Noise Exposure Map Update

Louisville
INTERNATIONAL AIRPORT

December 2016

Louisville International Airport

Noise Exposure Map Update

In Compliance with
14 CFR Part 150

2016

Louisville Regional Airport Authority
P.O. Box 9129
Louisville, Kentucky 40209-0129

Louisville
INTERNATIONAL AIRPORT

SPONSOR'S CERTIFICATION

The Noise Exposure Map (NEM) Update for Louisville International Airport, hereby submitted in accordance with Title 14 CFR Part 150, was prepared by our consultant Harris Miller Miller & Hanson Inc. (HMMH) with the best available information and is certified as true and complete to the best of my knowledge and belief.

The assumptions and activity levels used to develop the existing condition NEM are based on runway use data from 2014 and flight track data from 2015 with updates to reflect minor changes expected by 2016. The noise contours representing the existing condition are identified as the 2016 Noise Exposure Map. The assumption and activity levels used to develop the forecast condition NEM are based on reasonable, available forecasts, stakeholder interviews and other planning assumptions. The forecast condition NEM is based on data generated for a timeframe five years in the future from the year of submission. The noise contours representing the forecast condition are identified as the 2021 Noise Exposure Map.

The NEM update was prepared in consultation with local public and planning agencies whose area or any portion of whose area of jurisdiction is within the DNL contour depicted on the existing and future condition NEMs. The consultation also included Federal officials having local oversight responsibility and regular aeronautic users of the airport. It is further certified that adequate opportunity has been afforded interested persons to submit their views, data, and comments concerning the correctness and adequacy of the NEMs and the supporting documentation and forecasts.

December 23, 2016

Date of Signature

C. T. "Skip" Miller, A.A.E.

Executive Director

Louisville Regional Airport Authority

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Glossary

Acronym	Full Definition
ADO	Airports District Office
AEDT	Aviation Environmental Design Tool
ANAV	Accurate Navigation
ANSI	American National Standards Institute
ASNA	Airport Safety and Noise Abatement Act
ATADS	Air Traffic Activity Data System
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
CFR	Code of Federal Regulations
CNF	Community Noise Forum
dB	Decibel
DNL	Day-Night Average Sound Level
EIS	Environmental Impact Statement
ETMSC	Enhanced Traffic Management System Counts
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FMS	Flight Management System
FONSI	Finding Of No Significant Impact
GIS	Geographic Information System
GPS	Global Positioning System
HMMH	Harris Miller Miller & Hanson Inc.
HUD	Department of Housing and Urban Development
ICAO	International Civil Aviation Organization
INM	Integrated Noise Model
KYANG	Kentucky Air National Guard
LAAS	Local Area Augmentation System
LAIP	Louisville International Airport Improvement Program
LDA	Localizer type Directional Aid
LOJIC	Louisville and Jefferson County Information Consortium
LRAA	Louisville Regional Airport Authority

Acronym	Full Definition
NAVAIDS	Navigational Aid System
NCP	Noise Compatibility Program
NEM	Noise Exposure Map
NLR	Noise Level Reduction
RAA	Regional Airport Authority
RNAV	Area Navigation
ROA	Record of Approval
RSIP	Residential Sound Insulation Program
SDF	Louisville International Airport
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival Route
TAF	Terminal Area Forecast
UPS	United Parcel Service

1 INTRODUCTION

The emphasis on aircraft noise compatibility planning started with the passing of the Airport Safety and Noise Abatement (ASNA) Act of 1979. This act gave the Federal Aviation Administration (FAA) the authority to issue regulations on noise compatibility planning and provide a means for federal funding for projects dedicated to improving the noise environment around an airport. These regulations became the impetus for publishing Title 14 of the Code of Federal Regulation (CFR) Part 150.

As a result, 14 CFR Part 150 "Airport Noise Compatibility Planning,"[1] sets forth standards for airport operators to use in documenting noise exposure in their airport environs and for establishing programs to minimize noise-related land use incompatibilities. While participation in this program by an airport is voluntary, over 250 airports, including Louisville International Airport (SDF), have participated in the program, which assists in standardizing noise analysis at a national level. Airport participation provides access to federal funding for implementing any FAA-approved noise compatibility program measure. 14 CFR Part 150 includes two principal elements: (1) a Noise Exposure Map (NEM) and (2) a Noise Compatibility Program (NCP). The Louisville Regional Airport Authority (LRAA) is updating the NEM only at this time.

This volume presents the updated Noise Exposure Map documentation for Louisville International Airport, as required by the specific provisions of 14 CFR Part 150 Subpart B, Section 150.21, and Appendix A. A separate volume, "Noise Exposure Map Update Louisville International Airport Appendices", includes the Appendices referenced in the NEM documentation.

The purpose and goals of this NEM update are to:

- Update the SDF NEM to reflect current implementation of the Noise Compatibility Program and to reflect current and forecasted aircraft operations at SDF
- Collect, analyze and report information regarding current and forecasted operations as it relates to SDF aircraft noise and land use compatibility
- Continue implementation of the Noise Compatibility Program, in particular, the voluntary residential land acquisition program and sound insulation program
- Share data and information with the public

Appendix A of this document provides a reference to noise fundamentals and terminology. This chapter provides a historical perspective of the 14 CFR Part 150 at SDF (Section 1.1); a brief summary of the location and setting (Section 1.2); an introduction to 14 CFR Part 150 (Section 1.3); project roles and responsibilities (Section 1.4); and a completed copy of the FAA NEM review checklist (Section 1.5).

1.1 History of Noise and Land Use Compatibility at the Louisville International Airport

The existing aircraft noise and land use compatibility programs at SDF began with the 1990 Environmental Impact Statement (EIS) for the Louisville International Airport Improvement Program (LAIP). The LAIP EIS addressed the potential environmental impacts of: (1) the construction and use of parallel Runways 17L-35R and 17R-35L, (2) related airfield development projects, and (3) the acquisition and relocation of businesses and residential properties.

As part of the LAIP EIS, noise analyses were performed for 1988 (existing conditions) and future years 1995 and 2010 with and without the proposed project. The analyses concluded that overall noise exposure in the community would be substantially reduced with the LAIP in 1995 and 2010 as a result of (1) construction of the new parallel runways, (2) United Parcel Service's (UPS) commitment to operate only

[1] Title 14 of the Code of Federal Regulations (CFR) Part 150.

14 CFR Part 36 Stage 3 aircraft at the Airport, (3) acquisition of residential properties near the Airport, and (4) implementation of the following mitigation measures:

- Preferential daytime runway use program—maximum use of Runways 17L and 17R for departures (south flow)
- Contraflow aircraft operations (arrivals from the south and departures to the south) beginning no earlier than 10:00 p.m. and ending no later than 7:00 a.m.
- Straight-out, extended departure flight track procedures on Runways 17L, 17R, 35L, and 35R

The LAIP EIS acknowledged, however, that noise exposure would increase in some areas as a result of the new runways and associated flight tracks. By 2010, noise exposure levels were predicted to be significant south of the Airport in Minor Lane Heights and South Park View. As part of the LAIP EIS, the Regional Airport Authority of Louisville and Jefferson County[2] (RAA) committed to (1) soundproofing Minor Lane Heights Elementary School, the University of Louisville, and the historic residence at 2111 South Park Road; (2) undertaking other preventive and corrective land use measures; and (3) completing a 14 CFR Part 150 Noise and Land Use Compatibility Study.

As recommended by the LAIP EIS, the LRAA completed its first Noise Exposure Map in 1993. The official NEM provided maps for the existing and future conditions of 1991 and 1997, respectively. The FAA found the NEM in compliance with 14 CFR Part 150 requirements and accepted the NEM October 13, 1993. The FAA approved the associated NCP in 1994 and a supplemental NCP in 1995.[3]

In 2003, the LRAA submitted updated Noise Exposure Maps for 2003 and 2008 and an updated Noise Compatibility Program. The FAA found the 2003 and 2008 NEMs in compliance with 14 CFR Part 150 requirements effective on November 18, 2003 (Appendix B, Section 1). On May 14, 2004, the FAA approved in full 20 of the 42 measures proposed in the NCP Update. Of the remaining 22 measures, eight were approved in part, three were disapproved, four were disapproved for 14 CFR Part 150 purposes, and seven were categorized as "no action." The FAA took no action because additional technical and environmental analyses were required to determine feasibility and environmental impacts. The approvals indicate that the actions would, if implemented, be consistent with the purposes of 14 CFR Part 150. The FAA, on August 4, 2009, provided a Record of Approval (ROA) for three of the seven measures previously categorized as "no action." Copies of the May 14, 2004 and August 4, 2009 Record of Approvals are provided in Appendix C.

In 2011, the LRAA submitted updated Noise Exposure Maps for 2011 and 2016. The FAA found the 2011 and 2016 NEMs in compliance with 14 CFR Part 150 requirements effective on April 7, 2011 (Appendix B, Section 2).

1.2 Project Location and Setting

The Airport is located in Jefferson County approximately 5 miles south of downtown Louisville. The Airport is located within a built-up urban environment. Residential neighborhoods and commercial centers are located to the north, south, east, and west of the Airport.

The University of Louisville and the Kentucky Fair & Exposition Center (the Fairgrounds) are north of the Airport. Warehouses and industrial facilities are located south of the Airport along Fern Valley Road and Outer Loop Drive, including a Ford Motor Company plant and the Jefferson County Landfill. The

[2] The Regional Airport Authority of Louisville and Jefferson County provided operation and management of Louisville International Airport until 2003. In 2003 the City of Louisville annexed the area of Jefferson County forming a merged government. The name of the Airport governing body was then changed to the Louisville Regional Airport Authority (LRAA).

[3] FAA approved the NCP April 8, 1994 and a supplemental NCP November 13, 1995.

South Park View neighborhood is located near the intersection of Interstates 265 and 65. The east side of the Airport is bordered by Interstate 65 and the Edgewood neighborhood. The west side of the Airport is bordered by the CSX Railroad tracks and the Beechmont Neighborhood. A large industrial tract is located on the west side of Crittenden Drive, contiguous with the Airport.

Primary access to the Airport is provided via Interstate 264 (the Watterson Expressway), an east-west corridor on the north side of the Airport. Interstate 264 intersects Interstate 65 northeast of the Airport Interstate 65 parallels the Airport to the east and provides access to downtown Louisville and Interstate 265 (the Gene Snyder Freeway), located approximately 3 miles south of the Airport. Figure 1 shows the Airport and its surrounding area for reference.

1.3 14 CFR Part 150 Overview

14 CFR Part 150 sets forth a process for airport proprietors to follow in developing and obtaining FAA approval of programs to reduce or eliminate incompatibilities between aircraft noise and surrounding land uses. In establishing the requirements for the development of noise compatibility programs at airports, 14 CFR Part 150 prescribes specific standards and systems for:

- Measuring noise
- Estimating cumulative noise exposure
- Describing other means to assess the impacts of noise (including single aircraft event levels and cumulative levels)
- Coordinating Noise Compatibility Program development with local land use officials and other interested parties
- Documenting the analytical process used in developing compatibility program
- Submitting documentation to the FAA
- Providing for FAA and public review processes

As a result of applying these specific standards and systems, as stated earlier, 14 CFR Part 150 includes two formal submissions to the FAA: the NEM and the NCP. **The LRAA is updating the NEM only at this time.**

1.3.1 Noise Exposure Map

The NEM documentation describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting noise/land use compatibility situation. The aircraft noise exposure is expressed in decibels (dB) in terms of the Day-Night Average Sound Level (DNL).[4] Contours of equal DNL values, similar to topographic contours of equal elevation, form the basis for evaluating the noise exposure to the community. The NEM must address two time frames: (1) data representing the year of submission (the "existing conditions") and (2) the fifth calendar year or later following the year of submission (the "forecast conditions"). The NEM also addresses how the forecast operations will affect the compatibility of the land uses depicted. The primary objective is to describe the current and forecast conditions at the airport and the noise effects of the aircraft activity on the surrounding communities. While this description is normally processed into individual noise exposure maps, 14 CFR Part 150 requires more than a simple "map" to provide all the necessary information. The information required to provide the graphics and background for analysis include such tasks as:

- Collecting historical aviation activity data such as aircraft fleet mix, number and type of operations, aircraft departure weights, runway utilization

[4] Section 1.3.3 provides a brief overview of DNL. Noise metrics and noise effects are discussed in detail in Appendix A.

- Developing a forecast aircraft activity for a period at least five years in the future from the year representing the existing conditions
- Determining aircraft flight tracks and usage based on radar data, if available, or other source data
- Creating the necessary inputs to the FAA Integrated Noise Model using the average annual input conditions to include airport configuration, meteorological data, operations, etc.
- Obtaining approval for user-specified aircraft substitutions or profiles from the FAA
- Conducting supplemental noise measurements in accordance with 14 CFR Part 150, §A150.5, to better characterize any special noise effects on the community (optional and not included with this NEM update)
- Collecting data from local jurisdictions to establish detailed land use data in the airport environs
- Estimating population data within the local area

Therefore, in addition to the graphics, an extensive effort is made to document, through tabulated information and text discussions, the noise environment due to aircraft activity at the airport now and in the future. Thus, the NEM documentation describes the data collection and analysis undertaken in development and graphic depiction of existing and future noise exposure resulting from aircraft operations and the land uses in the airport environs. During the process, the airport initiates and maintains contact with the local airport community, via the previously formed Community Noise Forum, described in Section 1.4.3, to get the various perspectives on the modeling inputs. After considering all stakeholder and public comments, the airport sponsor submits the NEM document to the FAA, and, subsequent to a thorough review, the FAA makes a determination of compliance with the 14 CFR Part 150 standards.

The year of submission for this update is 2016. Therefore, the existing conditions noise contours are for 2016 and the five-year forecast case contours are for 2021.

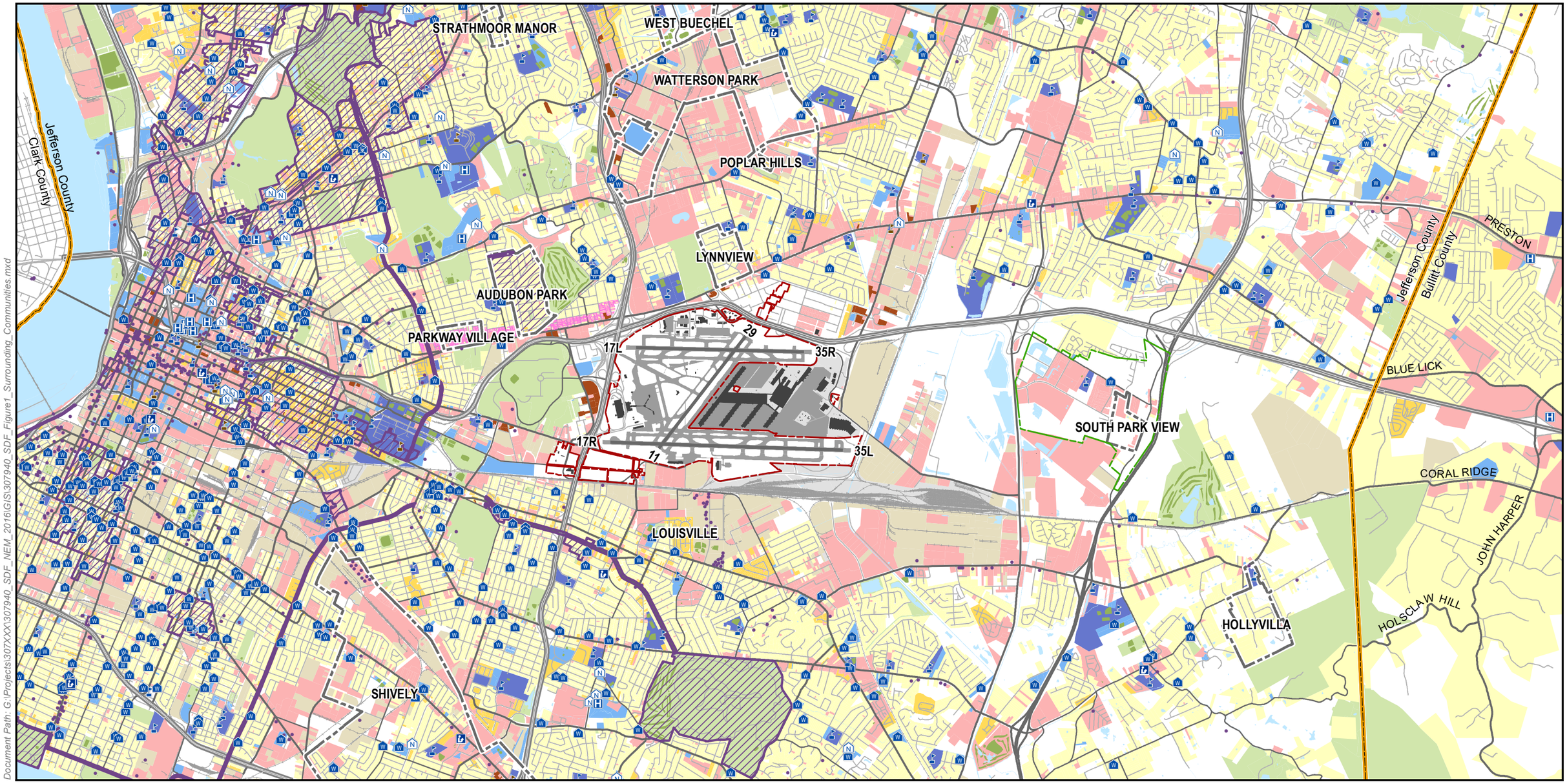
1.3.2 Noise Compatibility Program

The NCP is essentially a list of the actions the airport proprietor proposes to undertake to minimize existing and future noise/land use incompatibilities. This 2016 NEM Update reviewed the existing program measures and implementation status of the SDF NCP and suggested modifications in Section 2.

1.3.3 Day-Night Average Sound Level, DNL

In simple terms, DNL is the average noise level over a 24-hour period except that noises occurring at night (defined as 10:00 p.m. to 7:00 a.m.) are artificially increased by 10 dB. This weighting is intended to reflect the added intrusiveness of nighttime noise events attributable to the fact that community background noise levels decrease at night. More information on DNL (and other commonly used noise metrics) can be found in Appendix A.

14 CFR Part 150 requires airport noise studies to be based on computer modeled DNL contour estimates depicted in terms of equal-exposure 65, 70 and 75 dB noise contours. The LRAA has requested the 2016 NEM update also include the 60 dB DNL contour for information purposes only.



Document Path: G:\Projects\307XXX\307940_SDF_NEM_2016\GIS\307940_SDF_Figure1_Surrounding_Communities.mxd

Legend

- Airport Boundary
- Airport Relocation Area
- Runway
- Sound Insulation Completed
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

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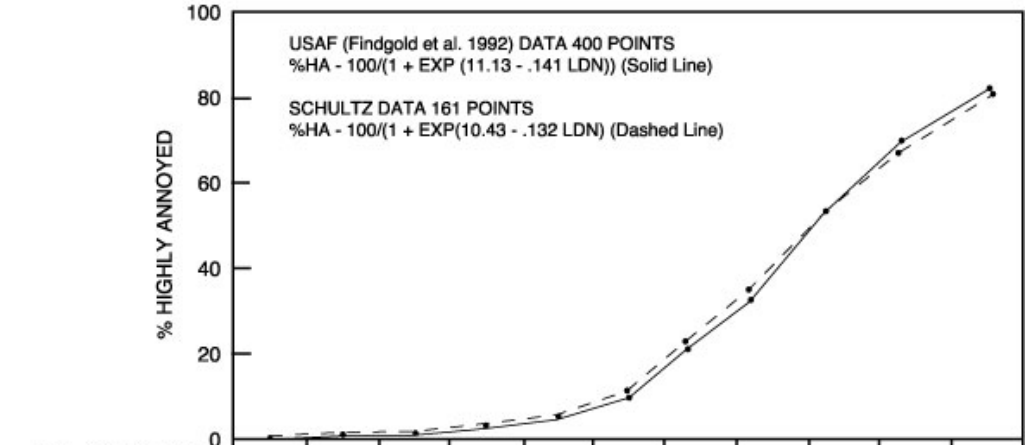
Figure: 1

Louisville International Airport and Surrounding Communities

1.3.4 Community annoyance

Numerous psychoacoustic surveys provide substantial evidence that individuals' reactions to noise vary widely for a given noise exposure level. However, since the early 1970's, researchers have determined and subsequently confirmed, that a community's aggregate response is generally predictable and relates reasonably well to measures of cumulative noise exposure, such as DNL. Figure 2 shows the widely recognized relationship between environmental noise and the percentage of people "highly annoyed," annoyance being the key indicator of community response usually cited in this body of research.



