is needed and can't meet the more stringent requirements for more ordinary projects. For these situations, a formal special permitting process is provided. Applicants must demonstrate that the lighting is appropriate and designed to mitigate light pollution. Communities are encouraged to hire consultants to check the designs for compliance.

Note: a list of lighting manufacturers approved by the International Dark Sky Association in available at **http://www.darksky.org/mc/page.do?sitePageId=56423&orgId=idsa**

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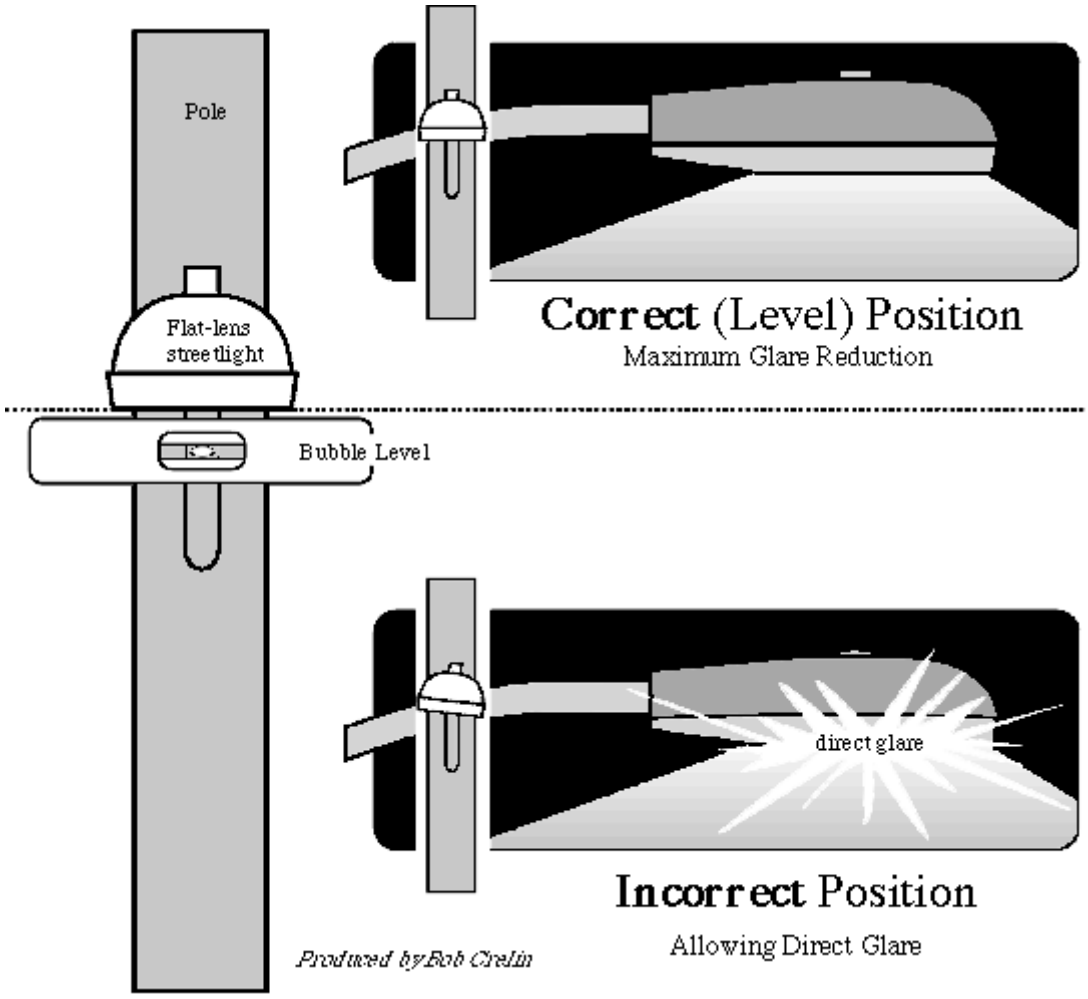
International Dark-Sky Association -- Information Sheet 144

Leveling Flat-Lens Cobrahead Streetlights for Optimum Glare Reduction

One of the most important benefits of the flat-lens, full-cutoff cobrahead streetlight is the reduction of direct glare to drivers, pedestrians, and nearby homeowners. The correct positioning of the flat-lens cobrahead is key to achieving optimum glare reduction and performance. Using a bubble level across the base (glass-lens side) of the fixture and parallel to the roadway during installation (as shown below) will determine the proper position before tightening in place. Even a slight tilt in either direction can cause some unnecessary glare, so achieving a level position for the flat-lens cobrahead is desired.



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International Dark-Sky Association -- Information Sheet 151

A Solution to Canopy Overlighting

Summary

The Flagstaff and Coconino County outdoor lighting codes limit the amount of light, measured in initial raw output lumens, per net acre of development projects. The limits address the issues of excessive outdoor lighting, energy waste, the resulting sky glow from light reflected into the sky, and glare.

Lights used beneath canopies or under roof overhangs have a reduced impact on sky brightening compared to lights mounted on poles, since the canopy or overhang prevents some of the light reflecting off the ground from reaching the sky. Because of this effect, such lighting counts less toward the lumen per acre caps in these codes. Luminaires located on poles or under a canopy and within five feet of the canopy or overhang edge count fully toward the cap; those located between five and ten feet count at one-quarter, and those further than ten feet count at one-tenth (for a discussion of canopy uplight impacts, see IDA Information Sheet 150 , *Uplight Impacts of Canopy Lighting*).

Using these factors, lighting is included toward the lumens per acre caps in approximate proportion to the amount of light they direct into the sky ("uplight"), without requiring an involved analysis for each installation.

Another obtrusive aspect of canopy lighting, not addressed by uplight considerations described above, is the excessive illumination levels that are increasingly seen under service station canopies. Illumination levels exceeding ten and even twenty times the level recommended by professional lighting designers are becoming common. Such overlighting with its attendant glare, besides contributing unnecessarily to the brightening of our night skies and wasting substantial amounts of energy resources, can interfere with the safe use of adjacent property and safe operation of motor vehicles on nearby roadways, particularly for those entering and leaving these areas.

To address this issue, the amount of light permitted under service station canopies is capped at a level consistent with Illuminating Engineering Society of North America (IESNA) recommendations of five and ten footcandles. (See publication IESNA RP-33-99, *Recommended Practice for Lighting for Exterior Environments* , and IDA Information Sheet 152 describing this publication and how to obtain it.) To achieve this goal without requiring planning staff to evaluate lighting designs in detail or measurement of actual average illumination levels, an approach parallel to the overall lumens per acre cap for outdoor lighting in the Flagstaff and Coconino lighting codes is taken. Limits of 40 initial raw lamp output lumens per square foot of canopy lead to initial illuminance of 15 to 20 footcandles (fc), which will dim to about 9-11 fc average when the lamps are old. Half this amount, or 20 initial raw output lumens per square foot of

canopy, will give an average illuminance of about 10 fc initially, dimming to 5 fc.

Calculations for the Model

Illumination under service station canopies has been modeled using a commercially available software package (POINT Version 7, by Lighting Analysts, Inc.) and photometric information for five flat-glass (fully shielded) luminaires appropriate for canopy illumination. The summarized designs assume luminaire heights of fifteen feet, 175 watt metal halide lamps, and the canopy dimensions and luminaire positions shown in Figure 1. Eight 175 watt metal halide lamps, with initial lamp outputs of 15,000 lumens each, give a total lumen budget of 120,000 lumens; for the 55 x 55 foot canopy, this is just under 40 lumens per square foot of canopy. Designs to achieve the lower value of 20 lumens per square foot can be achieved either by using four 175 watt lamps, or by using a design including sixteen 50 watt metal halide lamps with 3450 initial lumens each.