Day - Night Average Sound Level in dB	40	45	50	55	60	65	70	75	80	85	100
Calculated %HA Points: USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
Calculated %HA Points: SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Figure 2. Percentage of People Highly Annoyed

Source: Federal Interagency Committee on Noise, Vol. 2, Technical Report. "Federal Agency Review of Selected Airport Noise Analysis Issues". August 1992. (From data provided by USAF Armstrong Laboratory). pp. 3-6

This relationship shows that 12 to 13 percent of the exposed population will be highly annoyed at DNL levels of 65 dB, and that percentage increases to 22 to 23 percent at DNL levels of 70 dB.

1.3.5 Noise/Land Use Compatibility Guidelines

The FAA, other federal agencies, and several states have used the information on community reaction to noise to create guidelines for identifying the land uses that are compatible with which noise exposure levels – the more noise-sensitive the land use, the lower the noise exposure should be in order to achieve compatibility.

According to these FAA guidelines, all identified land uses, even the more noise-sensitive ones, normally are compatible with aircraft noise at DNL levels below 65 dB. The significance of this level is supported in a formal way by standards adopted by the U. S. Department of Housing and Urban Development (HUD). Part 51 of the Code of Federal Regulations indicates that areas exposed to DNL levels less than or equal to 65 dB are acceptable for HUD funding. Areas exposed to noise levels between 65 dB DNL and 75 dB DNL are "normally unacceptable," and require special abatement measures and review. Those at 75 dB DNL and above are "unacceptable" except under very limited circumstances.

FAA land use guidelines, as defined in 14 CFR Part 150 and reproduced here in Table 1, are unchanged since the previous Part 150 update and again used for this NEM update.

Table 1. 14 CFR PART 150 Noise/Land Use Compatibility Guidelines

Source: 14 CFR Part 150, Appendix A, Table 1

Land Use	Yearly Day-Night Average Sound Level, DNL, in Decibels					
	<65	65-70	70-75	75-80	80-85	>85
Residential Use						
Residential other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home park	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail--building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade--general	Y	Y	Y(2)	Y(3)	Y(4)	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Key to Table 1

SLCUM: Standard Land Use Coding Manual.

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

N(No): Land use and related structures are not compatible and should be prohibited.

NLR: Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35: Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes for Table 1

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under 14 CFR Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

1. Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often started as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2. Measures to achieve NLR of 25 dB 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 dB 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 dB 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. Land use compatible provided special sound reinforcement systems are installed.

6. Residential buildings require an NLR of 25.

7. Residential buildings require an NLR of 30.

8. Residential buildings not permitted.

1.4 Project Roles and Responsibilities

Several groups were involved in the development of the NEM update, including the Louisville Regional Airport Authority, the Federal Aviation Administration, the Community Noise Forum, airport users, and the consulting team.

1.4.1 Louisville Regional Airport Authority

As the "airport operator", the LRAA has authority over the NEM update study elements and submission to FAA. The LRAA retained a team of consultants to conduct the technical work required to fulfill the NEM analysis and documentation requirements, and to assist in public outreach and consultation. Section 1.4.4 describes the composition of the consulting team and the general assignment of responsibilities among its members.

The LRAA utilized the existing Community Noise Forum (CNF) to ensure that outside stakeholders were provided appropriate representation and involvement in this NEM update. The CNF is a key element of the comprehensive public involvement program conducted over the course of the NEM update, as described further in Section 6.1.

1.4.2 Federal Aviation Administration

For the NEM update, the FAA responsibility includes a review of the submission to determine that the technical work, consultation, and documentation comply with 14 CFR Part 150 requirements. The FAA must also approve the non-standard modeling requests, if any are proposed. The final role of the FAA is to accept or not accept the NEM update. FAA involvement includes participation by staff from at least two levels in the agency:

The ***Memphis Airports District Office (ADO)*** and/or ***Airports-Southern Region*** evaluates and accepts (or does not accept) the NEM and supporting documentation in accordance with 49 U.S.C. Section 47503 (enabled by the Aviation Safety and Noise Abatement Act of 1979).

FAA headquarters, in particular the ***Airport Planning and Environmental Division (APP-400) and the Office of Environment and Energy Noise Division (AEE-100)*** reviews and approves (or disapproves) of non-standard data inputs to the FAA Aviation Environmental Design Tool (AEDT). The FAA also provides Federal funding to complete the NEM update.

1.4.3 Community Noise Forum

The LRAA convened a Community Noise Forum to monitor the implementation of the NCP, and the CNF charter was adopted March 7, 2003.[5] The CNF is comprised of designated representatives from a broad spectrum of entities. These entities include the LRAA's Board of Directors, the LRAA Management, Louisville Air Traffic Control staff, Louisville Airport Affairs Committee, Kentucky Air National Guard, United Parcel Service, General Aviation community at SDF, University of Louisville, Louisville Metro Government, Airport Neighbors' Alliance, Southern Indiana, and community representatives from each quadrant bounding the airport.

The CNF formed the core advisory group during this NEM update process. The members are responsible for representing their constituents throughout the NEM update process, and review and provide comments

[5] The Community Noise Forum's charter is available at http://www.flylouisville.com/wp-content/uploads/CNF-Charter-amended-2012.pdf

on project material. The CNF also provides a medium for discussion of complex issues and sharing of differing perspectives on aircraft noise issues.

Section 6 discusses the public participation process, including the CNF participation, during the development of the NEM update for SDF.

1.4.4 Consulting team

The LRAA contracted with the consulting firm of ***HMMH*** to complete the technical work required for the NEM update. HMMH has overall project management responsibility for the NEM update, has responsibility for all noise-related technical elements, as well as responsibilities for airspace procedures, and assistance with land-use, airport plan and public outreach. Other elements of the NEM update were handled through a number of sub-consultant agreements:

C&S Engineers, Inc.(C&S) - in addition to discussions with airport users C&S reviewed the existing Master Plan Forecasts, the current FAA Terminal Area Forecast (TAF) forecast, and other publically available information to prepare the NEM update forecast that is reasonably consistent with recent developments at SDF. C&S Engineers, Inc. also coordinated, collected, and organized the base map and verified the land use data.

Guthrie/Mayes Public Relations - assisted with scheduling, announcing, and facilitating the public workshops and ongoing coordination between the LRAA staff and HMMH project team members.

1.5 FAA Checklist

The FAA has developed checklists for their internal use in reviewing NEM submissions. The FAA prefers that the Noise Exposure Map documentation include copies of the checklists. Table 2 presents a completed copy of the NEM checklist.

Table 2. 14 CFR Part 150 Noise Exposure Map Checklist

Source: FAA/APP, Washington, DC, March 1989; revised June 2005; reviewed for currency 12/2007[6]

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Louisville International Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
I. Submitting and Identifying the NEM:			
A. Submission properly identified:			
1. 14 C.F.R. Part 150 NEM?	X		Cover page, Section 1, p. 1
2. NEM and NCP together?		X	N/A Only NEM update
3. Revision to NEMs FAA previously determined to be in compliance with Part 150?	X		Section 1.1, p. 2
B. Airport and Airport Operator's name are identified?	X		Certification, p. iii
C. NCP is transmitted by operator's dated cover letter, describing it as a Part 150 submittal and requesting appropriate FAA determination?	X		Cover letter
II. Consultation: [150.21(b), A150.105(a)]			
A. Is there a narrative description of the consultation accomplished, including opportunities for public review and comment during map development?	X		Section 6, p.93
B. Identification of consulted parties:			
1. Are the consulted parties identified?	X		Section 6, p. 93
2. Do they include all those required by 150.21(b) and A150.105 (a)?	X		Section 6, p. 93
C. Does the documentation include the airport operator's certification, and evidence to support it, that interested persons have been afforded adequate opportunity to submit their views, data, and comments during map development and in accordance with 150.21(b)?	X		Section 6, p. 93
D. Does the document indicate whether written comments were received during consultation and, if there were comments that they are on file with the FAA regional airports division manager?	X		Certification p. iii and Section 6
III. General Requirements: [150.21]			
A. Are there two maps, each clearly labeled on the face with year (existing condition year and one that is at least 5 years into the future)?	X		Section 6 and Appendix O
B. Map currency:	X		Existing (2016) NEM is Figure 11; Forecast (2021) NEM is Figure 12
1. Does the year on the face of the existing condition map graphic match the year on the airport operator's NEM submittal letter?			

[6] http://www.faa.gov/airports/environmental/airport_noise/part_150/checklists/

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Louisville International Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
2. Is the forecast year map based on reasonable forecasts and other planning assumptions and is it for at least the fifth calendar year after the year of submission?	X		Cover letter; Figure 11 is 2011 existing NEM
3. If the answer to 1 and 2 above is no, the airport operator must verify in writing that data in the documentation are representative of existing condition and at least 5 years' forecast conditions as of the date of submission?	N/A		
C. If the NEM and NCP are submitted together:	N/A		NEM and NCP will not be submitted together
1. Has the airport operator indicated whether the forecast year map is based on either forecast conditions without the program or forecast conditions if the program is implemented?			
2. If the forecast year map is based on program implementation:			
a. Are the specific program measures that are reflected on the map identified?			
b. Does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?			
3. If the forecast year NEM does not model program implementation, the airport operator must either submit a revised forecast NEM showing program implementation conditions [B150.3 (b), 150.35 (f)] or the sponsor must demonstrate the adopted forecast year NEM with approved NCP measures would not change by plus/minus 1.5 DNL? [150.21(d)]			
IV. MAP SCALE, GRAPHICS, AND DATA REQUIREMENTS: [A150.101, A150.103, A150.105, 150.21(a)]	X		
A. Are the maps of sufficient scale to be clear and readable (they must be not be less than 1" to 2,000'), and is the scale indicated on the maps? (Note (1) if the submittal uses separate graphics to depict flight tracks and/or noise monitoring sites, these must be of the same scale, because they are part of the documentation required for NEMs.) (Note (2) supplemental graphics that are not required by the regulation do not need to be at the 1" to 2,000' scale)	X		1" to 5,000' scale of all map figures in main document with 1" to 2,000' scale maps of NEMs and flight tracks included in pocket folders
B. Is the quality of the graphics such that required information is clear and readable? (Refer to C. through G., below, for specific graphic depictions that must be clear and readable)			All figures
C. Depiction of the airport and its environs.	X		
1. Is the following graphically depicted to scale on both the existing condition and forecast year maps:			
a. Airport boundaries	X		Figure 11 (2016) and Figure 12 (2021) NEMs
b. Runway configurations with runway end numbers	X		

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Louisville International Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
2. Does the depiction of the off-airport data include?			
a. A land use base map depicting streets and other identifiable geographic features	X		Figures with geographic information delineates the boundaries and names of jurisdictions with planning and land use control authority in an area well beyond the DNL 65 dB
b. The area within the DNL 65 dB (or beyond, at local discretion)	X		
c. Clear delineation of geographic boundaries and the names of all jurisdictions with planning and land use control authority within the DNL 65 dB (or beyond, at local discretion)	X		
D. 1. Continuous contours for at least DNL 65, 70, and 75 dB?	X		All contour figures
2. Has the local land use jurisdiction(s) adopted a lower local standard and, if so, has the sponsor depicted this on the NEMs?		X	
3. Based on current airport and operational data for the existing condition year NEM, and forecast data representative of the selected year for the forecast NEM?	X		Certification letter, p. iii and Section 4.2 presents current and forecast operational data and other modeling inputs
E. Flight tracks for the existing condition and forecast year timeframes (these may be on supplemental graphics which must use the same land use base map and scale as the existing condition and forecast year NEM), which are numbered to correspond to accompanying narrative?	X		Figures 4 through 8
F. Locations of any noise monitoring sites (these may be on supplemental graphics which must use the same land use base map and scale as the official NEMs)		X	
G. Non-compatible land use identification:			
1. Are non-compatible land uses within at least the DNL 65 dB noise contour depicted on the map graphics?	X		Depicted on Figure 11 (2016) and Figure 12 (2021) NEMs. Tables 23 and 24 provide non-residential noise-sensitive receptor counts for 2016 and 2021
2. Are noise sensitive public buildings and historic properties identified? (Note: If none are within the depicted NEM noise contours, this should be stated in the accompanying narrative text.)	X		
3. Are the non-compatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	X		
4. Are compatible land uses, which would normally be considered non-compatible, explained in the accompanying narrative?	N/A		
V. NARRATIVE SUPPORT OF MAP DATA: [150.21(a), A150.1, A150.101, A150.103]			
A. 1. Are the technical data and data sources on which the NEMs are based adequately described in the narrative?	X		Section 4 presents current and forecast operational data and other modeling inputs; Appendix D

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Louisville International Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
2. Are the underlying technical data and planning assumptions reasonable?	X		
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	X		Section 4, p. 35; AEDT 2b
a. Is it FAA approved?	X		Section 4, p. 35; AEDT 2b
b. Was the same model used for both maps? (Note: The same model also must be used for NCP submittals associates with NEM determinations already issued by FAA where the NCP is submitted later, unless the airport sponsor submits a combined NEM/NCP submittal as a replacement, in which case the model used must be the most recent version at the time the update was started.)	X		
c. Has AEE approval been obtained for use of a model other than those that have previous blanket FAA approval?	N/A		
2. Correct use of noise models:			
a. Does the documentation indicate, or is there evidence, the airport operator (or its consultant) has adjusted or calibrated FAA-approved noise models or substituted one aircraft type for another that was not included on the FAA's pre-approved list of aircraft substitutions?	X		Letters requesting FAA approval and FAA response for aircraft substitutes and user-defined profiles See Appendices E, F, G, and H
b. If so, does this have written approval from AEE, and is that written approval included in the submitted document?	X		
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?	N/A		
4. For noise contours below DNL 65 dB, does the supporting documentation include an explanation of local reasons? (Note: A narrative explanation, including evidence the local jurisdiction(s) have adopted a noise level less than DNL 65 dB as sensitive for the local community(ies), and including a table or other depiction of the differences from the Federal table, is highly desirable but not specifically required by the rule. However, if the airport sponsor submits NCP measures within the locally significant noise contour, an explanation must be included if it wants the FAA to consider the measure(s) for approval for purposes of eligibility for Federal aid.)	N/A		The DNL 60 dB contour is shown for informational purposes only.
C. Non-compatible Land Use Information:			
1. Does the narrative (or map graphics) give estimates of the number of people residing in each of the contours (DNL 65, 70 and 75, at a minimum) for both the existing condition and forecast year maps?	X		Section 5.2 Table 25, p. 91
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	X		Section 1.3, p. 8

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Louisville International Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
a. If a local variation to table 1 was used:			
(1) Does the narrative clearly indicate which adjustments were made and the local reasons for doing so?	N/A		
(2) Does the narrative include the airport operator's complete substitution for table 1?	N/A		
3. Does the narrative include information on self-generated or ambient noise where compatible or non-compatible land use identifications consider non-airport and non-aircraft noise sources?	N/A		
4. Where normally non-compatible land uses are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?	N/A		
5. Does the narrative describe how forecast aircraft operations, forecast airport layout changes, and forecast land use changes will affect land use compatibility in the future?	X		Section 5.2, p. 82
VI. MAP CERTIFICATIONS: [150.21(b), 150.21(e)]			
A. Has the operator certified in writing that interested persons have been afforded adequate opportunity to submit views, data, and comments concerning the correctness and adequacy of the draft maps and forecasts?	X		Certification, p. iii
B. Has the operator certified in writing that each map and description of consultation and opportunity for public comment are true and complete under penalty of 18 U.S.C. Section 1001?	X		

2 EXISTING NOISE COMPATIBILITY PROGRAM

The LRAA developed the first SDF 14 CFR Part 150 NCP in 1993. A revised NCP was submitted to the FAA in 2003 and included a mix of noise abatement, program management, and land use elements. The FAA's Record of Approval (ROA) for the 2003 NCP was issued in May 2004 and listed the NCP elements in the order presented below. Italicized text is taken directly from the 2004 FAA ROA. In addition, the FAA prepared a second ROA in August 2009 that contains the FAA's approval/disapproval decisions for 3 of the 7 NCP measures that were previously deferred. Appendix C provides copies of both the May 2004 and August 2009 ROA.

On May 14, 2004, the FAA approved 20 of the 42 measures proposed. The approvals indicate that the actions would, if implemented, be consistent with the purposes of 14 CFR Part 150. Of those measures (22) not fully approved, eight were approved in part, three were disapproved, four were disapproved for 14 CFR Part 150 purposes, and seven were categorized as "no action." The FAA took no action because the data provided for those seven measures were insufficient to allow an approval/disapproval determination. On August 4, 2009, the FAA released another ROA to address the seven previously deferred "no action" measures.

2.1 Program Elements Summary – Aircraft Operational/Abatement Measures

This section contains a summary of the 18 aircraft operational/abatement measures submitted to the FAA in prior studies. A paraphrased summary of each measure is presented below in italics. The summary is followed by an evaluation of the measure to date. This NCP will not be altered as part of this NEM update. This discussion of the existing NCP is organized in the same manner as the FAA's ROA.

NA-1. Maintain South flow runway preference – Approved as Voluntary.

This measure would continue the current daytime preference for south flow when wind conditions permit except as revised in measure NA-3 below.

FAA Action (May 14, 2004): *Approved as voluntary. This measure continues a previously approved measure that places flights over areas to the south that are less densely populated.*

Implementation Status: Implemented

NA-2. Reverse East-West preference (Day and Night) – No action/Disapproved

Reverse the current runway use program to prefer the west runway. The trigger of 3 aircraft in the landing or departure queue currently used to direct air traffic to both runways would be retained. This measure would reduce the noise impacts within the DNL 65 contour to about 2,175 residents and 1,079 dwelling units but would increase noise over the University of Louisville, Old Louisville and neighborhoods to the northwest. Because students at U of L were not included in the impact analysis the number of students experiencing noise impacts is not known. The measure, if combined with Measure NA-7, would take advantage of a corridor of compatible land uses immediately north of the airport.

FAA Action (May 14, 2004): *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). A technical analysis of this measure in concert with Measures NA-3 and NA-7, and an environmental analysis, are required to determine its feasibility and environmental impacts. The FAA also will determine during any follow-on analysis whether the measure provides an overall net benefit to populations impacted, including the U of L, a requirement for approval under Part 150.*

FAA Action (August 4, 2009): Disapproved. This measure is disapproved because it is dependent/relational to NA-7 which is disapproved. Because the measure was disapproved operationally, no additional environmental study or analysis is necessary.

Implementation Status: Not Implemented

NA-3. Morning North flow Preference – No action/Disapproved

In conjunction with the offset approach and departure recommendation (NA-7), reverse the normal daytime runway use preference from south flow to north flow during morning hours 9:30 a.m. to 12:30 p.m. to minimize overflights of the University of Louisville and residential areas to the north of the airport. There are more aircraft arrivals than departures during this period at SDF.