The five luminaires listed in Table 1 were evaluated, and the average initial and end-of-life illuminances and uniformity ratios are shown in Table 2. The two values for the average illuminance reflect the fact that metal halide lamps become dimmer as they age, due principally to deterioration in the lamps and dirt accumulation within the luminaire. A conservative estimate for these effects will bring the lamp intensity at "end of life" to 60% of the initial value, and this figure is used to show the lowest level that should be encountered during the lifetime of the lamps. Uniformity ratios are not affected by this deterioration.

Table 1: Luminaires Analyzed

Manufacturer / Model	Photometric Specification	Table 2 Abbreviation
Huntington-I	Spaulding HTI-M175-FG	HTI
JPL 8 Surface	JPL8-M-2-V-R-C73 Luminaire	JPL8
Luminaire	JPL 9 Surface JPL9-M-7-V-R-C73	JPL9
SCM-175	General Electric SCMM17M0A1GMCS	GE
Pappi MiniSquare	MSQL-MH-208-VR-LG	MSQL

Table 2: Illumination Summary

Luminaire	Ave fc initial	Ave fc end of life	Uniformity Ave/Min
HTI	19	11	4.6
JPL8	18	11	3.9
JPL9	20	12	3.6
GE	18	11	2.8

MSQL	15	9	2.3

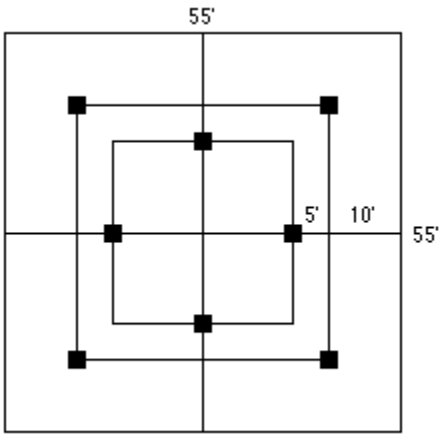

Figure 1: Canopy Design

Written by Christian B. Luginbuhl
U.S. Naval Observatory Flagstaff Station
25 November 1998

Billboards

Some Comments on Billboard Lighting

Billboards are controversial, and some persons would no doubt like to see them all banned. However, others feel that billboards provide a valuable advertising service for small and large businesses and welcome information for the weary traveler. IDA has no organizational policy concerning billboards as long as they do not contribute to light trespass and light pollution. Many billboards are illuminated all night and are ridiculously overlit with bottom-mounted lighting, the major part of which ends up in the sky rather than on the billboard. Billboard and roadway sign lighting can be effective and unobtrusive if it is done in the right manner.

Top-lit signs with well-shielded fixtures save energy and contribute little to light pollution. Yet, there are all sorts of objections raised to suggestions that billboards be designed in this fashion. Most, if not all, of these objections are fallacious. The majority of the billboards in the Tucson, Arizona area are top-lit, and all interstate roadway signs in southern Arizona are lit from the top. This has caused no problems, resulted in better sign lighting, probably saves money, and helps keep unwanted light out of the sky. A well- designed top-lit billboard is cheaper to run—a relatively low-wattage fluorescent fixture, for example, provides more than enough light to give the billboard easy visibility.

We have not noticed any objectionable shadows in the daytime caused by the lighting system being mounted at the top of the billboard. This is an objection often raised by opponents of top-lit billboards. They also complain that top-mounted fixtures are more difficult to service. This may be true in some cases, but in most instances in Tucson the billboards are quite large and are difficult to change or service no matter where the lights are located. There is little doubt that changing a lighting system for a billboard may be expensive. It is probably impractical to ask for all billboard owners to retrofit the lighting systems for bottom-lit signs. A first approach would be to ask for all new billboards to be top-lit. Older billboards could be left as they were for some time until they would ordinarily undergo major renovation due to their age.

There is also the question of whether a billboard needs to be lit at all when the business being advertised is not open. Most billboards and other advertising signs should be turned off after 10:30 or 11:00 p.m. We should point out to the sign owner, or better yet the business doing the advertising, how much coal is being burned (and wasted) to light the night sky. These individuals probably do not realize that in addition to light pollution they are also contributing to air pollution and possibly global warming. Most electricity comes from coal-burning power plants.

It does not take very much light to make a sign visible at night. The next time you are at an airport notice how dim the taxi and runway lights are. Nevertheless, they are easily seen. In your efforts to produce changes in the way signs are lit in your area, be reasonable and work with the sign owners and billboard companies. A well-constructed top-lit sign is easy to see at night and yet it contributes little to light pollution. We know it can be done because we see good examples in many places. Changing billboard and sign lighting will not be easy and it will take years to bring about a large scale transformation. It will not by itself stop light pollution but it will surely help and is a worthwhile goal to work toward.

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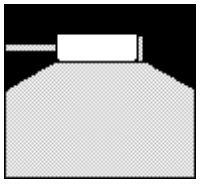
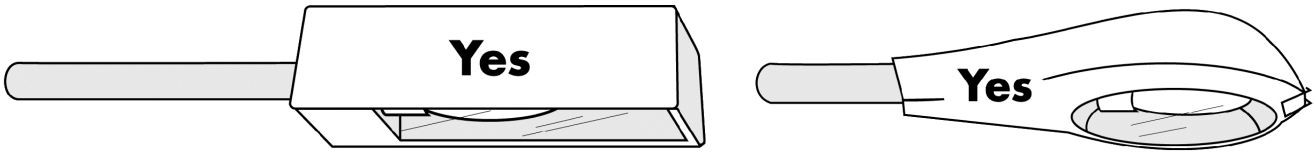
10/98

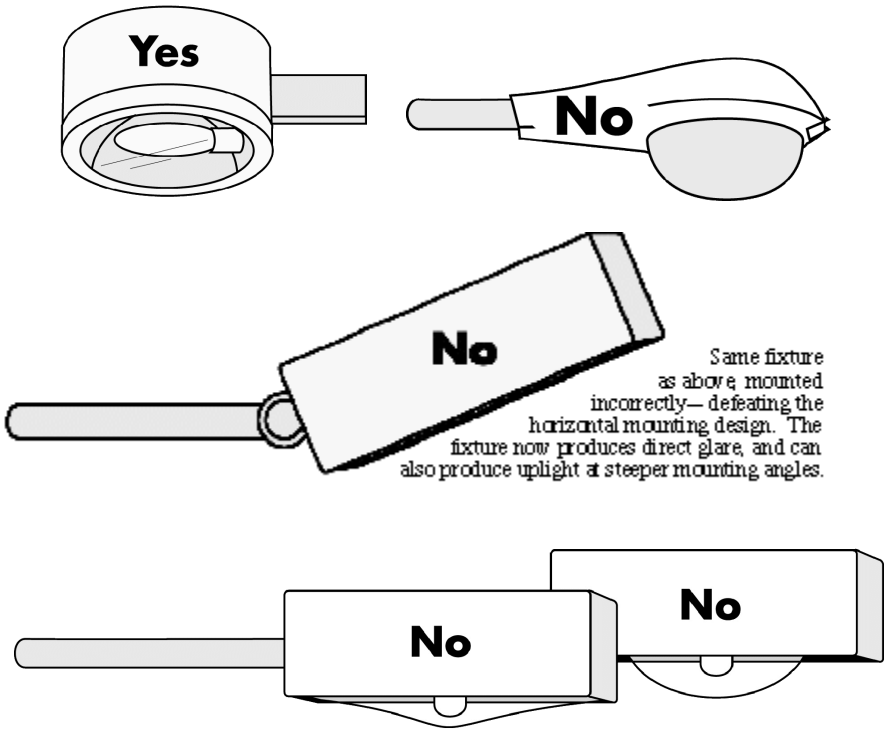
International Dark-Sky Association -- Information Sheet 143

What is a True "Full Cutoff" Outdoor Lighting Fixture?

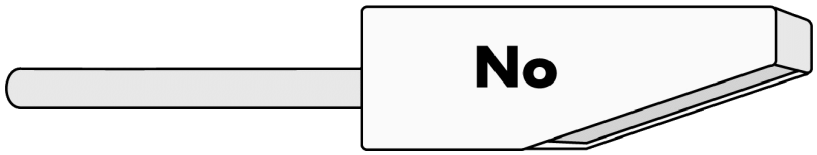




Flat glass lens, eliminates or minimizes direct glare, no upward throw of light. The housing for these fixtures is available in many styles.



Known as just "Cutoff". Center "drop" or "sag" lens with or without exposed bulb, produces direct glare.



Forward-Throw Style. Exposed bulb in the forward direction produces some direct glare.

Produced by Bob Crelin

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Sports and Recreational Area Lighting

As our populations have grown, many people have an increasing amount of leisure time. They are looking for healthy recreational opportunities for themselves, for their children, and for senior citizens. One way of meeting this demand is to provide illumination for existing parks and play areas. When new facilities are built, they usually include a night lighting system. These facilities bring pleasure to many, but they also bring irritation and annoyance to those who live nearby. The lighting systems are visible for miles around and produce a substantial amount of sky glow and light pollution. Lighted sports facilities are the most commonly mentioned system when people discuss light pollution in the nighttime environment.

Many cities have large outdoor professional sports venues. It is essentially impossible to mitigate the impact these types of facilities have on the surrounding areas. The amount and type of illumination are driven by television broadcasting requirements, and glare control of the luminaires is essentially impossible or not effective. However, these large, professional facilities do not normally operate every night of the week and are usually located some distance from the residential areas of the city.

This is not the case with the many recreational areas that have night lighting systems. The facilities are normally in or near residential areas and are operated several nights a week and year around or as long as weather permits. The off-site impact of these facilities can be reduced to some extent by utilizing several options. One of the most important is proper mounting heights of the luminaires. Many people think that low mounting heights help reduce the off-site impacts of the illumination system. This is exactly the opposite of the actual effect. The lower the mounting height, the higher the aiming angle and the more light that is delivered off site. This emphasizes the importance of having the facility designed by an experienced sports lighting professional. These systems need to be installed by a licensed electrical contractor in most jurisdictions, so design should be done by a licensed engineer. A selection process should be used to ensure that the best qualified and most experienced person is picked for this.

The Illuminating Engineering Society of North America (IESNA) has a Sports and Recreational Areas Lighting Committee. This committee develops standards and design criteria for various sports, both indoor and outdoor. This information is published as “Recommended Practice for Sports and Recreational Area Lighting,” (IESNA RP-6-01). The criteria are divided into several major sections plus five annexes, an extensive glossary of lighting terms, and a reference/bibliography pertaining to sports lighting design. While the RP covers recommendations for both indoor and outdoor sports, this summary will only cover outdoor sports.

RP-6 has established four classes of facilities, based mainly on the number of spectators, and provided illumination recommendations for each. They are as follows:

- Class I: Competition play before larger groups, from 5,000 to 10,000 or more spectators. The design criteria may not fully cover this type of facility, whose vertical and horizontal needs may be defined by individual sports and/or broadcasting organizations.

- Class II: Competition play with facilities for up to 5,000 spectators.

- Class III: Competition play with some spectator facilities.

- Class IV: Competition or recreational play only, with no provision for spectators.

continued

In general, the recommendations for Class IV are normally sufficient for most recreational sports facilities. When spectator facilities are added and the distance from the spectators to the field becomes greater, the illumination levels need to be increased. These higher levels are for the spectators; the lower levels are considered sufficient for the players.

Multidirectional aerial sports are those in which players and spectators view the playing object from many positions and angles. These sports require vertical illuminance over the height of the entire playing area and horizontal illuminance at ground level. Direct glare at the most frequent viewing directions must be avoided. These sports include badminton, baseball, basketball, football, handball, jai alai, ski jumping, soccer, squash, tennis, and volleyball.

Unidirectional aerial sports, in which the playing object is viewed in the air from a fixed position on the ground, require horizontal illuminance where the playing object starts and vertical illuminance where the playing object lands or is intercepted. Such sports are golf at a driving range and skeet and trap shooting.

In *multidirectional ground level* sports the players and spectators view the playing object from multiple positions, normally downward, horizontally, and occasionally upward. These sports include boxing, curling, field and ice hockey, skating, swimming and wrestling.

The playing object in *unidirectional ground level* sports is aimed at a fixed target, usually in a vertical position, near ground level. These sports include archery, bowling, skiing, and target shooting.

Fundamentals of Good Illumination

The goal of good sports lighting is to provide a luminous environment that contributes to the contrast of the playing object (ball), the competitors, and the surrounding backgrounds. Contrast is a function of the luminance of both the target and the background. Good design takes into consideration direct and reflected glare, color rendering, and color contrast.

The lighting recommendations also seek to minimize spill light, or light trespass, in areas near the sports facility. The lighting fixtures commonly used for sports lighting may be huge sources of direct glare, affecting not only nearby areas and those at considerable distances from the sports field, but also spectators and players using the facility. The brightest single source of light visible in a city nighttime landscape is often a sports facility. It is, then, no surprise that such lighting is usually the single greatest source of complaints and neighborhood tension. Designing excess light increases construction, operating, and maintenance costs and wastes energy.

Equipment and Design Factors

RP-6 covers light sources and equipment commonly used in sports lighting, along with their characteristics and typical applications.

The two light sources commonly used for sports facilities are high-intensity discharge (HID) and fluorescent. HID lamps, which are long lived and have high efficacy, may be metal halide or high-pressure sodium (HPS). However, when these lamps are turned on or restarted, they have a time delay, followed by a slow buildup of light output.

While fluorescent lamps provide relatively high efficacy, long lamp life, low brightness, and good color rendering, their physical length gives poorer optical control and they are very temperature-sensitive.

Luminaires offer a wide choice of optical characteristics. Based on their optical performance and mounting at the correct height and position, luminaires provide a lighting system with the desired characteristics. Luminaire designations explain how light from the lamp is controlled by the optical system and describe the fabrication of the complete unit. Since indoor and outdoor applications involve unique problems, lighting equipment is distinctly classified and designated accordingly.

continued

Indoor sports applications have similar design and calculations as those of any interior system. The walls and ceilings provide a means to control background luminances and assist in diffusing the available light.

Outdoor lighting choices are more limited, usually made up of direct distribution floodlights aimed at the playing surface. Full cutoff optical systems are now available for most recreational level sports applications. In fact, the full cutoff optical systems actually provide superior visibility for the players as well as the expected reduction in off-site impacts. HID sources (metal halide or high-pressure sodium) are the choice for most outdoor sports locations.