FAA Action (May 14, 2004): *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). A technical analysis of this measure in concert with Measures NA-2 and NA-7, and an environmental analysis, are required to determine its feasibility and environmental impacts. Implementation of this measure would be in conjunction with NA-2 and NA-7 if approved. (This measure would modify measure NAA 7.1 in the 1995 ROA.)*

FAA Action (August 4, 2009): *Disapproved. This measure is disapproved because it is dependent/relational to NA-7 and NA-2 which were disapproved. Because the measure was disapproved operationally, no additional environmental study or analysis is necessary. Implementation Status: Implemented locally*

NA-4. Southbound Divergence According to Destination – Approved as Voluntary

Continue the current practice of obtaining necessary divergence between aircraft departing to the south by assigning aircraft to departure tracks based on their route of flight.

FAA Action (May 14, 2004): *Approved as voluntary. This is a continuation of a previously approved measure. The NCP states that no other tracks to the south would provide a greater noise benefit.*

Implementation Status: Implemented (Divergence 15º)

NA-5. Maintain Contraflow Program – Approved as Voluntary

Contraflow at SDF means that arrivals between 10:00 p.m. and 7:00 a.m. are to the north and departures are to the south (subject to weather, wind and operational demand). This directs air traffic south of the airport over southern Jefferson and Bullitt counties which are less densely populated and where mitigation (relocation) measures have been and continue to be implemented.

FAA Action (May 14, 2004): *Approved as voluntary. This measure is a combination of previously approved measures 7.1, 7.3 and 7.5 in the 1995 ROA and would help reduce the DNL 65 dB noise contour to the north over noise-sensitive areas.*

Implementation Status: Implemented

NA-6. Reduce exceptions to contraflow– Disapproved

Enhancement of existing measure. Airport owner would work with airlines to adjust arrival and departure times for scheduled flights to more closely conform to normal peak arrival and departure periods.

FAA Action (May 14, 2004): *Disapproved for purposes of Part 150. The FAA disapproves reducing exceptions to contraflow. Contraflow requires departing aircraft to be "aimed" directly at arriving aircraft, and greater use increases the potential for loss of separation between arriving and departing*

aircraft. This could cause substantial delay. This disapproval under Part 150 does not prohibit airport management from seeking cooperation from the airlines to adjust schedules of a voluntary basis to more closely conform to normal peak periods. Scheduling changes that reduce exceptions to contraflow will require consultation with FAA's Air Traffic office to determine whether they impact aircraft operational safety.

Implementation Status: Implemented

NA-7. Use an Offset Departure from Runway 35L and Offset Approach to Runway 17R – No action/Disapproved

This measure is to take advantage of an industrial corridor to the northwest of the runway to reduce the adverse effects of the recommended change in preferential use of the east and west runways (Measure NA-2). Aircraft not equipped with GPS/FMS would require installation of a Localizer type directional aid (LDA). It is assumed that a Local Area Augmentation System (LAAS) would be required for a Global Positioning System (GPS) approach. This measure would remove about 423 homes north of the airport from the DNL 65 contour.

FAA Action (May 14, 2004): *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). A technical analysis of this measure in concert with Measures NA-2 and NA-3, and an environmental analysis, are required to determine its feasibility and environmental impacts. FAA is concerned that adoption of the arrival portion of this measure would reduce runway arrival capacity by approximately one-third when the offset approach is in use. While we do not object in principle to the departure procedure as a voluntary measure, the NCP does not provide separate analysis for the departure procedure alone. The FAA will review the study results to determine whether this measure is feasible. At present, when parallel approaches are being conducted, current procedures allow for lateral separation of 2 miles between two aircraft landing on the parallel runways. Using an offset approach to RWY 17R, this separation standard would increase to 3 miles.*

FAA Action (August 4, 2009): *Disapproved. Operational procedures necessary to implement this measure were detailed in the supplemental supporting information provided by LRAA requesting FAA approval for implementation of an Offset Approach to Runway 17R outside of the Part 150 process. The result of the FAA's technical evaluation concluded the procedures were unacceptable and the request was disapproved. This measure cannot be implemented without reducing the level of aviation safety provided and adversely affecting the efficient use and management of the navigable airspace and air traffic control systems. Because the measure was disapproved operationally, no additional environmental study or analysis is necessary.*

Implementation Status: Not implemented.

NA-8. Designate departure and arrival flight tracks to be used by all turbojet and applicable turboprop aircraft weighing over 12,500 pounds Approved in part, as Voluntary

These measures have the effect of reducing the width of noise contours and noise exposure as measured in grid point analyses by reducing aircraft dispersion around the existing flight tracks (New Measure). Conformance to recommended noise abatement flight tracks by non GPS/FMS or RNAV equipped aircraft would require the installation of navigational aids to define each course segment.

FAA Action (May 14, 2004): *Approved in part, as voluntary. Airport management may work with SDF ATCT to designate flight tracks within existing approved corridors. FAA's Flight Standard's office (ESO-31) must review these procedures before they may take effect. This measure is disapproved for new noise abatement flight tracks outside of existing corridors. It is noted that there is no request in this NCP for*

FAA approval, or a commitment by FAA, to install NAVAIDS to be used as departure navigational aids. At this time, FAA has suspended RNAV departure procedure development.

Implementation Status: Partially implemented

NA-9. Assign GPS/FMS or RNAV equipped aircraft to defined FMS/GPS Departure and Arrival Flight Tracks for Turbojet and Military Aircraft Approved in part, as Voluntary

The tracks recommended for this measure are generally consistent with those defined in Measure NA-8 above but are defined using area navigation (RNAV) capabilities, either satellite or ground based to reduce or eliminate the need for additional ground based facilities to define tracks.

FAA Action (May 14, 2004): *Approved in part, as voluntary. Flight tracks may be defined within existing or approved flight corridors. There are a number of actions necessary to implement the recommended ANAV procedures. Most of the required actions are the responsibility of FAA, primarily its Air Traffic Division.*

This measure is disapproved for new noise abatement flight tracks outside of existing corridors. There is no request for approval in this NCP, nor any commitment by FAA, to install NAVAIDS to be used as departure navigational aids. At this time, FAA has suspended RNAV departure procedure development.

Implementation Status: Partially implemented

NA-10. FMS/GPS Departure and Arrival Flight Tracks for Turboprop Aircraft weighing over 12,500 pounds – Approved in part, as Voluntary

Place FMS/GPS equipped turboprop aircraft on different departure tracks from those defined for turbojet aircraft in Measure NA-9 to minimize impact on departure capacity. This is to reduce aircraft dispersion around the existing flight tracks. Direct routes or earlier turns would be provided consistent with noise abatement goals to enhance conformance.

FAA Action (May 14, 2004): *Approved in part, as voluntary. Flight tracks may be defined within existing or approved flight corridors. This measure is disapproved for new noise abatement flight tracks outside of existing corridors.*

Implementation Status: Partially implemented

NA-11. Request FAA ATCT to require all aircraft to intercept the runway centerline at or beyond the initial approach fix – No action

Compliance with this measure would require limiting use of visual approaches that do not conform to the approach paths defined by the instrument approaches and result in arriving aircraft intercepting the glide slope at higher altitudes.
FAA Action: (May 14, 2004) *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). A technical evaluation on feasibility and environmental impacts should examine the measure's effects on aircraft safety, capacity, and efficiency.*
Implementation Status: Implemented locally

NA-12. Request FAA to publish a Standard Instrument Departure (SID) Procedure for each runway to be used in all weather conditions, including VFR conditions – No action

SIDs would be developed to enhance conformance to the recommended noise abatement departure procedures. These procedures would include instructions for following each segment of proposed departure flight tracks based on navigational equipment available. Inclusion of the ANAV would reduce dispersion of aircraft over noncompatible land uses.

FAA Action (May 14, 2004): *No action required at this time under 49 U.S.C. section 47504(b). This measure is to publish SIDs for flight procedures proposed in the NCP. The FAA has deferred action on those flight procedures because they require additional technical and other analyses. Implementation of this measure would be subject to: FAA approval of the proposed equipment to be used; development of the procedures in conjunction with airlines operating at SDF (primary carriers); and development of special charting and flight-testing. The FAA notes that there is no request in this NCP for FAA approval, or a commitment by FAA, to install NAVAIDS to be used as departure navigational aids. Not all air carrier aircraft would be equipped with devices that would allow them to utilize these procedures.*

Implementation Status: Implemented

NA-13. Request FAA to publish a Standard Terminal Arrival Route (STAR) for each runway to be used in all weather conditions including VFR conditions – No action

These procedures would include instructions for following each segment of proposed arrival flight tracks based on navigational equipment available.

FAA Action (May 14, 2004): *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). The FAA has deferred action on noise abatement approach procedures that would use the recommended STARs (NA-7, NA-11). The FAA notes that STAR guidance typically terminates 15-20 miles from the airport, and may be of little value in reducing noise. The results of the required studies for the deferred measures should specify changes to impacts and benefits so that FAA can make an informed determination under Part 150.*

Implementation Status: Implemented

NA-14. As part of an ongoing noise management program, extend noise abatement flight tracks beyond those identified in Measure NA-8 through NA-11 – No action

This would enable aircraft operators to conform more closely to recommended flight tracks over noise sensitive areas that are beyond the noise contours. Implementation would require more detailed information on the land uses affected and the effects on airspace and air traffic control than is possible in this [part 150] study. Development of flight procedures should be conducted in consultation with FAA, aircraft operators, and members of potentially affected communities.

FAA Action (May 14, 2004): *No action required at this time. This measure relates to flight procedures under 49 U.S.C. section 47504(b). There is insufficient information to determine either the noise benefits or operational impacts of extending the flight tracks. Environmental analysis would be required. This measure attempts to address impacts outside of the DNL 65 dB noise contour. Because it could introduce operational delay, analysis should show how any additional aircraft operational delay is offset by the expected benefits in those areas.*

Implementation Status: In progress locally

NA-15. Elimination of early descent – Disapproved

Current approach procedures allow aircraft to descend to the initial approach altitude prior to the initial approach point if directed by ATC. Under this measure, RAA would discourage ATC from directing descents earlier than required to maintain a constant rate of descent to the initial approach while maintaining adequate safety margins.

FAA Action (May 14, 2004): *Disapproved. This measure, if changed as described, would have the effect of "prohibiting descents" rather than "discourage descents" below the minimum, published altitude at those fixes. Any aircraft, including smaller fixed-wing and helicopters operating from any nearby base of operations would be required to climb to a minimum of the published altitude for any given fix until reaching that fix. The existing 2500' authorization for reduced altitudes was added at ATC's request for operational efficiency.*

Requiring aircraft to remain at or above 5000 feet would remove two IFR altitudes (3000 and 4000 feet) from ATC use, effectively reducing airspace by 25%. Implementing this proposal would restrict the ability of ATC to perform functions in a safe efficient manner. The NCP acknowledges, at page 8-10, that "In practice, modification to approach procedures are likely to entail unacceptable reductions in safety margins."

Implementation Status: Not implemented

NA-16. Request the airlines serving the airport to use the FAA Distant Noise Abatement Departure Procedure in Advisory Circular (AC) 91-53A, Noise Abatement Departure Procedure – Approved as Voluntary

This measure would benefit areas exposed to departure noise of DNL 65+ from Runways 35R, 35L, and 17L.

FAA Action (May 14, 2004): *Approved as voluntary. RAA can request the airlines follow the Distant Noise Abatement Procedure.*

Implementation Status: Implemented

NA-17. Continue Airport regulation restricting aircraft engine run-ups to certain hours and locations – Approved

FAA Action: (May 14, 2004) Approved. FAA approved as noise beneficial in 1994 the following run-up measures in the RAA's previous Part 150 submittal:

- *Require RAA pre-approval to conduct static run-ups between 9:00 p.m. and 7:00 a.m.*
- *Require run-ups lasting more than 1 minute to be conducted on the south end of Runway 1/19*
- *Require run-ups lasting more than 1 minute to be conducted on the east parallel taxiway at the south end of Runway 17R/35L*

Implementation Status: Implemented

NA-18. NA-18. Limit use of North runway extension to aircraft needing full runway length and use south extension for departures to the north – Disapproved

FAA Action (May 14, 2004): *Disapproved pending submission of additional information to make an informed analysis. FAA's 2003 Finding of No Significant Impact for the proposed north runway extension included a mitigation commitment that only aircraft requiring the full runway length for departures would use either runway extension. The ATCT has granted a waiver allowing some procedures based on the runway being declared departure only between the hours of 3:30 AM to 6:00 AM local time. The NCP*

speculates, but does not show, how this measure is more noise beneficial than that included in the 2003 FONSI. Changes to operational procedures also would require environmental analysis.

Implementation Status: Not Implemented

2.2 Program Elements Summary – Noise Mitigation Measures

This section contains a summary of the 19 noise mitigation measures submitted to the FAA in prior studies. The noise mitigation measures include remedial, preventive, and compensatory measures. The NCP states that implementation of some measures would be dependent upon the availability of noise program funding through FAA grants and the ability of the LRAA to devote the necessary matching funds for these programs

M-1. Continue the current Voluntary Residential Acquisition Program including the Innovative Housing Program – Approved

FAA Action (May 14, 2004): *Approved. Voluntary acquisition must comply with the Uniform Relocation and Real Property Acquisition Policies Act in order to be eligible for Federal funding. (Approved as measure LU #11A, #11B, & #11C in ROA 1994 and amended in ROA 1995.)*

Implementation Status: Implemented

M-2. Expanded Voluntary Residential Acquisition within the DNL 65 db to the south of the airport that will continue to be exposed to significant noise levels in 2008 – Approved

FAA Action (May 14, 2004): *Approved. Voluntary acquisition must comply with the Uniform Relocation and Real Property Acquisition Policies Act in order to be eligible for Federal funding. (Expansion of measure LU #11C, ROA 1995.)*

Implementation Status: Implemented- Continuing to work in conjunction with M-1

M-3. Provide soundproofing in residential areas within the DNL 65 dB contour to the north of the airport – Approved

Eligibility of individual structures would depend on the feasibility of achieving at least a 5.0 dB noise level reduction as required by FAA. (Measure LU#11 in ROA 1955 and considered in the LAIP EIS but not implemented with new runways construction.)

FAA Action (May 14, 2004): *Approved.*

Implementation Status: Implemented.

Revision proposed to remove the words ‘to the north of the airport’. This would allow for the possible soundproofing of residential areas in new areas of non-compatible land use.

M-4. Offer sound insulation for non-compatible institutional areas within DNL 65 (Potentially University of Louisville & additional churches) – Approved

FAA Action (May 14, 2004): *Approved. The airport sponsor made a commitment to soundproof the University of Louisville in the FAA's 1991 EIS. The sponsor has not yet fulfilled that commitment (see LAIP EIS page 1-30, FEIS, Addendum I, page 8 and FAA Record of Decision, January 7, 1991, p.18). This approval under Part 150 acknowledges that the measure would be noise beneficial.*

Implementation Status: In Progress. LRAA initiated a feasibility study in 2015 to determine eligibility of University of Louisville structures within the DNL 65 dB contour of the current FAA accepted Noise Exposure Map.

M-5. Residential Sales Assistance Program within DNL 65 dB Approved

Concurrently with the residential soundproofing program for areas within the DNL 65 contour, offer sales assistance to homeowners declining to participate in the soundproofing program.

FAA Action (May 14, 2004): *Approved. Implementation of this measure must comply with the Uniform Relocation and Real Property Acquisition Policies Act to be eligible for Federal funding.*

Implementation Status: Not Implemented

M-6. Construct an earth berm along the northwest side of the airfield to reduce ground noise associated with aircraft takeoffs on Runway 17R – Approved

FAA Action (May 14, 2004): *Approved. The RAA estimates that over 200 homes could receive a 5-7 dBA reduction in departure noise. This measure also was included in the November 21, 2003, FONSI for the runway extensions.*

Implementation Status: Implemented

M-7. Study potential noise barrier for Preston Park neighborhood – Approved

New airport facilities are anticipated in the southeast portion of the airport. The RAA would fund a study to determine whether such facilities could be constructed and oriented to shield areas to the east of the airport from ground noise originating in the immediate vicinity of the structures.

FAA Action (May 14, 2004): *Approved for study.*

Implementation Status: Not implemented

M-8. Construct Ground Run-up Enclosure (Hush Houses) if required to reduce noise from maintenance run-up activity – Disapproved

This measure should be given further consideration if changes in the pattern of engine run-ups generate community concerns

FAA Action (May 14, 2004): *Disapproved pending submission of additional information to make an informed analysis. Construction of run-up enclosures must be supported by sufficient analysis to demonstrate their noise benefits.*

Implementation Status: Not implemented

M-9. Residential sound insulation for areas between DNL 60 and DNL 65 that would experience a 3 dB increase in noise levels as a result of recommended noise abatement measures – Disapproved

FAA Action (May 14, 2004): *Disapproved for purposes of Part 150. Section 189 of Public Law 108-176, Vision 100-Century Of Aviation Reauthorization Act, December 12, 2003, specifically prohibits FAA approval of Part 150 program measures that call for Federal funding to mitigate aircraft noise below DNL 65 (through Fiscal Year 2007).*

Implementation Status: Not implemented

M-10. Offer sound insulation to non-compatible institutional land uses (examples, portions of University of Louisville and churches) between DNL 60 to DNL 65 that would experience a 3 dB increase in noise levels from the noise abatement measures – Disapproved

FAA Action (May 14, 2004): *Disapproved for purposes of Part 150. Section 189 of Public Law 108-176, Vision 100-Century Of Aviation Reauthorization Act, December 12, 2003, specifically prohibits FAA approval of Part 150 program measures that call for Federal funding to mitigate aircraft noise below DNL 65 dB(through Fiscal Year 2007).*

Implementation Status: Not implemented

M-11. Compatible Land Use Planning – Approved in part

The RAA would coordinate with the Planning Commission to adopt policies in its Cornerstone 2020 Plan to discourage new non-compatible development and disclose noise levels for new residential development. Measures to provide notification for new development would apply to DNL 60 dB and to areas within DNL 65 dB that are already substantially developed.

FAA Action (May 14, 2004): *The portion of this measure that permits new incompatible development within the DNL 65 dB, even with sound attenuation and/or disclosure, is inconsistent with the FAA's guidelines and 1998 policy and is disapproved for the purposes of Part 150. Other portions of this compatible land use planning measure that do not permit incompatible development within the DNL 65 dB noise contour are approved for the purposes of Part 150. This decision relates to the measure's consistency with the purposes of Part 150. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning.*

Implementation Status: Partially implemented

M-12. RAA would coordinate with the Planning Commission to adopt a policy concerning rezoning from compatible to non-compatible uses in the Airport environs –Approved

FAA Action (May 14, 2004): *Approved. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning.*

Implementation Status: Not implemented

M-13. Subdivision Regulations – Approved in part

The RAA would coordinate with the Planning Commission to include a noise disclosure statement for new subdivisions in Policy Areas 1 & 2, Cornerstone 2020 Plan. This would allow future residents to make informed land purchase decisions.

FAA Action (May 14, 2004): *The portion of this measure that permits new incompatible development within the DNL 65 dB, even with sound attenuation and/or disclosure, is inconsistent with the FAA's guidelines and 1998 policy and is disapproved for the purposes of Part 150.*

Other portions of this compatible land use planning measure that do not permit incompatible development within the DNL 65 dB noise contour are approved for the purposes of Part 150. This decision relates to the measure's consistency with the purposes of Part 150. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning.