In the past, fixtures, lighting designs, and the general level of the sports lighting state of the art often left little choice for communities and designers seeking to minimize spill and glare in sports lighting. Many facilities, especially older ones, continue to produce enormous amounts of light spill into adjacent areas, as well as direct and reflected light into the sky.

Recently, several luminaire manufacturers have begun to produce well-shielded - even fully shielded - luminaires suitable for sports lighting, particularly for the most commonly needed levels of lighting. These designs provide major reductions in off-site spill and can reduce or even eliminate direct uplight. This equipment must be carefully applied to provide the visibility to the players necessary for softball, football, and similar sports where the ball must be seen well above the playing surface. Proper mounting heights and mounting locations help these designs deliver improved lighting quality for the players on the field.

With quality designs using up-to-date fixtures, the obtrusive effects of lighting can be considerably reduced, but the huge amounts of light required in certain situations will always produce some negative impacts, even with the best design.

Illumination Recommendations for Outdoor Sports

Recommendations for illuminance values, uniformity ratios, and design considerations in facilities for specific outdoor sports are given for many sports.

The five annexes cover illuminance calculations, field measurement and performance evaluations, floodlight aiming, light loss and maintenance, and lighting economics.

Communities need to be aware of the potential impacts of a sports facility, and its location and alignment should be carefully considered. Technical specifications for sports lighting can be included in a lighting code that requires fully shielded lighting where possible and professional design and post-installation certification to ensure that standards are followed.

The RP is available from IESNA (www.iesna.org) and is a must for anyone interested in sports and recreational lighting.

Unshielded sports lighting

Fully shielded sport lighting

12/98

International Dark-Sky Association -- Information Sheet 145

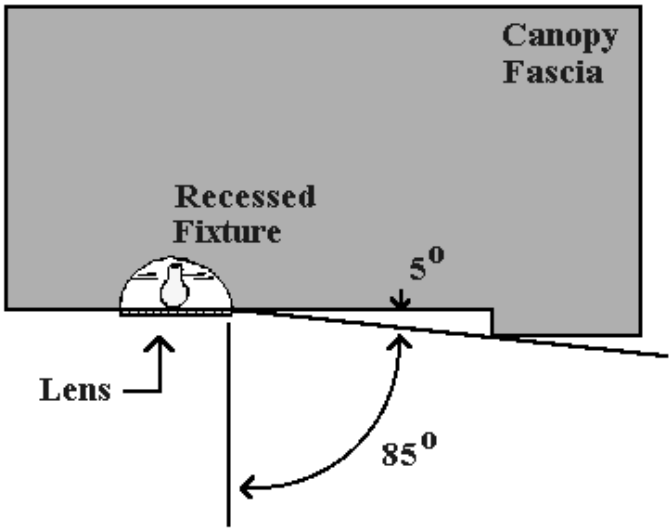
Service Station / Convenience Store Lighting

Many new or recently refurbished gasoline pump islands are being illuminated at three to four times the illumination level that was used only a few years ago. Why? Advertising! Many convenience stores and service stations are attempting to attract customers by making their canopy area the most brightly lit object in the neighborhood by far. The problem is in doing so, they are breaking nearly every rule of good lighting. The first rule of good lighting is use the right amount of light, not overkill. A good rule of thumb is that no retail establishment should have an illumination level that is more than 10 times the illumination level of the surrounding area. Since average illumination levels for roadways range between 0.3 and 1.6 footcandles (fc) and for parking lots between 0.8 and 3.6 fc, it is clear that canopies lit at between 80 and 110 fc are completely excessive. Such high light levels are simply not needed for safety, security, or visibility. It is advertising, plain and simple, and should be regulated as such.

When a business like a convenience store illuminates their property at extremely high lights levels, surrounding areas that used to look adequately lit now appear too dark by comparison. This occurs because the human eye adapts to the brightest object in its visual field. If an area is too bright, then one's pupils close down a little and normal night vision is impaired (through depletion of the photochemical rhodopsin in the eyes' rod receptors). Add to this the substantial sideways glare produced by many canopy light fixtures, and the problem grows even worse. The next time a neighboring business or the city streetlighting department upgrades their lighting system, they will often feel compelled to increase the light level. This phenomenon is called *ratcheting*, and results in ever-increasing light levels. Ratcheting has been going on for years, and the pace is accelerating. Have you noticed?

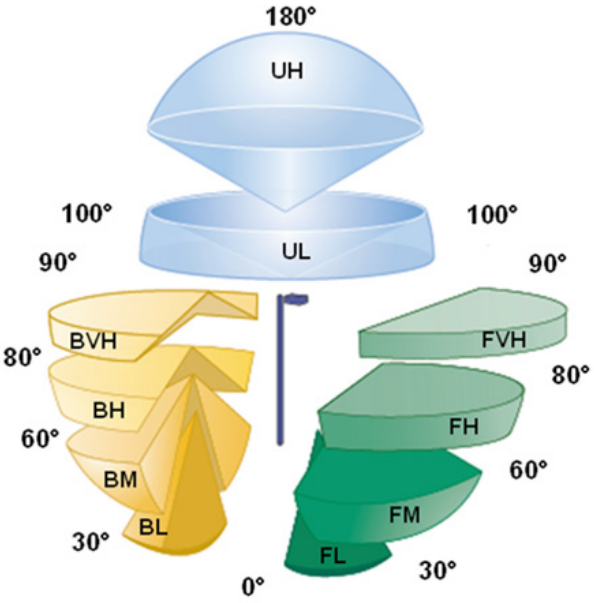
The Illuminating Engineering Society of North America (IESNA) has established that an illumination level of 20 fc is all that is needed for service station pump islands with dark surroundings, and 30 fc for pump islands with bright surroundings. As a general rule, bright surroundings will refer to service stations located in a designated commercial area. If the service station is located in a rural or residential area, then the dark surroundings illumination level should apply.

Another rule of good lighting is "hide the source, light the subject". In other words, avoid glare. Glare is always bad, and efforts should always be made to minimize it. Most new service station and convenience store canopies employ light fixtures which produce an enormous amount of glare, made all the more worse because the light source used is the harsh (at these levels), bluish-white light of metal halide. Glare can be substantially reduced by using fixtures that are completely recessed up into the canopy so the bottom of each light fixture is flush with the ceiling of the canopy. Additionally, a "skirt" around the edge of the canopy can be used to provide additional glare control, as shown below.



Specifier Bulletin for Dark Sky Applications

VOLUME 2: ISSUE 1 : 2009 — International Dark-Sky Association



A Classification System for Lighting Zones

The BUG System—A New Way To Control Stray Light from Outdoor Luminaires

BUG stands for "**Backlight**", "**Uplight**" and "**Glare**." The acronym describes the types of stray light escaping from an outdoor lighting luminaire. "B" stands for backlight, or the light directed in back of the mounting pole. "U" stands for uplight, or the light directed above the horizontal plane of the luminaire, and "G" stands for glare, or the amount of light emitted from the luminaire at angles known to cause glare.

It is expected that BUG values will be published by luminaire manufacturers so lighting specifiers, designers or purchasers can tell at a glance how well a certain luminaire controls stray light or compares with other luminaires under consideration for an installation.

The BUG system was developed by the Illuminating Engineering Society (IES) to make comparing and evaluating outdoor luminaires fast, easy and more complete than older systems.