Implementation Status: Not implemented

M-14. RAA would considere participation in a Redevelopment Program (Renaissance Zone Program) initiative – Approved in part

RAA would consider participation in a Redevelopment Program (Renaissance Zone Program) initiative that would redevelop areas in the Airport environs as part of a joint effort with the Fairgrounds, UPS, and Ford Motor Company. In conjunction with other participants, the RAA will work with the City of Louisville and Jefferson County to develop incentives for compatible development.

FAA Action (May 14, 2004): *The portion of this measure that permits new incompatible development within the DNL 65 dB, even with sound attenuation and/or disclosure, is inconsistent with the FAA's guidelines and 1998 policy and is disapproved for the purposes of Part 150.*

Other portions of this compatible land use planning measure that do not permit incompatible development within the DNL 65 dB noise contour are approved for the purposes of Part 150.

This decision relates to the measure's consistency with the purposes of Part 150. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning.

Release of land under control of the RAA must comply with FAA grant agreements, be consistent with FAA's Eligibility Handbook to preserve compatible land uses, and is subject to environmental review.

Implementation Status: Implemented

M-15. RAA would work with the Planning Commission to develop an overlay zone, to supplement other land use planning techniques – Approved in part

The RAA would work with the Planning Commission to develop an overlay zone, to supplement other land use planning techniques. This would be based on the 2007 NEM to be reflected in the Core Graphics section of the Cornerstone 2000 Plan

FAA Action (May 14, 2004): *The portion of this measure that permits new incompatible development within the DNL 65 dB, even with sound attenuation and/or disclosure, is inconsistent with the FAA's guidelines and 1998 policy and is disapproved for the purposes of Part 150.*

Other portions of this compatible land use planning measure that do not permit incompatible development within the DNL 65 dB noise contour are approved for the purposes of Part 150.

This decision relates to the measure's consistency with the purposes of Part 150. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning. We note that the official NEMs are for the years 2003 and 2008.

We note that the official NEMs are for the years 2003 and 2008. The document states that the 2008 NEM was based on a review of forecasts for the year 2007. The FAA assumes the reference to the "2007 NEM" in this measure is a reference to the official 2008 NEM.

Implementation Status: Not implemented

M-16. Building Code Revision – Approved in Part

The RAA would work with the Commonwealth of Kentucky to develop and adopt enabling legislation either permitting local building code provisions or incorporating sound insulation provisions in the statewide building code.

FAA Action (May 14, 2004): *The portion of this measure that permits new incompatible development within the DNL 65 dB, even with sound attenuation and/or disclosure, is inconsistent with the FAA's guidelines and 1998 policy and is disapproved for the purposes of Part 150.*

Other portions of this compatible land use planning measure that do not permit incompatible development within the DNL 65 dB noise contour are approved for the purposes of Part 150.

This decision relates to the measure's consistency with the purposes of Part 150. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no control over local land use planning.

Implementation Status: Not implemented

M-17. Consider Disclosure Ordinances – Approved

Work with local governmental bodies to examine the feasibility of ordinances to require disclosure of airport noise exposure within designated distances from the airport and/or documented levels of exposure. Disclosure would be for vacant and residentially developed properties within the DNL 65+ dB and DNL 60-65 dB noise contours.

FAA Action (May 14, 2004): *Approved. This measure is within the authority of the RAA and local planning jurisdiction. The Federal Government has no authority over local land use planning decisions.*

Implementation Status: Not implemented

M-18. Avigation easement purchase within DNL 65 – Approved

The RAA would purchase avigation easements from homeowners in areas eligible for residential soundproofing and sales assistance who do not believe they would benefit from either program. Program implementation would be contingent upon FAA grant funding.

FAA Action (May 14, 2004): *Approved.*

Implementation Status: Not implemented

M-19. Avigation easement purchase within DNL 60 to DNL 65 – Disapproved

The RAA would offer to purchase avigation easements from home owners in areas exposed to DNL 60 to DNL 65 noise levels that experience a 3 dB increase in noise exposure and that are eligible for residential soundproofing and sales assistance who do not believe they would benefit from either program

FAA Action (May 14, 2004): *Disapproved for purposes of Part 150. Section 189 of Public Law 108-176, Vision 100-Century Of Aviation Reauthorization Act, December 12, 2003, specifically prohibits FAA approval of Part 150 program measures that call for Federal funding to mitigate aircraft noise below DNL 65 (through Fiscal Year 2007).*

Implementation Status: Not implemented

2.3 Program Elements Summary – Program Management Measures

The recommended program management measures are to enhance the effectiveness of both the noise abatement and mitigation measures through continuing stakeholder coordination, research and development, data collection, and dissemination of program information.

PM-1. Establish new RAA staff position dedicated to management of noise compatibility program – Approved

Incumbent performs duties associated with data collection and analysis, implementation, liaison and further study. (This position has been established.)

FAA Action (May 14, 2004): *Approved.*

Implementation Status: Implemented

PM-2. Establish Advisory Committee – Approved

Establish advisory committee composed of community, user and air traffic control interests to maintain coordination among the stakeholders in the noise compatibility program

FAA Action (May 14, 2004): *Approved.*

Implementation Status: Implemented

PM-3. Acquire Portable Noise Monitoring Equipment – Approved

Acquire portable noise monitoring equipment to enable the Authority's Noise/Environmental Programs Coordinator to monitor actual noise and provide accurate information to community members.

FAA Action (May 14, 2004): *Approved. For reasons of aviation safety, this approval does not extend to use of the monitoring equipment for enforcement purposes by in situ measurement of any present noise thresholds.*

Implementation Status: Implemented

PM-4. Acquire Equipment to Monitor Aircraft Operations – Approved

Acquire equipment to monitor aircraft operations and establish a regular program of monitoring and reporting conformance with recommended noise abatement procedures.

FAA Action: (May 14, 2004) *Approved. For reasons of aviation safety, this approval does not extend to use of the monitoring equipment for enforcement purposes by in situ measurement of any present noise thresholds.*

Implementation Status: Implemented

PM-5. Airport Noise Office to collect and disseminate information – Approved

The RAA would use the Airport Noise Office as a central point to collect and disseminate information.

FAA Action (May 14, 2004): *Approved.*

Implementation Status: Implemented

3 LAND USE

The Airport is centrally located within a predominantly urbanized area, with the exception of areas south of the Gene Snyder Freeway (I-265). Noise sensitive residential and public land uses are located throughout the study area. The area north of the Airport contains a greater mixture of land uses, particularly in the downtown area adjacent to the Ohio River. This part of the study area is more urban in character and contains neighborhoods that are designated as historic districts by the Landmarks Commission and City of Louisville. Such neighborhoods/districts include Old Louisville, Limerick, Shelby Park, Audubon Park, and Cherokee Triangle.

The area to the south of the Airport includes the 5,000-acre Jefferson Memorial Forest and the communities of Fairdale and Okolona. Minor Lane Heights was a community in this area that was subject to the LRAA's existing land acquisition program and is now essentially vacant. A significant number of other parcels are currently undeveloped or used for agricultural purposes.

To create the GIS base map layers, data were collected and processed from Louisville/Jefferson County Information Consortium (LOJIC), the latest Louisville Planning and Zoning data, existing sound mitigation program boundaries, and airport layout information. The Airport Layout Plan layers include the airport property line, taxiway, runway information and airport buildings.

Land use data for the study area were developed from a number of sources. Existing zoning or land use maps were researched and updated to provide applicable information. The LOJIC database was the main source of land use information for Louisville Metro.[7] The Bullitt County Comprehensive Plan provided the source for similar information for the most southern portions of the study area.

Noise-sensitive land use locations were field-verified, as identified per 14 CFR Part 150 guidelines, within the boundaries of the expected 65 dB DNL contours. Land use data were developed out to 60 dB DNL without field verification. Land use data development within the 60 dB DNL and within Bullitt County is based on existing aerial photography in conjunction with the Bullitt County Comprehensive Plan.

Existing land uses were grouped in the following nine categories: Single-family Residential, Multi-family Residential, Commercial, Manufacturing, Public/Government Use, Education, Parks/Cemeteries/ Recreation, Transportation and Vacant. The single-family category includes all types of detached residential units, whereas the multi-family category includes all types of attached dwelling units, including duplexes, townhouses, and apartments. The commercial category includes all types of retail and business uses, as well as offices. The manufacturing use classification includes manufacturing and warehousing. The public/government use classification includes uses such as the University of Louisville,[8] libraries, places of worship, City- or County-owned properties used for governmental purposes, and the Fairgrounds. The parks/cemeteries/recreation category includes all publicly or privately owned lands held for park, conservation, or golf course uses and cemeteries. This category would include the Jefferson Memorial Forest, located south of the Airport along the Jefferson and Bullitt County border, and Iroquois Park, located west of the Airport. The transportation classification is a factor of activity and location comprising all properties dedicated to transportation resources and including properties owned by the LRAA for airport-related purposes.

[7] Louisville Metro was established in 2003 when the City of Louisville merged with Jefferson County.

[8] The University of Louisville has multiple land uses within its property which, based on conversations with the university, has been identified as educational use for purposes of this study.

3.1 Jurisdiction and Zoning around the Airport

Zoning and subdivision regulations are in effect for the entire study area. Existing zoning information was readily available for the Jefferson County portion of the area. Much of the area south of the Airport is currently zoned Enterprise Zone (EZ1) and Industrial (M3).

3.2 Compatible Land Use Analysis

Since land use outside of 65 dB DNL is considered "compatible" for purpose of 14 CFR Part 150, the analysis within 60 to 65 dB DNL only included an inventory of the estimated population and noise sensitive locations. The land use compatibility guidelines contained in 14 CFR Part 150, which are based on empirical studies of the correlation between reported levels of annoyance and levels of cumulative noise exposure, provide a description of the types of land uses that are most "sensitive" to airport related noise. For example, residential uses (including mobile home parks and transient lodgings), schools, and amphitheaters are considered incompatible with noise levels of 65 dB DNL or greater. Other uses, including hospitals, nursing homes, churches and auditoriums, are also considered incompatible within levels of 65 dB DNL or greater.

3.3 Land Use Measures

Planning and land use regulatory authority for Kentucky is authorized by state statute, which requires comprehensive planning as a prerequisite for the establishment of land use regulations and authorizes the creation of joint planning agencies. Where joint planning commissions are established, the commission prepares and adopts the comprehensive plan and administers the land use regulations. The applicable legislative bodies also adopt the comprehensive plan and land use regulations. The legislative bodies are also responsible for final decisions on zoning map amendments, although planning commissions have final approval authority for subdivisions.

3.3.1 Land acquisition and relocation

With the 1991 FAA approval of the expansion of SDF, a land acquisition and relocation plan was begun in areas near to the airport surroundings. The initial phase included relocating more than 4,000 people in 1,581 homes as well as 150 businesses on 100 business properties in the Standiford, Prestonia, Highland Park, and Tuberose areas. This effort evolved into a Voluntary Residential Relocation Program that concentrated on relocating those people within the FAA-approved 65 DNL contour for SDF. Through the years this program has resulted in 2,159 more residences approved for acquisition in the neighborhoods of Edgewood, Ashton Adair, along Preston Highway, and in the Minors Lane area. In conjunction with the Louisville Airport Improvement Program, 3,705 of the 3,740 families in the most noise-impacted areas near the Airport have been relocated to quieter neighborhoods as of July 31, 2016.

The relocation became so successful that it placed a drain on comparable homes in the local area with fewer homes available in the related price category. The LRAA and FAA worked cooperatively to develop an innovative program using $10 million in grants from both entities to purchase and develop the infrastructure on a 287-acre site. This established the Heritage Creek program under which the LRAA reimburses those displaced families to build new homes in that area.

The Voluntary Residential Relocation Program currently supports the traditional purchase program and the Heritage Creek Program. Both programs offer families the opportunity to move from their noise-affected homes, which are demolished upon vacating. In addition, the acquired and vacated land has been designated for uses to benefit SDF, the City of Louisville, and the Commonwealth of Kentucky. Former neighborhoods contain airport related functions (e.g., Fixed Base Operator [FBO], Kentucky Air National

Guard [KYANG], SDF maintenance facility and fuel farm) while others are identified for commercial and industrial redevelopment or other non-residential uses.

3.3.2 Sound insulation

One of the recommended and approved measures of the 2003 NCP (M-3, summarized in Section 2.2, M-3) provided a means for the LRAA to develop a Residential Sound Insulation Program (RSIP). The program focused on those incompatible residential uses to the north of the airport within the 65 dB DNL and higher noise contours. Approved sound insulation program areas are depicted on the NEMs (Figure 10 and Figure 11).

The objective of RSIP is to provide interior noise levels compatible with normal indoor activities. Sound attenuation treatments typically include acoustical windows, doors, and other treatments to reduce the penetration of aircraft noise into the living spaces. Participation in the RSIP is voluntary for those residential units inside the FAA-approved 65 dB DNL contour. The goals of the program are to provide an interior aircraft noise environment not to exceed 45 dB DNL indoors and provide a noticeable improvement, which is at least a 5 dB increase in noise level reduction of the structure. Upon completion of the construction and verification of goal attainment, the soundproofed residential units are then considered compatible with the aircraft noise exposure levels.

The program is generally broken into groups of residences by area or phase. As of September 30, 2015 construction has been completed on 542 residential units within Phases 1-7 of the program.

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4 DEVELOPMENT OF NOISE CONTOURS

The DNL contours were prepared using the most recent release of the FAA's AEDT (Aviation Environmental Design Tool), Version 2b. AEDT requires inputs in the following categories:

- Physical description of the airport layout
- Number and mix of aircraft operations
- Day-night split of operations (by aircraft type)
- Runway utilization rates
- Prototypical flight track descriptions
- Flight track utilization rates

The model was used without any unauthorized "calibration" or "adjustment." Contour input was developed using proprietary flight track pre-processing software that provides greater detail to the modeling process by improving the precision of modeling individual aircraft flight tracks and is further described in Section 4.5.

4.1 Airport Physical Parameters

The SDF airfield, located approximately 5 miles south of downtown Louisville, KY, consists of three 150-foot wide runways, two of which are parallel, and one "crosswind" runway that is roughly perpendicular to the set of parallel runways. The two parallel runways provide SDF with the greatest capacity to accommodate aircraft operations while the "crosswind" runway is occasionally used during strong crosswinds.

Each end of the runways is designated by a number that, with the addition of a trailing "0", reflects the magnetic heading of the runway to the nearest 10º, as seen by the pilot. Thus, the crosswind runway, 11-29, has the designation "11" at the west end of the pavement looking eastward, indicating that it is aligned on a magnetic heading of approximately 110º, while the opposite end of the same piece of pavement has the designation "29" indicating its orientation on an approximate heading of 290º. Runway 11-29 is 7,250 feet long. The two parallel runways, 17L-35R and 17R-35L, are oriented on approximate magnetic headings of 170º and 350º and are 8,578 feet and 11,887 feet long, respectively. The parallel runways are distinguished from each other with letter endings "L", meaning left, and "R", meaning right, as seen by the pilot.

Runway length, runway width, instrumentation and declared distances may affect which aircraft might use a particular runway and under what conditions, and therefore how often a runway would be used relative to the other runways at the airport. Figure 3 presents the existing SDF airport layout and Table 3 provides the actual coordinates and parameters for each runway end. It should be noted that while the full length of Runway 17R/35L is available, most departures start their take-off roll at the intersections of Taxiways B, which is also the location of the respective displaced thresholds. The location of the displaced landing thresholds for Runways 17R and 35L are indicated by red arrows in Figure 3 and specified in the table. Helicopter operations were modeled from Taxiway E4 as this is the primary departure and arrival location as indicated by discussions with the LRAA staff, FAA Air Traffic Control and the Fixed Base Operators. No changes to the airfield are expected within the 5-year time frame for this project and therefore, the runway layout modeled for the 2016 base year and the 2021 forecast year is identical.

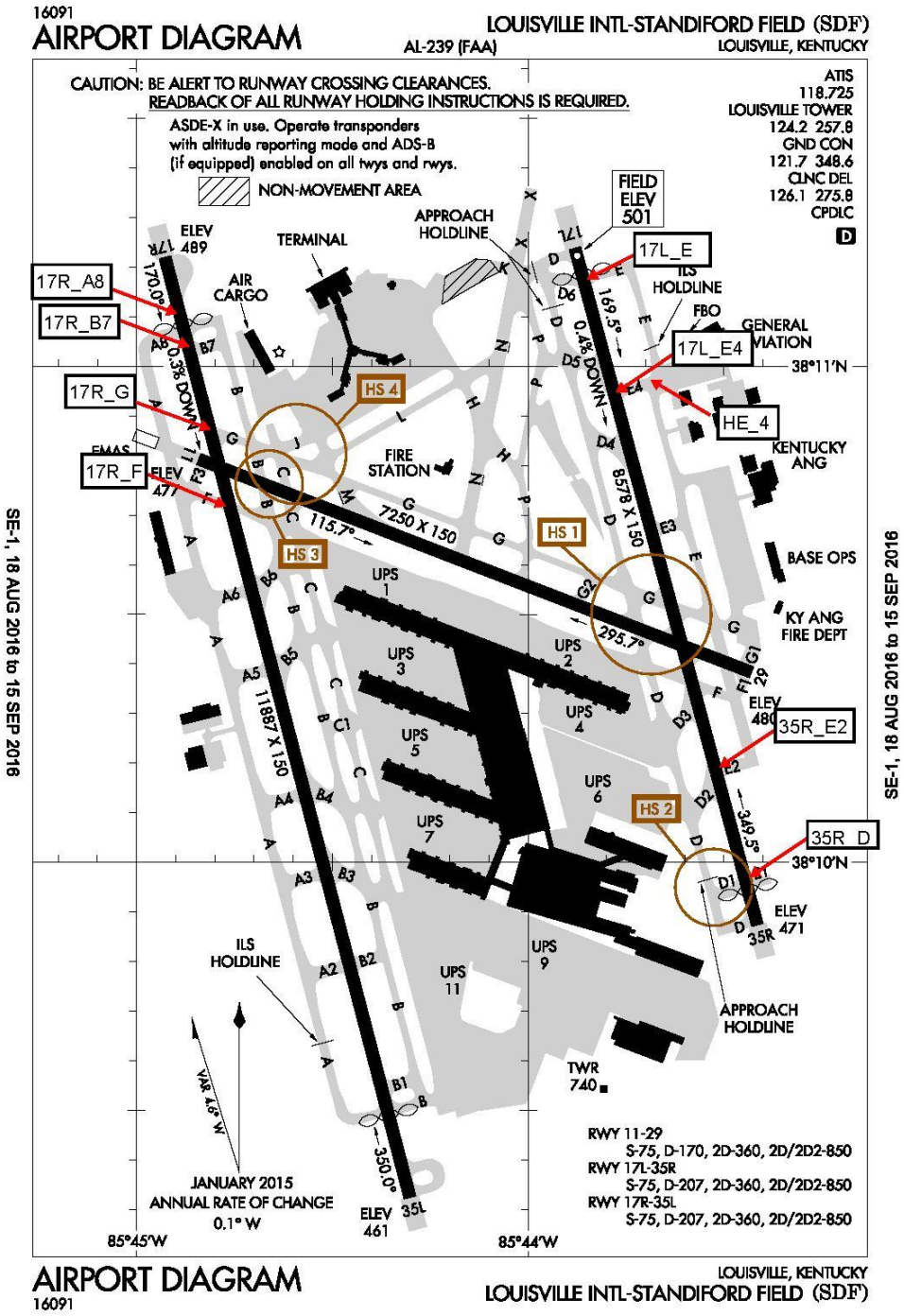

Figure 3. Existing SDF Airport Layout

Source: FAA, digital Terminal Procedures, effective October 21, 2010 to November 18, 2010

Note: Red arrows and labels added as discussed in the text

Table 3. Runway Details

Source: (Federal Aviation Administration's (FAA) Airport Master Record Forms 5010 February 1, 2016

Runway	Latitude (dd-mm-ss)	Longitude (dd-mm-ss)	Latitude (degrees)	Longitude (degrees)	Elevation (ft. MSL)	Displaced Threshold	Glide Slope	Threshold Crossing Height	Magnetic Orientation (degrees)*
11	38-10-48.8165	85-44-50.4554	38.180227	85.747349	476	-	3	65	111
17L	38-11-14.2768	85-43-52.8303	38.187299	85.731342	501	328	3.32	71	165
17R	38-11-13.1562	85-44-55.6058	38.186988	85.748779	489	846	3	75	165
29	38-10-22.9895	85-43-25.7658	38.173053	85.723824	480	-	3	56	291
35R	38-09-52.4022	85-43-24.8692	38.164556	85.723575	471	449	3	72	345
35L	38-09-19.4498	85-44-18.0885	38.155403	85.738358	461	1040	3	75	345
17L_E	38-11-14.2764	85-43-52.8276	38.187299	85.731341	501	450	3.3	50	165
17L_E4	38-11-14.2764	85-43-52.8276	38.187299	85.731341	501	1840	3.3	50	165
17R_B7	38-11-13.1568	85-44-55.6044	38.186988	85.748779	489	1200	3	50	165
17R_D	38-11-13.1568	85-44-55.6044	38.186988	85.748779	489	880	3	50	165
17R_F	38-11-13.1568	85-44-55.6044	38.186988	85.748779	489	3150	3	50	165
17R_G	38-11-13.1568	85-44-55.6044	38.186988	85.748779	489	2250	3	50	165
35R_D	38-09-52.4052	85-43-24.8664	38.164557	85.723574	471	490	3	50	345
35R_E2	38-09-52.4052	85-43-24.8664	38.164557	85.723574	471	1990	3	50	345
HE4	38-11-14.3520	85-43-51.8700	38.18732	85.731075	501	-	-	-	-

Notes:

Runways labeled with "_[X]" suffix are the intersection of taxiway [X] and the start of take-off roll on the named runway.