Work on the BUG system started in 2005 when the IES upgraded the roadway shielding classification system. The original system, which included the ratings full cutoff, cutoff, semi-cutoff and non cutoff, had been designed as a rating system solely for street lighting. However, increasing demand for control of glare and light trespass extended these terms to all types of outdoor lighting, and the IES realized that a more comprehensive system was needed.

The Lighting Research Center, acting as an IES contractor, developed a new classification concept that addresses light emitted from the luminaire in all directions, not just up into the sky. This system, released to the public as IES Technical Memorandum TM-15, technically replaced the old system. It divides the sphere around a luminaire into zones assigning values according to expected environmental impact. This rating system offers the most complete evaluation of the total light emitted from luminaires to date. A point to

The BUG System

ida

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IES Illuminating ENGINEERING SOCIETY

For more information on FSA approved luminaires please visit the IDA Web site www.darksky.org.

remember, however, is that while the values assigned by the new system are good indicators, they may not in all cases directly correlate to light pollution. ***It still depends upon the site, the application and how the luminaire is installed***.

A fundamental component of the Model Lighting Ordinance (MLO), currently under public review, divides lighting requirements into lighting zones according to environmental impact. ***See Appendix A***. The joint IDA/IES task force in charge of drafting the MLO reviewed TM-15 and realized that it could be modified to serve as a key measure of all forms of light pollution related to shielding and the direction of light, becoming an important tool to determine which luminaires are appropriate for each zone. Modifications were made, including subdividing the TM-15 uplight zone to better address artificial sky glow, and subdividing the upper downlight zone to better address glare. The IES accepted these adjustments and released TM-15-07 (revised). ***See Figure 1***.

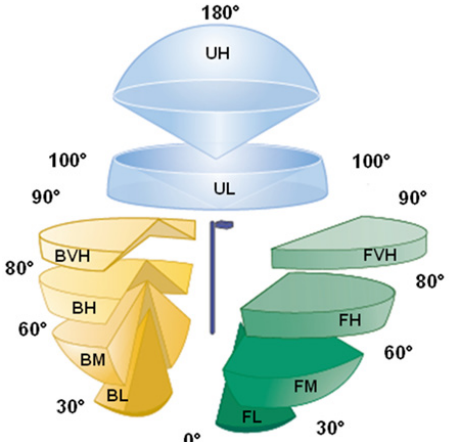


***Figure 1*:** the revised outdoor luminaire distribution measuring system from TM-15-07 (revised)

After reviewing hundreds of candidate luminaires, the MLO task force established the three composite (BUG) ratings based on TM-15-07 (revised):

Backlight, which creates light trespass onto adjacent sites. The B rating takes into account the amount of ligwht in the BL, BM, BH and BVH zones, which are direction of the luminaire OPPOSITE from the area intended to be lighted.

Uplight, which causes artificial sky glow. Lower uplight (zone UL) causes the most sky glow and negatively affects professional and academic astronomy. Upper uplight (UH) is mostly energy waste. The U rating accounts the amount of light into the upper hemisphere with greater concern for the lower uplight angles in UL.

Glare, which can be annoying or visually disabling. The G rating takes into account the amount of frontlight in the FH and FVH zones as well as BH and BVH zones.

Appendix A:

Lighting Zone Definitions: The Lighting Zone shall define the limitations for outdoor lighting as specified in this ordinance. The policymaking body is able to designate areas according to the following descriptions, thereby creating a custom lighting plan according to local needs, functions, and geography.

LZ0: No ambient lighting Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Little or no lighting is expected. When not needed, lighting should be extinguished.

LZ1: Low ambient lighting Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety, security and/or convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.

LZ2: Moderate ambient lighting Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety, security and/or convenience but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.

LZ3: Moderately high ambient lighting Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.

LZ4: High ambient lighting Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.

Figure 1: the revised (or BUG) outdoor luminaire distribution measuring system from TM-15-07 (revised)

The resulting rating system, called BUG for obvious reasons, is a comprehensive system that takes into account uplight shielding, glare shielding and backlight shielding as well as limiting lamp lumens to values appropriate for the lighting zone. BUG is a simple system consisting of a a table of consensus acceptable values against which any luminaire having photometric data can be judged. A luminaire's numerical rating is the LOWEST light zone number in which it can be used. BUG will be part of the latest IES outdoor lighting system update.

The BUG rating system is a principal component of the Model Lighting Ordinance (MLO). The MLO is also a simple system that considers BUG ratings in the context of total lumens allowed per site. which the total site lumens are restricted. Use of the BUG system as the measuring tool for the MLO creates a straightforward system of controlling light pollution that can be implemented by persons having minimal experience or education in outdoor lighting design.

BUG FAQs

Are BUG luminaire ratings better than using the old full cut off, semi cut off, non cut off, etc. designations for shielding?

Yes, because BUG ratings provide backlight and glare information as well as how well the luminaire controls uplight. These additional measurements provide a much more accurate picture of lumen distribution and the overall efficiency of a luminaire.

Does BUG allow any uplight?

BUG requires downlight only with low glare (better than full cut off) in lighting zones 0, 1 and 2, but allows a minor amount of uplight in lighting zones 3 and 4. In lighting zones 3 and 4, the amount of allowed uplight is enough to permit the use of very well shielded luminaires that have a decorative drop lens or chimney so that dark sky friendly lighting can be installed where in places that traditional-appearing fixtures are required.

Will all outdoor lighting manufacturers rate their luminaires according to BUG?

Not at first. Since BUG is designed to prevent bad lighting practices, a lot of current outdoor products won't pass BUG, so there will be no point in rating them. But it is expected that manufacturers will rate their "good" luminaires and make changes to current products to improve BUG ratings.

Will BUG apply to residential lighting?

No. BUG can't be used for residential luminaires because they generally are not photometrically tested. The IDA Fixture Seal of Approval Program can be used to rate residential outdoor luminaires.

Is BUG as strict as the toughest anti-light pollution ordinances in effect today?

BUG, by itself, is a luminaire rating tool. It can easily be applied more stringently by using the zonal factors in response to community choices of lighting zones. While lighting zone determinents are clearly outlined in the MLO, the community decides upon zone placement. If a community adopts the MLO and chooses all lighting zones LZ0 and LZ1, the MLO with BUG is actually more restrictive than any of the toughest ordinances. However, zone assignment will always remain at the discretion of the community.

Addendum A for IES TM-15-07: Backlight, Uplight, and Glare (BUG) Ratings

Text, charts, and photograph from IES TM-15-07:
http://www.iesna.org/PDF/Erratas/TM-15-07BUGRatingsAddendum.pdf

The following **Backlight**, **Uplight**, and **Glare** ratings may be used to evaluate luminaire optical performance related to light trespass, sky glow, and high angle brightness control. These ratings are based on a zonal lumen calculations for secondary solid angles defined in TM-15-07. The zonal lumen thresholds listed in the following three tables are based on data from photometric testing procedures approved by the Illuminating Engineering Society for outdoor luminaries (LM-31 or LM-35).

Notes to Tables ***A-1***, ***A-2***, and ***A-3***:

1. Any one rating is determined by the maximum rating obtained for that table. For example, if the BH zone is rated B1, the BM zone is rated B2, and the BL zone is rated B1, then the backlight rating for the luminaire is B2.
2. To determine BUG ratings, the photometric test data must include data in the upper hemisphere unless no light is emitted above 90 degrees vertical (for example, if the luminaire has a flat lens and opaque sides), per the IES Testing Procedures Committee recommendations.
3. It is recommended that the photometric test density include values at least every 2.5 degrees vertically. If a photometric test does not include data points every 2.5 degrees vertically, the BUG ratings shall be determined based on appropriate interpolation.
4. A "quadrilateral symmetric" luminaire shall meet one of the following definitions:
    a. Type V luminaire is one with a distribution that has circular symmetry, defined by the IES as being essentially the same at all lateral angles around the luminaire.
    b. Type VS luminaire is one where the zonal lumens for each of the eight horizontal octants (0-45, 45-90, 90-135, 135-180, 180-225, 225-270, 270-315, 315-315-360) are within ±10 percent of the average zonal lumens of all octants.