*Magnetic Orientation from the FAA's Airport Diagram, current 08/18/2016 to 09/15/2016.

**FAA Form 5010 did not provide guidance on the glide slope and threshold crossing heights for Runways 11 and 29. Assumed values are industry standards.

***HE4 is a representation of Taxiway E4 for noise modeling of helicopter operations only. These data are not from FAA Form 5010.

4.2 Airport Operations

14 CFR Part 150 and its table of noise/land use compatibility guidelines require the calculation of "yearly DNL" values. That is, the daily noise exposure level (in DNL) averaged over a year – usually a calendar year. The AEDT produces these values of exposure utilizing an "average annual day" of airport operations. In this NEM update, calendar year 2015 SDF aircraft activity was used as the baseline to develop the average annual day's operations for 2016. Adjustments were made to the 2015 operations data to reflect changes in 2015 that would then provide the representative operations for 2016 conditions.

4.2.1 Development of 2016 operations

The 2016 operations and fleet mix information were developed from several sources. Operations were obtained from the LRAA's Noise and Operations Monitoring System (NOMS) for the time period of January 1, 2015 through December 31, 2015. These 12 months of data were then adjusted to represent annual 2016 operations by scaling to 2016 FAA Terminal Area Forecast (TAF) operations counts according to the four categories defined by the FAA: Air Carrier, Air Taxi, General Aviation and Military. See Table 4. The NOMS data were supplemented with published airline fleet inventories which were used to estimate the number of aircraft having different engine types within a given operator's fleet. General aviation aircraft were assigned representative AEDT model types based on the flight plan information filed with each flight in the NOMS database. The NOMS flight track data were also modified to account for fleet mix changes expected to occur between calendar years 2015 and 2016.

The NOMS data provided aircraft flight tracks from SDF's flight tracking system. These data will be used directly in the modeling process per the FAA's AEDT and categorized individual operations by operator, aircraft type and time of day (daytime or nighttime) for both departures and arrivals. The HMMH team supplemented the NOMS data with data from the FAA Terminal Area Forecast (TAF)[9], the FAA Traffic Flow Management System Counts (TFMSC)10, historical and real time information from Flight Wise[11], economic and demographic projections from Woods & Pool Economics, Inc.12, the FAA's Aircraft Registration Database[13] and LRAA landing reports[14]. To assist in the proration of this data to the FAA tower counts, the HMMH team associated each operation to one of the three civilian FAA categories: Air Carrier, Air Taxi and General Aviation. Operations were also scaled such that the modeled arrival operations match the modeled departure operations by aircraft type.

The mix of engines and noise treatments varies among operators. The flight tracking data, supplemented by published sources, provide the detailed engine information needed to develop SDF-specific noise emissions for each individual operation. This procedure ensured that the efforts of operators to achieve a quieter fleet, especially for nighttime operations, would be properly represented in the noise model calculations.

According to ATADS (Air Traffic Activity Data System) data, there were 2,993 itinerant military operations (excluding over-flights) and 187 local military operations in 2015 for a total of 3,180 operations. Of these, 1,404 are assumed to be attributed to KYANG (when adjusting for the formation

[9] http://aspm.faa.gov/

[10] http://aspm.faa.gov/

[11] https://flightwise.com/

[12] https://www.woodsandpoole.com/

[13] http://www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/

[14] http://www.flylouisville.com/RAA/Reports-and-Statistics.aspx

departures that are not accurately reflected in the ATADS data), leaving 1,776 operations that are occurring by transient aircraft. The vast majority (estimated at 95 percent) of these are occurring during daytime hours. Of those, 95% were fixed-wing aircraft with the remaining 5% being helicopter.

The locally-based military operations were modeled using the AEDT 2b representative type for the C-130 aircraft operations by the Kentucky Air National Guard (KYANG) and based at SDF. The total number of locally-based KYANG operations was estimated to be 1,560 annual operations for both 2016 and 2021.[15] This estimate is higher than the corresponding tower count due to the nature of military flight formations. Aircraft flying in formation are represented by a single tower count.[16] ANG and FAA Air Traffic Control Tower discussions indicate that for every three tower counts, there are four operations. Two outbound aircraft are counted once, and upon return are counted again separately.

4.2.2 Operations in 2016

This section presents the detailed average daily aircraft activity summaries developed for calendar year 2016 as described in the previous section. The FAA count of the total numbers of operations at SDF for the entire calendar year is listed below in Table 4.

Table 4. 2016 Operations Summary

Source: HMMH, C&S, LRAA, FAA ATADS

Category	Number of Forecast Annual Operations	Number of Annual Operations Modeled	Number of Daily Average Operations Modeled
Air Carrier	108,312	108,312	296.7
Air Taxi	26,109	26,109	71.5
General Aviation	12,039	11,516[1]	31.5
Military	3,336	3,336	9.1
Total[2]	149,796	149,273	409.0

Notes:
1. Local operations are counted differently by FAA ATADS than by AEDT. In ATADS, a local operation is counted as one arrival and one departure. In the AEDT model, a local operation is counted as one operation.
2. Totals may not be exact due to rounding

Table 5 shows the number of average annual daily aircraft arrivals and departures, as well as whether they occur during the day or night time period – 7 a.m. to 10 p.m. and 10 p.m. to 7 a.m., respectively. The day/night breakdown is critical to the calculation of DNL because the metric weight night operations by a factor of 10 (mathematically equivalent to adding ten decibels to the noise level produced by aircraft operating at night). The aircraft are designated by the AEDT type with which they were modeled.

[15] Based on information that the KYANG provided for 2016 and 2021. The KYANG military activity is anticipated to remain steady through the planning horizon.

[16] FAA's guidelines for counting military operations is in Section 9-1-4 of FAA Order 7210.3. The most current version of this order is available at http://www.faa.gov/air_traffic/publications/

Table 5. Modeled Average Daily Aircraft Operations for 2016

Source: HMMH, C&S, LRAA

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
Air Carrier – Cargo[1]	A306	5.69	26.28	6.90	25.08
	B763	10.15	20.71	11.30	19.56
	B752	4.00	12.75	3.58	13.18
	MD11	7.10	11.02	7.17	10.95
	B744	0.56	2.60	0.55	2.61
	B722	0.20	0.14	0.21	0.12
	DC91	0.12	0.08	0.13	0.08
	DC93	0.08	0.06	0.10	0.04
Air Taxi – Cargo[2]	SH36	0.01	2.29	0.07	2.23
	SH33	0.00	0.70	0.01	0.69
Air Carrier – Passenger[1]	B737	8.11	2.58	8.77	1.91
	B733	1.62	0.29	1.81	0.10
	B738	0.51	0.17	0.66	0.02
	MD88	2.57	0.87	2.99	0.45
	B712	2.84	0.48	2.98	0.33
	A319	1.56	0.04	1.56	0.03
	MD90	0.08	0.11	0.18	0.01
	A320	0.03	0.04	0.05	0.02
	CRJ9	7.88	3.22	9.06	2.03
	E170	8.24	2.91	8.53	2.62
	E190	0.06	0.00	0.06	0.00
	CRJ7	2.03	0.16	2.04	0.15
	B734	0.06	0.02	0.05	0.03
	B717	0.28	0.09	0.33	0.05
Air Taxi – Passenger[2]	E145	10.26	2.36	11.22	1.40
	E45X	3.56	0.71	3.88	0.40
	CRJ2	5.61	0.47	5.75	0.33
	B190	0.07	1.81	0.30	1.58
	SW4	0.01	0.87	0.03	0.85
	E135	0.71	0.06	0.62	0.15
	C56X	1.16	0.07	1.15	0.08
	E55P	0.40	0.03	0.41	0.03
	C750	0.29	0.01	0.29	0.01
	C560	0.22	0.00	0.22	0.01
	H25B	0.25	0.01	0.25	0.01
	C680	0.16	0.01	0.15	0.01
	GALX	0.10	0.00	0.10	0.01

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
	F2TH	0.07	0.01	0.08	0.00
	CL30	0.19	0.00	0.19	0.00
	FA20	0.26	0.90	0.29	0.87
	PC12	0.00	0.65	0.00	0.65
	C25A	0.15	0.01	0.16	0.01
	BE40	0.55	0.02	0.54	0.03
	LJ40	0.05	0.00	0.05	0.00
	LJ35	0.15	0.03	0.16	0.02
	E50P	0.11	0.00	0.11	0.00
	B350	0.05	0.01	0.06	0.00
	BE99	0.04	0.05	0.05	0.05
	BE9L	0.00	0.07	0.00	0.07
	E120	0.07	0.01	0.07	0.02
	AC50	0.00	0.06	0.00	0.06
General Aviation[3]	C56X	1.62	0.15	1.70	0.07
	F2TH	1.34	0.09	1.38	0.05
	CL60	0.87	0.11	0.94	0.04
	FA50	0.76	0.05	0.78	0.03
	C560	0.76	0.02	0.76	0.02
	H25B	0.75	0.01	0.75	0.01
	C550	0.52	0.04	0.54	0.02
	LJ45	0.50	0.03	0.52	0.01
	GLF5	0.42	0.06	0.42	0.05
	BE20	0.42	0.03	0.42	0.03
	GLF4	0.39	0.04	0.42	0.01
	C25A	0.41	0.02	0.43	0.01
	C650	0.36	0.04	0.39	0.01
	C172	0.35	0.01	0.33	0.02
	BE40	0.37	0.01	0.35	0.03
	B350	0.37	0.01	0.37	0.01
	LJ60	0.31	0.02	0.33	0.00
	C525	0.31	0.01	0.31	0.01
	CL30	0.27	0.00	0.27	0.00
	SR22	0.25	0.00	0.24	0.01
	C680	0.24	0.01	0.25	0.00
	PC12	0.20	0.02	0.20	0.01
	C510	0.20	0.00	0.21	0.00
	PRM1	0.20	0.02	0.19	0.03
	LJ31	0.17	0.04	0.19	0.03

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
	LJ35	0.19	0.03	0.18	0.03
	C310	0.11	0.09	0.11	0.10
	E55P	0.20	0.00	0.19	0.01
	C25B	0.18	0.01	0.19	0.00
	C750	0.16	0.00	0.16	0.01
	BE9L	0.16	0.00	0.15	0.01
	UNKN	0.10	0.02	0.10	0.02
	BE30	0.14	0.00	0.14	0.00
	HELO	0.12	0.01	0.13	0.00
	P180	0.11	0.04	0.09	0.06
	BE58	0.12	0.01	0.12	0.01
	BE36	0.11	0.01	0.12	0.01
	F900	0.10	0.01	0.09	0.02
	P28A	0.09	0.02	0.09	0.02
	GALX	0.10	0.00	0.10	0.00
	C25C	0.10	0.00	0.10	0.00
	DA40	0.09	0.01	0.09	0.00
	JS31	0.07	0.03	0.06	0.03
	C182	0.06	0.03	0.06	0.03
	DC91	0.10	0.00	0.10	0.00
	E135	0.09	0.00	0.09	0.00
	LJ40	0.08	0.00	0.08	0.00
	G150	0.08	0.00	0.08	0.00
	EA50	0.08	0.00	0.06	0.01
	TBM8	0.07	0.00	0.07	0.00
	GL5T	0.06	0.00	0.06	0.01
	C414	0.06	0.00	0.06	0.00
Military	C130	1.87	0.27	2.14	0.00
	SH-60	0.23	0.01	0.23	0.01
	TEX-2	0.92	0.05	0.92	0.05
	BE40	0.46	0.02	0.46	0.02
	F-18	0.23	0.01	0.23	0.01
	T-38	0.46	0.02	0.46	0.02

Notes:
Operations are carried to out to 4 decimal places, but are only presented to 2 decimals ($1/100^{th}$). $1/100^{th}$ of an average annual day operation is less than 4 flights per year.
1 These aircraft are capable of carrying more than 60 passengers and therefore are counted as Air Carrier by FAA (FAA Order 7210.3)
2 These aircraft are not capable of carrying more than 60 passengers and therefore are counted as Air Taxi by FAA (FAA Order 7210.3)
3 These types of aircraft can be counted by FAA as either Air Taxi or General Aviation depending on how the flight plan for the individual operation was filed.

4.2.3 Development of 2021 operations

A five-year forecast of operations was prepared using a variety of data sources including, but not limited to:

- Louisville International Airport 2004 Airport Master Plan Forecast
- FAA Terminal Area Forecast (TAF)
- FAA Air Traffic Activity System (ATADS)
- FAA Traffic Flow Management System Counts (TFMSC)
- Operator interviews

The methodology and assumptions in the Master Plan Forecast were not reasonably consistent with other recent trend and growth projections such as the TAF. For example, the 2004 Master Plan did not reflect the decline in air taxi activity over the past decade. Thus, the Master Plan was deemed unsuitable for use in the development of an updated forecast. The TAF served as the starting point for establishing an updated forecast. The TAF was supplemented by a review of socioeconomic and industry forecast factors, as well as discussions and interviews with major operators at the Airport. Appendix D presents the forecast memorandum that was submitted to FAA. July 18, 2016.

4.2.4 Operations in 2021

Table 6 presents the 2021 operations forecast as approved by FAA, and the associated daily average modeled operations. The five-year forecast projects 156,345 total operations in 2021 with estimated growth in the Cargo and General Aviation aircraft operation categories. Discussions with the KYANG and the local FBO indicated that there are no expected changes in military operations during the five-year period and formation flights are expected to remain at the same level as discussed in Section 4.2.1

Table 6. 2021 Operations Summary

Source: HMMH, C&S, LRAA, FAA ATADS

Category	Number of Forecast Annual Operations	Number of Annual Operations Modeled	Number of Daily Average Operations Modeled
Air Carrier	127,327	127,327	348.8
Air Taxi	13,429	13,429	36.8
General Aviation	12,254	11,693[1]	32.0
Military	3,336	3,336	9.1
Total[2]	**156,345**	**155,784**	**426.8**

Notes:
1 Local operations are counted differently by FAA ATADS than by AEDT. In ATADS, a local operation is counted as one arrival and one departure. In the AEDT model, a local operation is counted as one operation.
2 Totals may not be exact due to rounding

Table 7 shows the number of average annual daily aircraft arrivals and departures, as well as whether they occur during the day or night time period – 7 a.m.to 10 p.m. and 10 p.m. to 7a.m., respectively. Detailed aircraft assignments were based on several sources, including discussions with operators. In the absence of operator information, growth in operations was assumed to be primarily from aircraft types that are currently in production. Aircraft types that are not currently in production were generally assumed to stay the same as 2016 or reduce operations/phase-out if such information was available. No new aircraft types were assumed to operate at SDF by 2021. The split between day/night operations was assumed to be the same as the existing operations, unless additional operator information was available.