Table A-1: Backlight Ratings (maximum zonal lumens)

Backlight Rating

	Secondary Solid Angle	B0	B1	B2	B3	B4	B5
Backlight / Trespass	BH	110	500	1000	2500	5000	>5000
	BM	220	1000	2500	5000	8500	>8500
	BL	110	500	1000	2500	5000	>5000

Table A-2: Uplight Ratings (maximum zonal lumens)

Uplight Rating

	Secondary Solid Angle	U0	U1	U2	U3	U4	U5
Uplight/ Skyglow	UH	0	10	100	500	1000	>1000
	UL	0	10	100	500	1000	>1000
	FVH	10	75	150	>150		
	BVH	10	75	150	>150		

Table A-3: Glare Ratings (maximum zonal lumens)

Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)

	Secondary Solid Angle	G0	G1	G2	G3	G4	G5
Glare / Offensive Light	FVH	10	250	375	500	750	>750
	BVH	10	250	375	500	750	>750
	FH	660	1800	5000	7500	12000	>12000
	BH	110	500	1000	2500	5000	>5000

Glare Rating for Quadrilateral Symmetrical Luminaire Types (Type V, Type V Square)

	Secondary Solid Angle	G0	G1	G2	G3	G4	G5
Glare / Offensive Light	FVH	10	250	375	500	750	>750
	BVH	10	250	375	500	750	>750
	FH	660	1800	5000	7500	12000	>12000
	BH	660	1800	5000	7500	12000	>12000

"BUG" RATING EXAMPLE:

A 250-watt MH area luminaire, Type IV forward throw optical distribution. Based on the photometric test data, the luminaire has the following zonal lumen distribution:

	Lumens	% Lamp Lumens
Forward Light		
FL (0–30 degrees)	1618	5.9%
FM (30–60 degrees)	6093	22.2%
FH (60–80 degrees)	3748	13.6%
FVH (80–90 degrees)	27	0.1%
Backlight		
BL (0–30 degrees)	985	3.6%
BM (30–60 degrees)	930	3.4%
BH (60–80 degrees)	136	0.5%
BVH (80–90 degrees)	16	0.1%
Uplight		
UL (90–100 degrees)	0	0.0%
UH (100–180 degrees)	0	0.0%

Backlight Rating:

Determine the lowest rating where the lumens for all of the secondary solid angles do not exceed the threshold lumens from ***Table A-1***. In this example the backlight rating would be B2 based on the BL lumen limit.

Uplight Rating:

Determine the lowest rating where the lumens for all of the secondary solid angles do not exceed the threshold lumens from ***Table A-2***. In this example the uplight rating would be U1 based on the FVH and BVH lumen limits.

Glare Rating:

Determine the lowest rating where the lumens for all of the secondary solid angles do not exceed the threshold lumens from ***Table A-3*** for a Type IV distribution. In this example, the glare rating would be G2 based on the FH lumen limit.

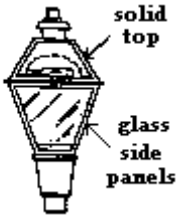
Therefore, the BUG rating for this luminaire would be: **B2 U1 G2**

05/97

International Dark-Sky Association -- Information Sheet 122

Examples of Good and Bad Lighting Fixtures

GOOD Even post-top ornamental fixtures, like this Salem Cutoff from GE Lighting, can be cutoff with clear panels and lamp/reflector located above.



GOOD The Yorktown, another ornamental from Emery Fixtures, also has clear panels and bulb located above for maximum glare and spill light control.

BAD Non-cutoff fixtures like this "acorn" ornamental cause light pollution.

GOOD Flat-lens cobra head fixtures, like this American Electric Series 125 Roadway Cutoff luminaire, provide excellent roadway lighting with greatly reduced glare and no uplight.

GOOD This new generation of flat-lens cobra head fixture from American Electric, call the DuraStar 2000, provides superior lighting uniformity at standard mounting heights and spacings.

BAD The ubiquitous drop-lens cobra head luminaire produces a level of glare and uplight that is both unacceptable and unnecessary.

GOOD Many existing dusk-to-dawn security lights and residential streetlights can be retrofitted with the Hubbell Skycap.

GOOD The Hubbell Skycap turns any standard Barn Light into a full-cutoff light with wide area coverage.

BAD Barn Light style fixtures are very inefficient, sending about 20% of the light upward and another 20% horizontally outward, creating glare.

GOOD Flat-lens shoebox fixtures come in many forms; square, rectangular, circular, etc. All control the light with internal reflectors. Glare and light trespass are minimized; no uplight is produced.

GOOD Post-top flat-lens shoebox fixtures like this one provide good area illumination without light pollution.

BAD (sometimes) The telltale sag lens gives this luminaire away as a possible problem. If the lens is clear and very shallow, and the bulb wattage is not too high, this type of light can cover a wider area without too much glare or uplight, but beware!

GOOD Full-cutoff wall packs such as this mcPhilben 101 Wall Sconce make excellent entryway and building

GOOD Recessed canister lights built into the eaves or canopy of a house, garage, or other building is the

BAD Wall packs like this should never be used. They produce enormous

perimeter lights, and there is enough forward throw that adequate lighting is provided for near-building parking.

first choice for lighting building exteriors.

glare and uplight.

GOOD If floodlights must be used, they should always have top and side shielding, and be pointed at least 45 ° below the horizontal.

GOOD Even sports lighting can be done well, if one uses cutoff light fixtures such as these from Soft Lighting Systems.

BAD Unshielded floodlights provide a trashy "prison yard" look and should not be used.

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12/97

International Dark-Sky Association -- Information Sheet 130

Communication Tower Lighting

In recent years we have seen a growing number of communication towers with white strobe lights on them. When these white strobes operate at night, the results can be disastrous for the astronomer, recreational stargazer, and anyone who enjoys the serenity of the night. Flashing at a rate of 40 or 60 times a minute - all night long - these white strobes can be exceedingly annoying, can light up the night sky for miles around, and make it impossible to "dark adapt" anywhere within sight of the tower. Even worse, such towers are often located in "pristine" rural areas without other sources of light pollution.

The rapid growth of the cellular phone industry and other communication services will mean many thousands of new communication towers are likely to be constructed in the next few years. Many of these towers will be lighted, often with white strobe lights at night. Hopefully, legislation will be forthcoming requiring communication service providers to share antenna facilities. And we are not alone: aircraft pilots dislike these towers, and many others consider them a blight upon the landscape.

The Federal Aviation Administration (FAA) considers a tower to be an obstruction to air navigation if it is of a height greater than 500 feet above ground level (AGL) and six or more nautical miles from an airport. At five miles this height reduces to 400 ft. AGL; four miles, 300 ft. AGL; three miles, 200 ft. AGL. Greater restrictions apply when a tower is closer than three nautical miles from an airport. If the FAA determines that a tower is an obstruction to air navigation, then obstruction marking (alternating aviation orange and aviation white paint) and/or lighting (red lights or white lights) will be required.