Table 7. Modeled Average Daily Aircraft Operations for 2021

Source: HMMH, C&S, LRAA

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
Air Carrier - Cargo	A306	7.26	25.17	8.88	23.55
	B763	9.24	21.04	10.38	19.90
	B752	6.31	18.51	4.83	19.99
	MD11	7.88	9.50	8.27	9.11
	B744	1.39	3.33	1.28	3.43
	B722	0.23	0.15	0.24	0.14
	DC91	0.15	0.09	0.15	0.09
	DC93	0.10	0.07	0.12	0.05
Air Taxi - Cargo	SH36	0.01	2.34	0.07	2.28
	SH33	0.00	0.71	0.01	0.71
Air Carrier - Passenger	B737	9.58	3.04	10.37	2.26
	B733	1.91	0.34	2.14	0.11
	B738	0.61	0.20	0.78	0.02
	MD88	1.68	0.57	1.96	0.30
	B712	3.35	0.56	3.52	0.39
	A319	1.85	0.04	1.85	0.04
	MD90	0.09	0.13	0.21	0.01
	A320	0.04	0.04	0.07	0.02
	CRJ9	16.91	4.87	18.63	3.14
	E170	9.74	3.44	10.08	3.10
	E190	0.07	0.00	0.07	0.00
	CRJ7	2.40	0.19	2.41	0.18
	B734	0.07	0.02	0.07	0.03
	B717	1.68	0.57	1.96	0.30
Air Taxi - Passenger	E145	2.33	0.60	2.72	0.22
	E45X	2.30	0.46	2.50	0.25
	CRJ2	3.03	0.30	3.12	0.21
	B190	0.05	1.17	0.20	1.02
	SW4	0.01	0.56	0.02	0.55
	E135	0.46	0.04	0.40	0.10
	C56X	0.75	0.04	0.74	0.05
	E55P	0.26	0.02	0.26	0.02
	C750	0.19	0.00	0.19	0.01
	C560	0.14	0.00	0.14	0.00
	H25B	0.16	0.01	0.16	0.01
	C680	0.10	0.01	0.10	0.01
	GALX	0.07	0.00	0.06	0.01

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
	F2TH	0.05	0.01	0.05	0.00
	CL30	0.12	0.00	0.12	0.00
	FA20	0.17	0.58	0.19	0.56
	PC12	0.00	0.42	0.00	0.42
	C25A	0.10	0.01	0.11	0.00
	BE40	0.36	0.01	0.35	0.02
	LJ40	0.04	0.00	0.03	0.00
	LJ35	0.09	0.02	0.10	0.01
	E50P	0.07	0.00	0.07	0.00
	B350	0.04	0.00	0.04	0.00
	BE99	0.03	0.04	0.03	0.03
	BE9L	0.00	0.04	0.00	0.04
	E120	0.05	0.01	0.05	0.01
	AC50	0.00	0.04	0.00	0.04
General Aviation	C56X	1.65	0.15	1.73	0.07
	F2TH	1.36	0.09	1.41	0.05
	CL60	0.88	0.11	0.96	0.04
	FA50	0.78	0.05	0.80	0.03
	C560	0.77	0.02	0.78	0.02
	H25B	0.76	0.01	0.76	0.01
	C550	0.53	0.04	0.55	0.02
	LJ45	0.51	0.03	0.53	0.01
	GLF5	0.42	0.06	0.43	0.05
	BE20	0.43	0.03	0.43	0.03
	GLF4	0.39	0.04	0.43	0.01
	C25A	0.42	0.02	0.43	0.01
	C650	0.36	0.04	0.39	0.01
	C172	0.35	0.01	0.34	0.02
	BE40	0.38	0.01	0.36	0.03
	B350	0.38	0.01	0.38	0.01
	LJ60	0.31	0.02	0.34	0.00
	C525	0.31	0.01	0.31	0.01
	CL30	0.28	0.00	0.27	0.00
	SR22	0.25	0.00	0.24	0.02
	C680	0.25	0.01	0.25	0.00
	PC12	0.20	0.02	0.21	0.01
	C510	0.21	0.00	0.21	0.00
	PRM1	0.20	0.02	0.19	0.03
	LJ31	0.17	0.05	0.19	0.03

Aircraft Type	AEDT Type	Arrivals		Departures	
		Day	Night	Day	Night
	LJ35	0.19	0.03	0.18	0.03
	C310	0.12	0.09	0.11	0.10
	E55P	0.20	0.00	0.19	0.01
	C25B	0.18	0.01	0.19	0.00
	C750	0.17	0.00	0.16	0.01
	BE9L	0.17	0.00	0.16	0.01
	UNKN	0.10	0.02	0.11	0.02
	BE30	0.15	0.00	0.15	0.00
	HELO	0.13	0.01	0.13	0.00
	P180	0.11	0.04	0.09	0.06
	BE58	0.12	0.01	0.12	0.01
	BE36	0.12	0.01	0.12	0.01
	F900	0.11	0.01	0.09	0.02
	P28A	0.10	0.02	0.09	0.02
	GALX	0.11	0.00	0.10	0.00
	C25C	0.11	0.00	0.11	0.00
	DA40	0.09	0.01	0.09	0.00
	JS31	0.07	0.03	0.06	0.03
	C182	0.07	0.03	0.07	0.03
	DC91	0.10	0.00	0.10	0.00
	E135	0.09	0.00	0.09	0.00
	LJ40	0.08	0.00	0.08	0.00
	G150	0.08	0.00	0.08	0.00
	EA50	0.08	0.00	0.07	0.01
	TBM8	0.07	0.00	0.07	0.00
	GL5T	0.07	0.00	0.06	0.01
	C414	0.07	0.00	0.07	0.00
Military	C130	1.87	0.27	2.14	0.00
	SH-60	0.23	0.01	0.23	0.01
	TEX-2	0.92	0.05	0.92	0.05
	BE40	0.46	0.02	0.46	0.02
	F-18	0.23	0.01	0.23	0.01
	T-38	0.46	0.02	0.46	0.02

Notes:

Operations are carried to out to 4 decimal places, but are only presented to 2 decimals (1/100th). 1/100th of an average annual day operation is less than 4 flights per year.

1 These aircraft are capable of carrying more than 60 passengers and therefore are counted as Air Carrier by FAA (FAA Order 7210.3)

2 These aircraft are not capable of carrying more than 60 passengers and therefore are counted as Air Taxi by FAA (FAA Order 7210.3)

3 These types of aircraft can be counted by FAA as either Air Taxi or General Aviation depending on how the flight plan for the individual operation was filed.

4.3 Aircraft Noise and Performance Characteristics

Specific noise and performance data must be entered into the AEDT for each aircraft type operating at the airport. Noise data are included in the form of sound exposure level (SEL – see Appendix A) at a range of distances (from 200 feet to 25,000 feet) from a particular aircraft with engines at a specific thrust level. Performance data include thrust, speed and altitude profiles for takeoff and landing operations. The AEDT database contains standard noise and performance data for over one hundred different fixed-wing aircraft types, most of which are civilian aircraft. The AEDT automatically accesses the noise and performance data for takeoff and landing operations by those aircraft.

This study included many different aircraft types. While many aircraft could be modeled by direct assignments from the standard AEDT database, some were not in the AEDT database. For those aircraft types not in the AEDT standard database, FAA-approved substitutions were used to model the aircraft with a similar type. User defined aircraft/substitutions were submitted to FAA on June 8, 2016 (Appendix E) with FAA approval or recommendation response received on July 7, 2016 (Appendix F).

In addition to the aircraft substitutions, there were several aircraft types whose flight profiles were different enough from the standard AEDT profiles that user-defined profiles were developed in cooperation with the aircraft manufacturer, Boeing Aircraft Company.

Two aircraft types had user-defined profiles to represent reduced thrust takeoff typically used at SDF for air cargo jets (Boeing 757-200 and Boeing 767-300). The Assumed Temperature Method is a common procedure used to reduce the takeoff thrust. In this method, pilots program their aircraft's on-board Flight Management System (FMS) to assume temperatures higher than actual temperatures in order to reduce thrust at takeoff. The aircraft then automatically reduces the thrust and calculates a flight path based on lower density air, caused by the assumed higher temperature. The result is generally a slower airspeed and a lower altitude as compared to the standard AEDT profile. These user profiles were verified by comparing the profiles to actual climb performance data at SDF.

User-defined profiles for the Boeing MD-11 were developed to present procedures that are used at SDF that are not available in AEDT for these particular aircraft. The procedures used by these aircraft are typical of those used by large aircraft, and are available for other types in AEDT, but not offered for the MD-11.

Appendix G provides the documentation of the user-defined aircraft profiles for the predominant air cargo jets that were submitted to the FAA on June 8, 2016. Also included in Appendix G is additional information that was provided to the FAA, at their request, on July 26, 2016 for review. FAA provided their approval on July 28, 2016 for the use of all recommended user-defined profiles (Boeing 757-200, Boeing 767-300 and Boeing MD-11) for the NEM update (Appendix H).

The reduced thrust settings in the Boeing 757 and 767 user-defined profiles produce a lower altitude on departure as compared to the AEDT Standard profiles. The MD-11 user-defined profiles better replicate the ICAO A procedures when compared to the standard AEDT profiles. A least-squares analysis of actual aircraft speed and altitude profiles obtained from the SDF monitoring system verified the greater agreement achieved by the FAA-approved user-defined profiles.

Within the Aviation Environmental Design Tool (AEDT) database, the FAA's software used to produce the contours for the Noise Exposure Maps, aircraft departure profiles are usually defined by a range of trip distances identified as "stage lengths." A longer trip distance or higher stage length is associated with a heavier aircraft due to the increase in fuel requirements for the flight. For this study, city pair distances were determined for each departure flight track and used in most cases to define the specific stage length using the AEDT standard definitions. Given that cargo flights typically take off with an increased average takeoff weight, stage lengths were adjusted where expected takeoff weight (TOW) were known. Applicable stage lengths associated with the TOW by aircraft were provided by the AEDT database and assigned to forecasted activity.

4.4 Runway Utilizations

Weather, in particular wind direction and wind speed, is the primary factor affecting runway use at airports. Additional factors that may affect runway use include the position of a facility relative to the runways and temporary runway closures, generally for airfield maintenance and construction. The flight tracks within the radar data reviewed for the Louisville Noise Exposure Map Update include the use of all six directions on the three runways at SDF.

4.4.1 Existing Conditions Runway Utilization

The flight track data from NOMS for calendar year 2015 contained the necessary information to determine the actual runway end used for each arrival and departure. However, due to the closure of Runway 11/29 from May 4th 2015 – November 16th 2015, the 2015 radar data did not represent typical runway use at the Airport. Therefore, the NOMS flight track data for calendar year 2014 was used to acquire the necessary information to determine the actual runway end used for arrivals and departures.

Due to a lack of military operations in the flight track data from NOMS (these operations are typically filtered out by design), military runway use estimates were developed through discussions with the KYANG. The KYANG base is located on the east side of the airfield and, therefore, it is convenient for the KYANG aircraft to use Runway 17L and Runway 35R. The north/south directional flow was accounted for in the military runway use by assuming the military aircraft would approximately follow the percentage of air carrier passenger aircraft flow use as wind is the predominant factor in direction of aircraft operations. Transient military aircraft were assumed to have the same runway use as KYANG since transient military aircraft taxi to and from the FBO facility, which is just north and adjacent to the KYANG base.

Discussions with the LRAA, FAA Air Traffic Control and the FBO indicated that all helicopters, both civilian and military, were assumed to arrive and depart Taxiway E4, which is located near the FBO facility.

The summarized runway use percentages projected for calendar year 2016, as presented in Table 8, were based on the actual annual-average runway use for both arrivals and departures in calendar year 2014 based on the NOMS flight track data. Table 9 provides additional details, including runway use percentages by the time period (daytime and nighttime) and aircraft group. The groupings and time periods in Table 9 correspond to the aircraft operations presented in the operations tables.

Table 8. Overall Runway Use Percentages for 2016

Source: HMMH, LRAA, KYANG

Runway	Departures	Arrivals
11	0.0%	0.1%
17L	32.5%	31.6%
17R	41.1%	14.5%
29	1.4%	1.3%
35L	9.4%	30.1%
35R	15.5%	22.4%
Total	100.0%	100.0%

Notes:
Totals may not match exactly due to rounding.
Runway use based on 2014 SDF radar data due to closure of Runway 11/29 May 4th – Nov. 16th 2015.
All helicopters, military and civilian, were modeled using Taxiway E4.
Source: HMMH, LRAA, NOMS data

Table 9. Modeled Average Daily Runway Use for 2016

Source: HMMH, LRAA, KYANG

	Departures		Arrivals	
Runway	Day	Night	Day	Night
Air Carrier Passenger				
11	0.0%	0.0%	0.0%	0.0%
17L	29.9%	36.6%	54.1%	25.5%
17R	37.4%	46.5%	7.6%	11.6%
29	1.9%	0.0%	2.7%	0.0%
35L	5.2%	1.3%	21.3%	34.9%
35R	25.6%	15.6%	14.3%	27.9%
Air Carrier Cargo				
11	0.0%	0.0%	0.0%	0.0%
17L	10.1%	30.0%	21.3%	12.1%
17R	60.6%	52.4%	32.2%	18.0%
29	1.7%	0.0%	1.7%	0.0%
35L	22.4%	11.8%	34.9%	44.7%
35R	5.2%	5.9%	9.9%	25.1%
Air Taxi Passenger				
11	0.0%	0.0%	0.0%	0.0%
17L	43.2%	46.0%	54.6%	28.6%
17R	22.4%	35.7%	7.3%	5.9%
29	2.6%	0.3%	3.2%	0.4%
35L	3.8%	0.2%	16.9%	21.4%

	Departures		Arrivals	
Runway	Day	Night	Day	Night
35R	28.1%	17.8%	17.9%	43.7%
Air Taxi Cargo				
11	0.0%	0.0%	0.0%	0.0%
17L	37.7%	52.4%	42.2%	20.4%
17R	16.4%	26.2%	26.0%	9.3%
29	2.7%	0.0%	1.7%	0.0%
35L	3.5%	8.8%	20.2%	20.8%
35R	39.7%	12.6%	9.8%	49.5%
GA				
11	0.1%	0.0%	0.3%	0.0%
17L	57.1%	62.6%	58.6%	44.5%
17R	5.1%	7.8%	6.1%	4.5%
29	4.2%	0.8%	2.6%	0.4%
35L	4.8%	4.9%	3.8%	5.7%
35R	28.7%	23.9%	28.7%	44.9%
Military				
11	0.0%	0.0%	2.6%	0.0%
17L	55.4%	50.0%	52.4%	0.0%
17R	3.5%	0.0%	2.1%	0.0%
29	9.8%	0.0%	0.5%	0.0%
35L	1.6%	0.0%	1.1%	0.0%
35R	29.7%	50.0%	41.3%	100.0%

The airport's informal preferential runway use agreement (Appendix I) for turbojet aircraft lists the preferred runway combinations for arrivals and departures for four time periods as presented below. The agreement includes the most preferred arrival and departure runway combination, followed by the preferred list of alternatives, with the least preferred arrival and departure runway combination at the end of the list for the respective time period. In some cases, pilots, at their discretion, may request a different runway.

The agreement describes the following four time periods and associated first-preference runway combinations.

- Operations from 7:00 a.m. to 9:30 a.m.
  - Depart on Runways 17L and 17R
  - Arrive on Runway 17L
- Operations from 9:30 a.m. to 12:30 p.m.
  - Depart on Runway 35R
  - Arrive on Runway 35L and 35R
- Operations from 12:30 p.m. to 10:00 p.m.
  - Depart on Runways 17L and 17R

  - Arrive on Runway 17L
- Operations from 10:00 p.m. to 7:00 a.m.
  - Depart on Runways 17L and 17R
  - Arrive on Runways 35L and 35R

Table 10 provides the 2016 modeled civilian turbojet runway use percentages for the four time periods defined in the informal preferential runway use agreement. The percentages associated with the first-preference runways are the most used runways during the respective time period. The single exception is the arrival operations during the 9:30 a.m. to 12:30 p.m. time period, in which the second preference arrival runway is Runway 17L.

Table 10. Modeled Average Daily Civilian Turbojet Runway Use by Time of Day for 2016

Source: HMMH, LRAA, CNF Meeting Minutes

Runway	11	17L	17R	29	35L	35R	Total
Operation: 7:00 AM - 9:30 AM							
Departure	0.0%	**42.9%**	**33.7%**	1.2%	5.0%	17.2%	100.0%
Arrival	0.1%	**49.8%**	25.4%	0.9%	13.4%	10.3%	100.0%
Operation: 9:30 AM - 12:30 PM							
Departure	0.1%	31.2%	17.2%	2.6%	11.4%	**37.5%**	100.0%
Arrival	0.0%	28.2%	15.9%	2.1%	**30.8%**	**22.8%**	100.0%
Operation: 12:30 PM - 10:00 PM							
Departure	0.0%	**33.2%**	**35.9%**	2.7%	9.5%	18.7%	100.0%
Arrival	0.1%	**55.9%**	10.9%	3.2%	14.1%	15.9%	100.0%
Operation: 10:00 PM - 7:00 AM							
Departure	0.0%	**33.2%**	**48.1%**	0.0%	10.2%	8.4%	100.0%
Arrival	0.0%	16.6%	15.8%	0.1%	**40.0%**	**27.5%**	100.0%

Notes:

Totals may not match exactly due to rounding.

Numbers in bold and in green shaded cells indicated preferred runways during the respective period.

Military operations are not included.

4.4.2 Forecast Conditions Runway Utilization

For the forecast runway use, adjustments were based on a sample of long-term historical trend data. The development of projected runway use for the 2021 NEM also considered two time periods of interest defined in the informal runway use agreement – contraflow during nighttime and the late morning period.

4.4.2.1 CONTRAFLOW DURING NIGHT TIME PERIOD

The LRAA contraflow reports provided eight full-calendar years from 2007 to 2014 of annual average percentage of jet and large propeller operations at SDF departing to or arriving from the south during the nighttime period (Table 11). Appendix J provides an example of a LRAA contraflow summary report. The last 5-year historical average departure and arrival contraflow percentages were 80% and 71% respectively, and were used for the 5-year planning projection. Any adjustments to the future runway use based on this information were applied to all aircraft types.

Table 11. Annual Average Contraflow Percentages

Source: LRAA

Year	Arrival	Departure
2007	63%	79%
2008	63%	78%
2009	63%	78%
2010	72%	80%
2011	72%	76%
2012	66%	83%
2013	73%	82%
2014	70%	81%
5-year Average	71%	80%

4.4.2.2 LATE MORNING TIME PERIOD

The late morning time period has been tracked in the CNF meeting minutes for two full consecutive calendar years from 2013 to 2014. The annual average runway use for these two years shown in Table 12 was used for the late morning time period and applied to all civilian aircraft types. Military aircraft runway use was not modified since information from KYANG suggested the majority of the military operations occur during the afternoon hours.

Table 12. Two-Year Historical Average Daily Runway Use for Late Morning Time of Day

Source: HMMH, LRAA, CNF Meeting Minutes

Runway	17L	17R	11	29	35L	35R	Total
Operation	9:30 AM – 12:30 PM						
Departure	21.7%	15.6%	0.0%	2.4%	13.6%	**47.1%**	100%
Arrival	20.4%	14.8%	0.0%	1.8%	**37.0%**	**25.1%**	100%
Notes:							
Totals may not match exactly due to rounding.							
Numbers in bold and in green shaded cells indicate preferred runways during the respective period.							

4.4.2.3 FORECAST RUNWAY UTILIZATION SUMMARY

The future runway use data for the contraflow and late morning time periods were incorporated into the development of the overall and modeled average day runway use percentages for 2021 as shown in Table 13 and Table 14. As provided for the existing conditions, Table 15 details the modeled average runway use for turbojet aircraft for the various times of the day. The percentages associated with the first-preference runways during the respective time periods are highlighted in the table.

Table 13. Overall Runway Use Percentages for 2021

Source: HMMH, LRAA, KYANG

Runway	Departures	Arrivals
11	0.0%	0.1%
17L	30.9%	31.1%
17R	42.8%	15.1%
29	1.4%	1.2%
35L	9.9%	30.9%
35R	15.0%	21.6%
Total	100.0%	100.0%
Notes: Totals may not match exactly due to rounding. Runway use based on 2014 SDF radar data due to closure of Runway 11/29 May 4th – Nov. 16th 2015. All helicopters, military and civilian, were modeled using Taxiway E4.		

Table 14. Modeled Average Daily Runway Use for 2021

Source: HMMH, LRAA, KYANG

	Departures		Arrivals	
Runway	**Day**	**Night**	**Day**	**Night**
Air Carrier Passenger				
11	0.00%	0.00%	0.00%	0.00%
17L	29.92%	36.60%	54.11%	25.54%
17R	37.43%	46.46%	7.56%	11.61%
29	1.85%	0.00%	2.67%	0.00%
35L	5.23%	1.34%	21.33%	34.95%
35R	25.56%	15.60%	14.33%	27.90%
Air Carrier Cargo				
11	0.0%	0.0%	0.0%	0.0%
17L	10.13%	29.96%	21.34%	12.13%
17R	60.57%	52.36%	32.21%	17.99%
29	1.72%	0.00%	1.68%	0.00%
35L	22.36%	11.79%	34.92%	44.74%
35R	5.22%	5.90%	9.85%	25.15%
Air Taxi Passenger				
11	0.00%	0.00%	0.00%	0.00%
17L	43.20%	46.00%	54.61%	28.57%
17R	22.37%	35.75%	7.30%	5.88%
29	2.58%	0.30%	3.23%	0.42%
35L	3.77%	0.15%	16.94%	21.43%

	Departures		Arrivals	
Runway	**Day**	**Night**	**Day**	**Night**
35R	28.08%	17.80%	17.92%	43.70%
Air Taxi Cargo				
11	0.0%	0.0%	0.0%	0.0%
17L	37.72%	52.42%	42.20%	20.42%
17R	16.38%	26.15%	26.01%	9.27%
29	2.73%	0.00%	1.73%	0.00%
35L	3.47%	8.83%	20.23%	20.82%
35R	39.70%	12.60%	9.83%	49.49%
GA				
11	0.12%	0.00%	0.27%	0.00%
17L	57.14%	62.55%	58.55%	44.49%
17R	5.06%	7.82%	6.08%	4.49%
29	4.17%	0.82%	2.58%	0.41%
35L	4.85%	4.94%	3.84%	5.71%
35R	28.66%	23.87%	28.68%	44.90%
Military				
11	0.00%	0.00%	2.65%	0.00%
17L	55.38%	50.00%	52.38%	0.00%
17R	3.48%	0.00%	2.12%	0.00%
29	9.81%	0.00%	0.53%	0.00%
35L	1.58%	0.00%	1.06%	0.00%
35R	29.75%	50.00%	41.27%	100.00%

Table 15. Modeled Average Daily Civilian Turbojet Runway Use by Time of Day for 2021

Source: HMMH, LRAA, CNF Meeting Minutes

Runway	11	17L	17R	29	35L	35R	Total
Operation: 7:00 AM - 9:30 AM							
Departure	0.0%	**42.9%**	**33.7%**	1.2%	5.0%	17.2%	100.0%
Arrival	0.1%	**49.8%**	25.4%	0.9%	13.4%	10.3%	100.0%
Operation: 9:30 AM - 12:30 PM							
Departure	0.1%	31.2%	17.2%	2.6%	11.4%	**37.5%**	100.0%
Arrival	0.0%	28.2%	15.9%	2.1%	**30.8%**	**22.8%**	100.0%
Operation: 12:30 PM - 10:00 PM							
Departure	0.0%	**33.2%**	**35.9%**	2.7%	9.5%	18.7%	100.0%
Arrival	0.1%	**55.9%**	10.9%	3.2%	14.1%	15.9%	100.0%
Operation: 10:00 PM - 7:00 AM							
Departure	0.0%	**33.2%**	**48.1%**	0.0%	10.2%	8.4%	100.0%
Arrival	0.0%	16.6%	15.8%	0.1%	**40.0%**	**27.5%**	100.0%

Notes:

Totals may not match exactly due to rounding.