The FAA recognizes the following categories of obstruction lighting:

Type	Description
L-810	Steady-burning red obstruction light
L-856	High intensity flashing white obstruction light, 40 flashes per minute (FPM)
L-857	High intensity flashing white obstruction light, 60 FPM
L-864	Flashing red obstruction light, 20 - 40 FPM
L-865	Medium intensity flashing white obstruction light, 40 FPM
L-866	Medium intensity flashing white obstruction light, 60 FPM
L-855	Flashing red obstruction light, 60 FPM

Obviously, the least obtrusive kind of nighttime tower lighting is type L-810, L-864, or L-855 red lights. Even though white strobes may be required during daylight and twilight, the FAA can often be convinced to require the tower owner to use red lights at night when there are significant environmental concerns. This is called a dual lighting system.

Generally speaking, any tower construction or alteration of more than 200 feet AGL requires FAA approval before construction can begin.

Decisions about tower lighting are made on a case by case basis by the regional FAA office. To contact your regional FAA office, call the FAA Consumer Hotline at 1 800-FAA-SURE and they will give you the appropriate address and phone number.

Often, there is no public hearing during the tower approval process, but there should be. What can you do? Write your local zoning authority, elected officials, regional FAA office, and local aviation authorities and formally request that you be informed about all permit applications for structures that are to have obstruction lighting. Follow up with phone calls. Be sure everyone involved understands your concerns. Medium-intensity flashing white obstruction lights are not normally recommended on structures less than 200 feet AGL.

High-intensity flashing white obstruction lights are not recommended on structures 500 feet AGL or less, unless an FAA aeronautical study concludes otherwise. Also, FCC licensees are required to file an environmental assessment with the FCC when seeking authorization for the use of the high intensity flashing white lighting system.

What can be done for existing towers that use white strobes at night or if a new tower with white lighting suddenly appears without your knowledge? The first thing to check is whether the white strobe light is going to low intensity at night. The FAA requires that white strobe lights have three (in the case of high intensity white lights) or two (in the case of medium intensity white lights) levels as follows:

Type	Peak Intensity (candelas)	
L-856	day	270,000
	twilight	20,000
	night	2,000
L-857	day	140,000
	twilight	20,000
	night	2,000
L-865/866	day/twilight	20,000
	night	2,000

Note that at night all white obstruction lights should have substantially less intensity than during the daytime. Frequently, however, white strobe light systems can be seen flashing at full daytime intensity at night. This is clearly in violation of FAA regulations, so if you see such a tower, contact your regional FAA office giving the tower location and owner (if known), and they will have the situation rectified promptly.

If the white obstruction lights are operating properly at night, but you still find them obtrusive, contact both the FAA and the tower owner to request that a red lighting system be installed for nightime use.

Sometimes, white obstruction lights are installed on towers when they are not required by the FAA. Such situations could be avoided by passing a local tower ordinance specifically prohibiting tower lighting not required by the FAA. Bloomington, Minnesota is one community with such an ordinance.

You may have wondered why white strobe lights are now used on many towers, when in the past only red lights were used. A major reason is increasing visual clutter (from the pilot's

perspective) due to bright, upward shining light fixtures! Here we find yet another reason to control light pollution. California amateur astronomer and pilot Stuart Home summed it up pretty well when he said,

> *Red beacons are not readily visible against a backdrop of city lights. Unlike the astronomer, who is looking up, the pilot is looking down on that light, and the red beacon loses visibility in such a circumstance. Perhaps the thing to do is to use red beacons in rural areas and places where city lighting falls below a certain level.*

For more information, request the following FAA publications:

Advisory Circular 150/5345-43E, Specification for Obstruction Lighting Equipment (10/19/95)

Advisory Circular 70/7460-1J, Obstruction Marking and Lighting (11/29/95)

Federal Aviation Regulations, Part 77: Objects Affecting Navigable Airspace (March 1993)

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APPENDIX H: MODEL FORT CAMPBELL ACTIVITY ZONE ORDINANCE

Introduction

This document includes land use and design standards for the areas surrounding Fort Campbell.

Summary

The Fort Campbell zoning district is intended to provide for uses and unique design requirements for lands adjacent to and within accident potential zones, airspace zones, and noise zones for Fort Campbell. Site design and other standards are necessary to protect navigable airspace and may include height limitations, smoke limitations, lighting limitations, and other standards necessary to ensure protection of the airspace. Three districts are established for the Fort Campbell Activity Zones (FCAZ): FCAZ I, FCAZ II, and FCAZ III. FCAZ I includes the Clear Zones and Accident Potential Zone I associated with Campbell Army Airfield. FCAZ II includes Accident Potential Zones II and all areas within the noise zone LDN 70. FCAZ III includes all land inside the JLUS Area of Concern.

The official zoning map delineates the boundaries of the FCAZ I, FCAZ II, and FCAZ III districts, based upon the Accident Potential Zones and LDN noise zones.

Site Design Standards for the Fort Campbell Activity Zoning Districts (FCAZ)

A. The purpose of the Fort Campbell Activity Zoning Districts (FCAZ I, FCAZ II, and FCAZ III) is to:
    1. Ensure safety to people and property within the FCAZ;
    2. Prohibit the establishment of incompatible structures within the designated FCAZ I, II and III;
    3. Protect the airspace, Military Operating Area, approach zones, inner horizontal zones, conical zones, outer horizontal zones, and transitional zones from the establishment of structures or placement of objects that interfere with the safe operation of aircraft;
    4. Limit land uses within the FCAZ to those uses that are compatible with military operations;
    5. Protect people and property from the potential adverse effects of aircraft noise; and aircraft crashes and
    6. Ensure the continued presence of Fort Campbell in _____ County.

B. The following documents are hereby adopted by reference as is fully set forth within this Ordinance:
    1. Fort Campbell Joint Land Use Study (JLUS) Report.
    2. JLUS Maps (i.e. Figure 22).

C. Location of districts within the FCAZ:
    1. FCAZ I: Includes all property in the Clear Zones and Accident Potential Zones (APZs) I.
    2. FCAZ II: Includes APZs II and areas within noise zone LDN 70.
    3. FCAZ III: Includes all land in the JLUS Area of Concern.

D. Development standards within the FCAZ Zoning Districts
    1. Within the FCAZ I, the following uses are prohibited:
        a. Any structures in the Clear Zone
        b. Any residential uses in Accident Potential Zone 1
        c. Any uses that concentrates, within a structure on a regular basis, more than 25 people per acre. This limitation applies to: sports stadiums, amphitheaters, auditoriums, clubhouses, churches, schools, hospitals, assisted living and other medical facilities, hotels and motels, restaurants and other eating and drinking establishments built to such a scale that gatherings of more than 25 people per acre would be expected on a regular basis.
    2. Within the FCAZ II, the following uses are prohibited:
        a. Multi-family residential development; and
        b. Single-family residential with a density of more than one (1) unit per two (2) acres.
    3. Within all FCAZ areas (except for those areas under easements which set a lower height restriction), buildings, structures, and objects with a height of seventy-five (75) feet or more are prohibited, except where a Representative from For Campbell specifically certifies that the proposed height is not a hazard to aircraft take-offs, landings, or flight operations.
    4. Within all FCAZ areas, all lights used in conjunction with streets, parking, signs, and uses of land shall be arranged and operated in such a manner that they do not interfere with pilot vision during take-off, landing, or flight operations (See proposed lighting ordinance).
    5. Within all FCAZ areas, no uses or operations of any type shall produce smoke, glare, birds or other visual interference that will present a hazard to aircraft during take-off, landing, or flight operations. Agricultural uses are exempt.
    6. Within all FCAZ areas, no uses or operations of any type shall produce electronic interference with navigation signals or radio communication between aircraft, the airport, or the air traffic controller.