Numbers in bold and in green shaded cells indicated preferred runways during the respective period.

Military operations are not included.

4.5 Flight Track Geometry and Utilization

As discussed earlier, a proprietary pre-processing software was used to provide increased precision in modeling flight tracks. The software uses individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data. This provides the advantage of modeling each aircraft operation on the specific runway it actually used and at the actual time of day of the arrival or departure. The software was used to process the radar flight tracks into a format that was easily imported into AEDT. Note that the software was used for track processing only and all noise modeling was done in AEDT.

Due to a lack of military operations in the flight track data from LRAA, the traditional modeling approach was used for some military aircraft, which populates nominal flight tracks with military aircraft operations. The nominal military fixed-wing flight tracks developed in the previous Part 150 were used for this NEM update. The same flight tracks were used for both 2016 and 2021 military operations.

4.5.1 Flight Tracks for All Aircraft except Military Aircraft

Model tracks for North Flow (Runways 35L/R and 29) and South Flow (Runways 17L/R and 11) are provided in Figure 7 and Figure 8 respectively. A total of 136,606 individual flight tracks were modeled for both the existing and forecast conditions, with different weightings assigned to each track depending on the representative year. No changes to the airfield are expected within the 5-year time frame for this project.

4.5.2 Flight Tracks for Military Aircraft

Due to a lack of military operations in the flight track data, the traditional modeling approach was used for some military aircraft, which populates nominal flight tracks with military aircraft operations. The military F-18 and TEX-2 aircraft required nominal flight tracks. The nominal military fixed-wing flight tracks developed in the previous Part 150. 11 were used for this NEM update. Figure 9 displays the military arrival and departure modeled flight tracks and Table 16 show the flight track use for the military flight operations. The forecast military flight tracks and usage remained unchanged between the existing and forecast conditions.

Table 16. Military Fixed-Wing Aircraft Flight Tracks and Use

Source: HMMH, LRAA, KYANG

Runway	Arrival Flight Track	Departure Flight Track	Daytime Use %	Nighttime Use %
11	ML_A1	-	100.0 %	-
17L	ML_A1	-	100.0 %	-
	-	ML_D1	95.5 %	4.5 %
17R	ML_A1	-	100.0 %	-
	-	ML_D4	100.0 %	-
29	ML_A1	-	100.0 %	-
	-	ML_D1	100.0 %	-
35L	ML_A1	-	100.0 %	-
	-	ML_D4	100.0 %	-
35R	ML_A1	-	88.7 %	11.3 %
	-	ML_D1	91.9 %	8.1 %

4.5.3 Overall Flight Track Density

In addition to the north and south flow flight track graphics, flight track density plots are included showing arrivals and departures. These plots permit presentation of comparative information for longer time frames using thousands of actual aircraft flight tracks. Rather than presenting every individual track, these plots use color gradations to depict the frequency of aircraft operations over extended time periods. These graphics summarize the flight track geometry, dispersion, and the frequency of aircraft operations by using a uniform color gradient scheme based on the relative density of traffic. The “warm” colors (reds) indicate the areas where the most aircraft operations occurred and the “cool” colors (blues) indicate the areas where the fewest aircraft operations occurred given the sets of flight track data described above.

The flight density plots in Figure 10 and Figure 11 represent the density (i.e., frequency) of jet arrivals and jet departure flight tracks, respectively. The plots are each based on the use of over 67,000 actual flight tracks. These figures provide a visual summary of where aircraft predominantly fly throughout the year and represent a sample of the flight tracks that were used to develop the noise contours in this NEM Update. Note that aircraft densities appear to drop suddenly over the airfield due to the flight tracks beginning and ending near the airfield within the data set.

4.6 Meteorological Conditions

AEDT default weather data include average annual weather (i.e., based on 30-year normal and 10-year averages) for each airport, as well as International Standard Atmosphere (ISA) conditions. For airport actions, AEDT default airport-specific average weather conditions should be used to compute noise for the airport to be studied. Use of non-default weather data requires written approval from AEE.[17]

For this NEM update, AEDT default weather data for SDF was used.

4.7 Terrain

Terrain data describe the elevation of the ground surrounding the airport and on airport property. AEDT uses terrain data to adjust the ground level under the flight paths. The terrain data do not affect the aircraft's performance or emitted noise levels, but do affect the vertical distance between the aircraft and a "receiver" on the ground. This in turn affects the noise levels received at a particular point on the ground. The terrain data were obtained from the United States Geological Survey (USGS)[18].

[17] "Appendix C. Guidance on Using the Aviation Environmental Design Tool (AEDT) 2b to Conduct Environmental Modeling for FAA Actions Subject to NEPA", July 16, 2015

[18] Terrain data downloaded from USGS website on 06/03/2016 in 1/3 arc-second GridFloat format. http://viewer.nationalmap.gov/

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5 EXISTING AND FORECAST CONDITION NOISE EXPOSURE MAPS

The development of the NEM Update requires the use of an FAA approved methodology or computer program, which for this project is Version 2b with Service Pack 2 (SP2) of the Aviation Environmental Design Tool (AEDT). The fundamental noise elements of the NEM are DNL contours for existing and five-year forecast conditions: i.e., 2016 and 2021 in this NEM Update. Figure 4 and Figure 5 present the contours for existing conditions and forecast conditions, respectively. Figure 6 depicts the existing and forecast conditions contours together for ease of visual comparison.

5.1 Comparison of 2016 Existing Contours and 2021 Forecast Contours

The modeling assumptions related to airport layout, runway use, and air traffic procedure use remain unchanged from 2016 to 2021; however, the conditions differ in terms of the level and mix of aircraft activity. The aircraft operations assumptions used in developing these two sets of contours are presented in Section 4.2, the runway use for the existing and forecast conditions is presented in Section 4.4 and the flight track use is described in Section 4.5.

The comparison shows little to no change to the noise exposure to the sideline of the runways, while showing a slight increase to the southern extents of the contours and a slight increase to the northern extents. The slight increases are likely related to the increase in overall operations from existing to forecast conditions, as well as the continued fleet mix trend of increasing Air Carrier jet usage and decreasing Regional jet usage. As shown in Table 17 the increase in overall area within the 65 dB DNL contour was approximately 5.5% from 2016 to 2021.

Table 17. Comparison of Land Area Enclosed by the 2016 and 2021 dB DNL Contours

Source: HMMH

Noise Level, DNL	Contour Land Area (Square Miles)		
	Existing Contours 2016	Forecast Contours 2021	Percent Change
60-65	16.3	17.4	6.7%
65-70	6.8	7.2	5.9%
70-75	2.4	2.5	4.2%
75+	1.6	1.7	6.3%
Total 65+	**10.9**	**11.5**	**5.5%**
Total 60+	27.2	28.9	6.3%

Notes:

Totals and sub-totals may not match exactly due to rounding

Percent change denoted is relative to the existing condition (2016) contours.

5.2 Compatible Land Use Analysis

The objective of airport noise compatibility planning is to promote the compatible growth and development of airports with their surrounding communities. The LRAA uses the FAA's land-use compatibility guidelines, as set forth in 14 CFR Part 150, Appendix A, Table 1, which is reproduced in Table 1, Section 1.3.5 of this document. As the table indicates, the FAA considers all land uses to be compatible with aircraft-related DNL Levels below 65 dB. Residential hotels, retirement homes,

intermediate care facilities, hospitals, nursing homes, schools, preschools, and libraries are subject to the same criteria.

Based on these compatibility guidelines, a list of noise-sensitive land uses was prepared and the existing land use from the LOJIC database was refined to identify the location of all potential existing noise-sensitive land uses. This list of uses includes public and private schools and universities, hospitals, nursing homes, libraries, historic sites, parks, religious facilities, and the University of Louisville. The noise-sensitive land use database was supplemented by information received from public agencies that were requested to provide a description of anticipated land use changes. Historic resources were also identified and added to the inventory of sensitive land uses and facilities. Pursuant to Section 106 of the National Historic Preservation Act, any project involving federal funding must assess the project's impact on properties that have been accepted or are eligible for National Register designation. Existing noise-sensitive facilities and historic resources located within the study area are depicted on the NEM Figures, Figure 4 through Figure 6.

5.2.1 Historic Resources and Non-Residential Noise-Sensitive Land Uses within the Noise Contours

The NEM base map depicts existing land uses, according to major categories identified in 14 CFR Part 150 guidelines, including residential, commercial, industrial, and agriculture/forest. The "industrial" classification includes warehouse, light manufacturing, assembly and heavy commercial uses. Where industrial, office, and other commercial uses are intermixed, the figure indicates the most common use. The University of Louisville has multiple land uses within its property which, based on conversations with the university, has been identified as educational use for purposes of this study.

As mentioned previously, Figure 4 and Figure 5 present NEMs for 2016 and 2021, respectively. There are 5 public facilities and historic resources within the noise exposure contour (65 dB DNL) associated with SDF's operations in 2016; the 2021 forecast identifies the same 5 public facilities and historic resources. The number of historic resources and non-residential noise-sensitive receptors by contour interval is provided in Table 18 with a listing of each identified facility in

Table 19.

Table 18. Number of Historic Resources and Non-Residential Sensitive Receptors within the 2016 and 2021 DNL Contours

Source: HMMH

Noise Level, DNL	Existing Contours - 2016			Forecast Contours – 2021		
	Educational Facilities	Places of Worship	Other	Educational Facilities	Places of Worship	Other
65-70	2	2	3	2	2	3
70-75	0	0	0	0	0	0
75+	0	0	0	0	0	0
Total	0	2	3	0	2	3

Note: "Other" includes hospitals, libraries, historic, and other noise sensitive receptors

Table 19. Listing of Historic Resources and Non-Residential Sensitive Receptors within the 2016 and 2021 DNL Contours

Source: HMMH

Facility	DNL Contour Interval			
	2016		2021	
	65-70	70-75	65-70	70-75
Schools				
Churchill Park School	X		X	
University of Louisville/Belknap Campus	X		X	
Places of Worship				
Fourth Presbyterian Church	X		X	
Charity Mission Baptist Church	X		X	
Libraries				
University of Louisville Library	X		X	
Historic Properties				
Adath Israel Cemetery (Gatehouse)	X		X	
Louisville Fire Brick Company Complex	X		X	
Kentucky Wagon Works	X		X	
Armory	X		X	
Speed, JB Art Museum	X		X	
House 900 Audubon Pkwy	X		X	
House 907 Audubon Pkwy	X		X	
House 908 Audubon Pkwy	X		X	
House 911 Audubon Pkwy	X		X	
House 915 Audubon Pkwy	X		X	
House 3209 Robin Rd			X	
House 3211 Robin Rd			X	
House 3213 Robin Rd			X	
House 3215 Robin Rd			X	
House 3217 Robin Rd			X	
House 3219 Robin Rd			X	
House 3300 Robin Rd	X		X	
House 3302 Robin Rd	X		X	
House 3304 Robin Rd	X		X	
House 3306 Robin Rd	X		X	
House 3308 Robin Rd	X		X	
House 3310 Robin Rd	X		X	
House 3312 Robin Rd	X		X	
House 3314 Robin Rd	X		X	
House 3316 Robin Rd			X	
House 3318 Robin Rd			X	

5.2.2 Residential Land Uses and Population within the Noise Contours

Estimates of existing population and future population trends within the study area are an essential part of the 14 CFR Part 150 process. These estimates provide a basis for examining the effects of existing airport operations, as well as noise abatement alternatives. When quantified, an assessment of the relative impacts of various alternatives on existing and projected population and households provide one means to measure the effectiveness of such alternatives. The analysis of the growth of population and households in the study area, particularly in areas that may be more significantly impacted by aircraft noise, is also important in identifying land use and noise mitigation strategies.

The objective of airport noise compatibility planning is to promote the compatible growth and development of airports with their surrounding communities. The FAA considers all land uses to be compatible with aircraft-related DNL Levels below 65 dB. Table 20 presents the estimated residential population within these contours. Residential properties that are included on the National Register of Historic Places and listed in

Table 19 are counted in the associated housing units and population estimates shown in Table 20.

Residential population and housing unit count estimates for the 2016 and 2021 DNL contour impacts were calculated using Louisville parcel data and Census 2010 data. Utilizing the smallest enumeration unit; Census block data, and Geographic Information Systems (GIS) tools, the contours were intersected with the Census block data for each DNL noise contour interval (65-70, 70-75, >75). The population and housing units within the contours were derived by:

- Identifying all structure or unit points contained within a residential parcel
- Calculating the population factor for each point using the Census 2000 data
- Selecting all residential parcels that intersect the contour interval and then identifying the structure or unit point that was within that parcel

The results were then used to develop the estimated population and housing counts shown in Table 20 Using the LOJIC parcel coverage, parcel and unit counts were derived by selecting all single- and multi-family parcels that intersect each contour interval and summarizing the unit values in the respective database.

Table 20. Estimated Residential Population within 2016 and 2021 DNL Contours

Source: HMMH

Noise Level, DNL	Existing Contours – 2016			Forecast Contours – 2021		
	Estimated Population	Estimated Single Family Houses	Estimated Multi-Family Housing Units	Estimated Population	Estimated Single Family Houses	Estimated Multi-Family Housing Units
65-70	3,895	1,518	289	4,345	1,731	285
70-75	220	2	100	246	2	112
75+	0	0	0	0	0	0
Total	4,114	1,520	389	4,591	1,733	397
Notes: These counts include noise insulated homes.						

The overall increase in estimated number of single-family houses within the contours is based on the slight, mostly uniform growth of the noise contours from existing conditions to forecast conditions.

In addition to relocation, the Airport has initiated seven phases of a RSIP focused in an area northeast of the Airport. As of September 30, 2015, there have been 542 units mitigated through sound insulation.

5.3 Comparison of 2016 NEM Existing Contours to Forecast Contours from 2011 Part 150 Study

The last Part 150 Noise Exposure Map Update for SDF was submitted in 2011, and included a 2011 existing contour and a 2016 forecast contour. The 2011 NEM Forecast contour (2016) varies in several ways to the 2016 NEM Existing contour (2016).

Along the sidelines of the parallel runways, the 2016 NEM Existing contour is slightly larger than the 2011 NEM Forecast contour. This increase in size is due to changes in the overall fleet mix, and new meteorological standards associated with the use of AEDT. The overall fleet mix at SDF, and in fact across the country, has been transitioning away from smaller regional jets and increasing the use of larger jets. These larger jets tend to have more thrust and produce more noise along sideline during takeoff. Using AEDT, the FAA requires the use of an atmospheric absorption type "SAE-ARP-5534" for all noise modeling. This absorption type is different than the type used in INM during the last Part 150 study in 2011, which did not account airport specific temperature, relative humidity, and atmospheric pressure. Some airports are noticing some "swelling" in their contours due to this change in the absorption type.

The difference between the 2016 NEM Existing contour and 2011 NEM Forecast contour is greatest to the south of the airport. The increased size to the south is due to fleet mix changes and atmospheric absorption type changes as discussed above regarding sideline noise, as well as increased adherence to the Contraflow Program (NCP NA-5). Table 10 shows contraflow usage percentages for the last 7 years. Increased Contraflow usage means more arrivals from the south and more departures to the south during the nighttime period.

There is also a change in the contour shape to the southwest, from 17R departures turning to the west. This change in shape is due to RNAV usage assumptions. In the 2011 NEM, it was assumed that many of the aircraft capable of using the new RNAV procedures would be using them in the forecasted year of 2016. For the 2016 NEM Existing contour, no assumptions were made regarding RNAV procedure, instead actual radar tracks were used from the most recent calendar year (2015). These radar tracks showed less RNAV usage than predicted in the 2011 NEM Forecast contours, particularly at night where there is a significant DNL night weighting. There is a possible benefit to the majority of aircraft equipped with RNAV flying the RNAV procedure during nighttime hours. Specifically, the southwest contour lobe may decrease in size in such a way that all non-compatible land uses near the southwest contour lobe are outside of the 65 DNL contour. In short, the use of the RNAV procedure at night could result in only compatible land uses within the contour in that area. The flight track density shown in Figure 10 illustrates the RNAV and non-RNAV use from 17R departures.

To allow for mitigation within the increased contour area south of the airport, this NEM proposes to amend mitigation measure M-3 to include eligible residential structures anywhere within the DNL 65 dB contour.