7. Within all FCAZ areas, approval for a permit for residential development shall require a perpetual nonexclusive easement acknowledging that the property is situated in an area that may be subjected to conditions resulting from military training at Fort Campbell.
8. Within all FCAZ areas, all real estate transactions shall include a form disclosing proximity of the site to the military installation. The form shall be affixed to all listing agreements, sales and rental contracts, subdivision plats, and any individual marketing materials, such as brochures, etc. Disclosure is required as soon as practicable, but must be before the execution of a contract, i.e., before the making or acceptance of an offer.
9. The following standards apply to development within the noise impact areas that are 60 dB plus (Note this includes areas near the Land Use Planning Buffer associated with large arms firing):
    a. All work and operations shall be conducted within buildings or enclosed structures.
    b. All new development, redevelopment, and building alterations or additions permitted within the noise impact area shall be required to meet the noise attenuation requirements of JLUS Report (See the land use compatibility guidance for noise areas).
    c. Applications for the approval of development within the noise impact area shall include certification from a qualified acoustical expert that the proposed construction complies with the standards of JLUS Report

2. All applications for rezoning and development approval, including site plans, building permits, subdivision plats, sign permits, temporary use permits, and other permits and plans in the JLUS Area of Concern shall be subject to review by a Representative at Fort Campbell. Such review shall be limited to issues of compatibility with Fort Campbell and issues affecting the safety of persons and property related to aircraft take-offs, landings, and flight operations.

APPENDIX I: STAKEHOLDER INPUT SUMMARY

1) What actions (policies, ordinances, plans, meeting participation, informational materials, etc…) has your organization taken since the original 1996 Joint Land Use Study to promote development compatibility around Ft. Campbell?

- In Oak Grove, plans are sent to Ft. Campbell (FTC) for approval as though it were another city department. The city maintains a close relationship with FTC through a planning/zoning/utilities committee. The utility agenda for Oak Grove is sent to FTC each month.
- The Trigg County Planning Commission has signed an agreement with FTC to attach noise warnings to plats within a set distance.
- In Clarksville, the Sabre Heliport Overlay district ordinance and map has been adopted.
- A Memorandum of Understanding (MOU) has been signed between Clarksville-Montgomery Co. and FTC.
- In Clarksville, FTC now gets site/subdivision review within a one mile buffer of the installation.
- FTC has an exhaustive and recently updated list of actions taken since the initial JLUS.

2) Have recommendations for land use controls and growth management been formally adopted into local code or plans?

- Oak Grove will likely pass a lighting ordinance for 41-A in August. Oak Grove also has a good relationship with Christian County and with Hopkinsville. Ambulance/EMS services are supplied by the county.
- In Christian County, height restrictions have been added to the zoning ordinance.
- In Clarksville, the comprehensive plan has been updated so as to be compatible with FTC (in addition to Sabre Heliport and MOU).
- In Christian County, there is no zoning authority. This could only come with adoption of a zoning ordinance for the entire county, and as of now that has not happened. However, a Memorandum of Agreement (MOA) has been signed with FTC that allows FTC to have review over developments in southern Christian County. The MOA also provides that noise warnings be attached to plats that are in noise zones.

3) Have the actions taken thus far been effective in limiting encroachment?

- In Oak Grove, the city provided a venue for Wal-Mart and Ft. Campbell to meet and negotiate Wal-Mart's plans for the new store at corner of 911 and 41-A. Wal-Mart agreed to build oversized stormwater basins to ensure that runoff would not affect the installation's rail line. The recently built Oak Grove Shopping Plaza was approved by FTC.
- In Clarksville, at least one area that was intended to be a buffer zone was rezoned R-1 to bring it into the urban growth boundary as a projected growth area, thus qualifying it under Tennessee law to have sewer extended. It "slipped through the cracks."
- In Clarksville, the Liberty Parkway subdivision was designed with FTC compatibility in mind.
- There is concern that not many effective actions have been taken in Clarksville, although a number of meetings have taken place.
- Hopkinsville's actions have been somewhat effective.

4) What do you think have been the major obstacles to implementing JLUS recommendations (funding, lack of regulatory tools, communication, or community awareness, etc…)?

- In Oak Grove, the biggest obstacle has been the transition involved in getting a new planner. Community awareness is also not an issue because the city is 80 percent military.
- Some at Pennyrile Area Development District (PADD) noted that there have been a lot of complaints about conflicting information coming from FTC about what can be built and where, especially in easement areas. People often do not know who to talk to at FTC to get answers.
- In Clarksville, politics has been an obstacle, particularly issues surrounding the Exit 1 and Exit 4 growth areas.
- Clarksville is adding 6,000 people per year to the population.
- Hopkinsville/Christian County—political will on part of community and military. Each wants to push land regulation on to the other to avoid takings liability. Communication between community and military is also a problem. Example: Hopkinsville adopted a noise contour map as part of its zoning ordinance, but the contours were updated without the municipality being informed of such. A conflict arose when there was a discrepancy between the adopted map and the updated map.

5) Are there current development trends or planned infrastructure improvements in your community that you think could affect land use patterns around Ft. Campbell?

- In Oak Grove, KDOT is designing a project to widen KY 911 to 5 lanes. Development along 911 (Thompsonville Ln.) will be residential with pockets of commercial and Wal-Mart at KY911 and 41-A.
- The main obstacle to growth for Oak Grove is sewer (water is not a problem). They are currently at 64 percent sewer capacity. They are considering connecting their sewer line with Hopkinsville. Permits have been issued for 1,300 new houses in the city.
- In Oak Grove, there is also a project currently in development on Walter Garrett Ln. that will include a walking trail, a playground, a city amphitheater, and a convention center.
- In Hopkinsville, Pennyrile Pkwy is being extended to I-24.
- Also in Hopkinsville, a developer bought a large amount of land around Bell Station Rd (just north CAAF). A lot of the land is easement land and is not sewered; however, he is trying to get sewer extended to the property.
- In Clarksville-Mont. Co. the Exit 1 and Exit 4 areas are reaching capacity and developers are looking to the PGA just south of FTC for growth.
- Clarksville is in the process of revamping zoning districts to incorporate smart growth. They are looking at density issues in particular.

6) Is your community experiencing any current compatibility issues, such as noise complaints?

- According to Oak Grove, they have received next to no noise complaints. They do have complaints from a handful of property owners who want FTC to purchase their land instead of placing restrictions on it.
- Clarksville is facing the same issue. They are currently being sued by property owners.

7) What would you like to see the updated JLUS add to the 1996 plan recommendations?

- Public meeting just for Oak Grove (to work out property issues)
- NVD Guidelines for lighting ordinance
- Sample zoning overlay ordinances
- A map showing where properties with restrictive easements lie
- A website should be set up by FTC that offers information about what people can do with which properties, etc. The site would be similar to a county or city site where plans and maps could be found that give information about buffer zones and ordinances in place.
- Information on buffers

8) Are there any other tools or approaches that you would like us to explore?

- Plan for terrorism/evacuation/preparation
- Suggestion that extra jurisdictional zoning authority be given to FTC for parts of Christian County so that the County will not have to adopt an ordinance and zone the entire county.