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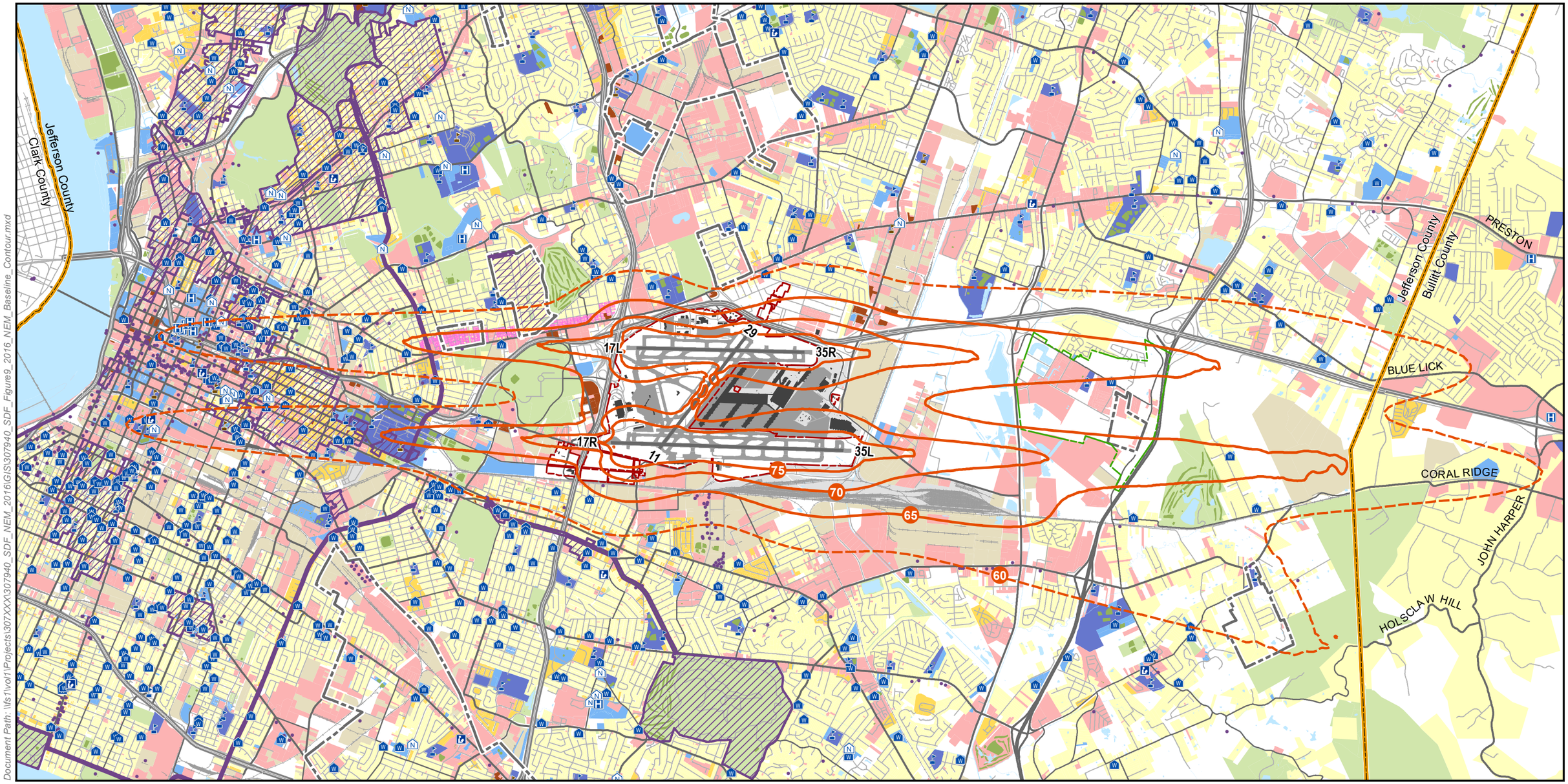

Document Path: \\fs1\vol1\Projects\307XXX\307940_SDF_NEM_2016\GIS\307940_SDF_Figure9_2016_NEM_Baseline_Contour.mxd

Legend

- 2016 NEM Baseline DNL Contour (65-75 dB)
- 2016 NEM Baseline DNL Contour (60 dB)

(60 dB DNL Contours for Information Purposes Only)

- Airport Boundary
- Airport Relocation Area
- Runway
- Sound Insulation Completed
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: **4**

2016 NEM Baseline (2016) Contours

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Legend

- 2016 NEM Forecast DNL Contour (65-75 dB)
- 2016 NEM Forecast DNL Contour (60 dB)

(60 dB DNL Contours for Information Purposes Only)

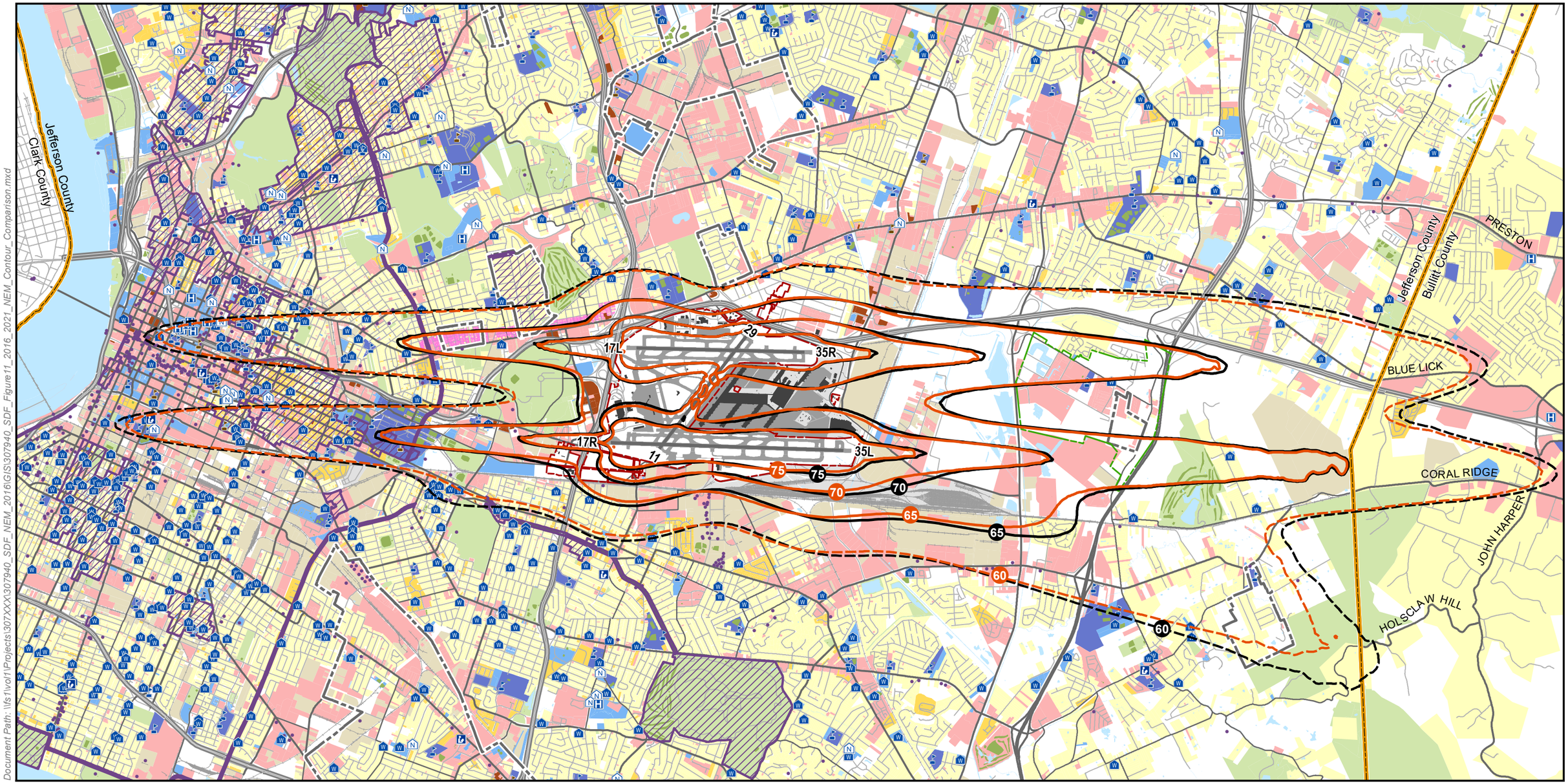
- Airport Boundary
- Airport Relocation Area
- Runway
- Sound Insulation Completed
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: **5**

2016 NEM Forecast (2021) Contours



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Legend

- 2016 NEM Baseline DNL Contour (65-75 dB)
- 2016 NEM Baseline DNL Contour (60 dB)
- 2016 NEM Forecast (2021) Contours (65-75 dB)
- 2016 NEM Forecast (2021) Contours (60dB)

(60 dB DNL Contours for Information Purposes Only)

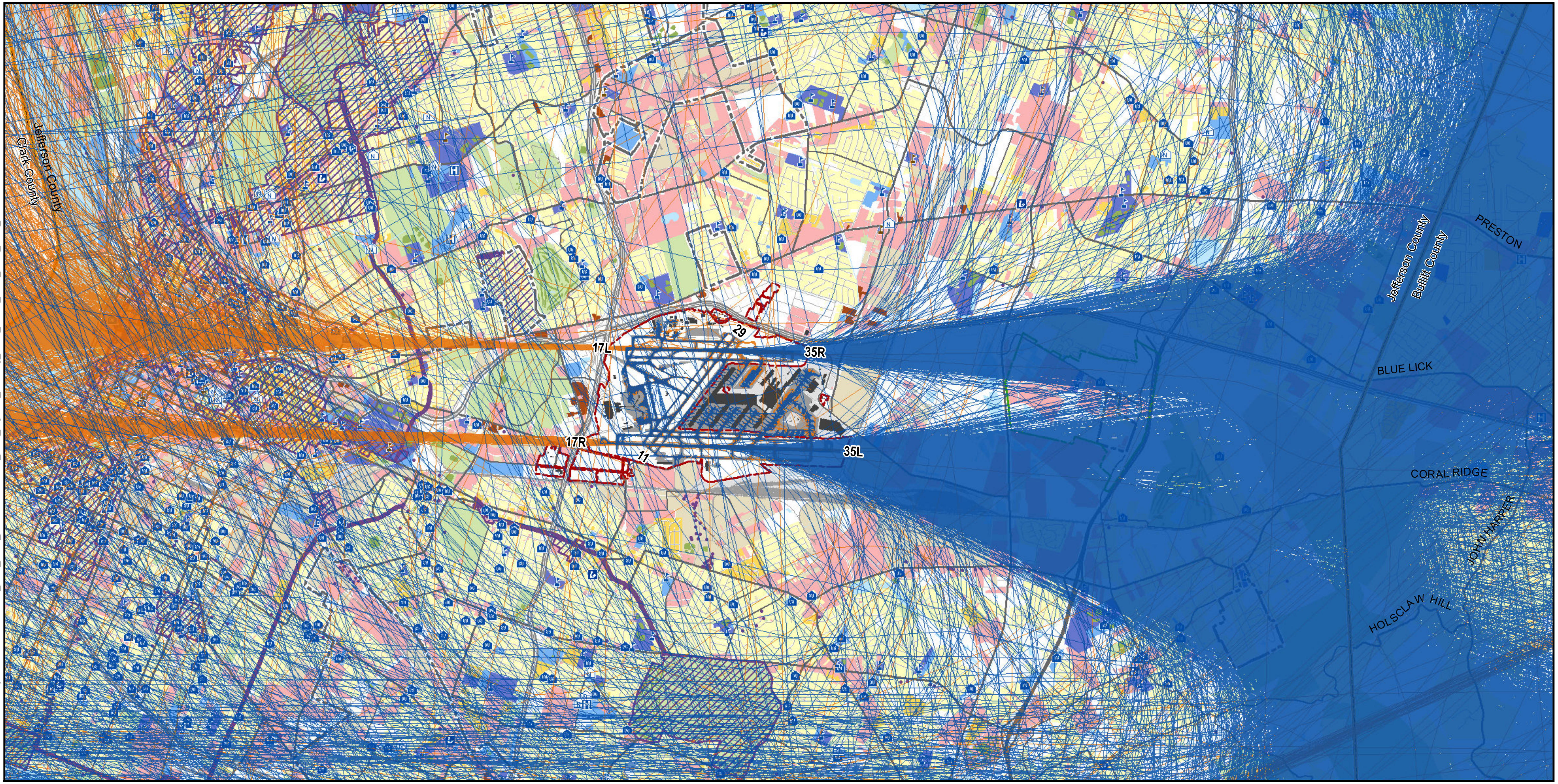
- Airport Boundary
- Airport Relocation Area
- Runway
- Sound Insulation Completed
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: **6**

Comparison of 2016 NEM Baseline (2016), and 2016 NEM Forecast (2021) Contours



Document Path: G:\Projects\307XXX\307940_SDF_NEM_2016\GIS\307940_SDF_Figure5_Existing_2016_South_Flow_ARR_DEP_Tracks.mxd

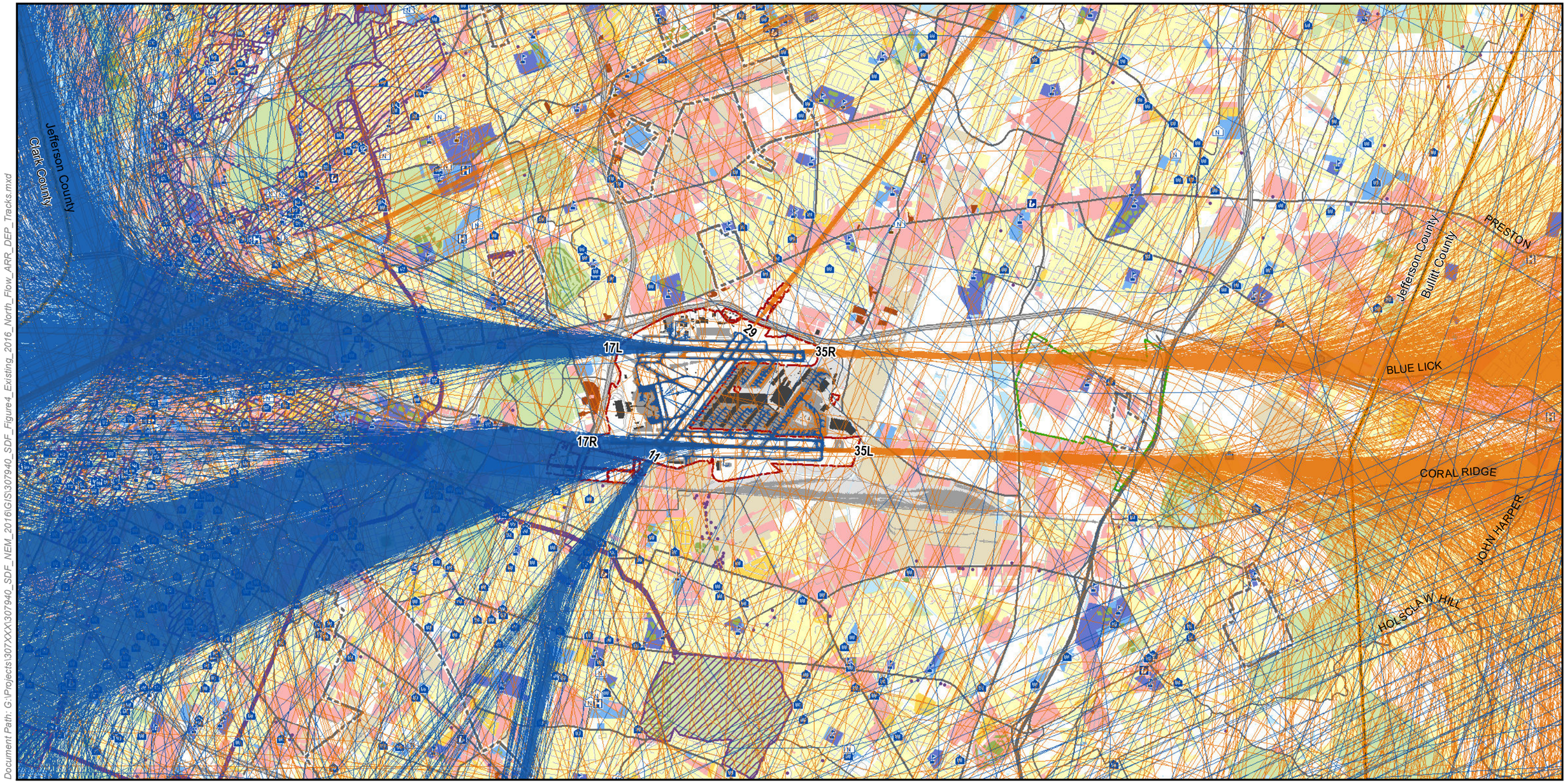
Legend

- South Flow Arrival Tracks
- South Flow Departure Tracks
- Airport Boundary
- Airport Relocation Area
- Runway
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: 7
South Flow Arrival and Departure Tracks



Document Path: G:\Projects\307XXX\307940_SDF_NEM_2016\GIS\307940_SDF_Figure4_Existing_2016_North_Flow_ARR_DEP_Tracks.mxd

Legend

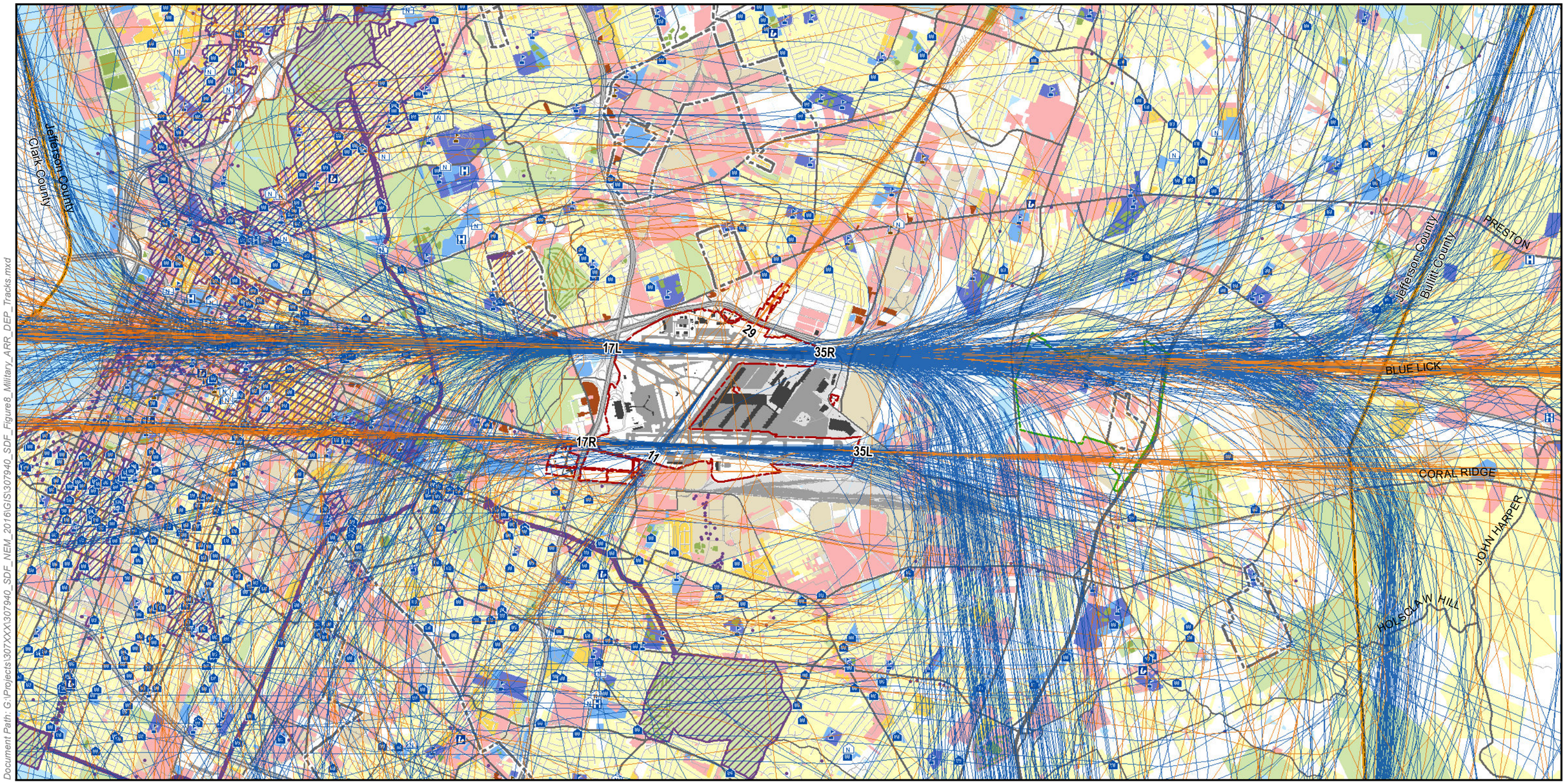
- North Flow Arrival Tracks
- North Flow Departure Tracks
- Airport Boundary
- Airport Relocation Area
- Runway
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: 8
North Flow Arrival and Departure Tracks

hmmh



Document Path: G:\Projects\307XXX\307940_SDF_NEM_2016\GIS\307940_SDF_Figure8_Military_ARR_DEP_Tracks.mxd

Legend

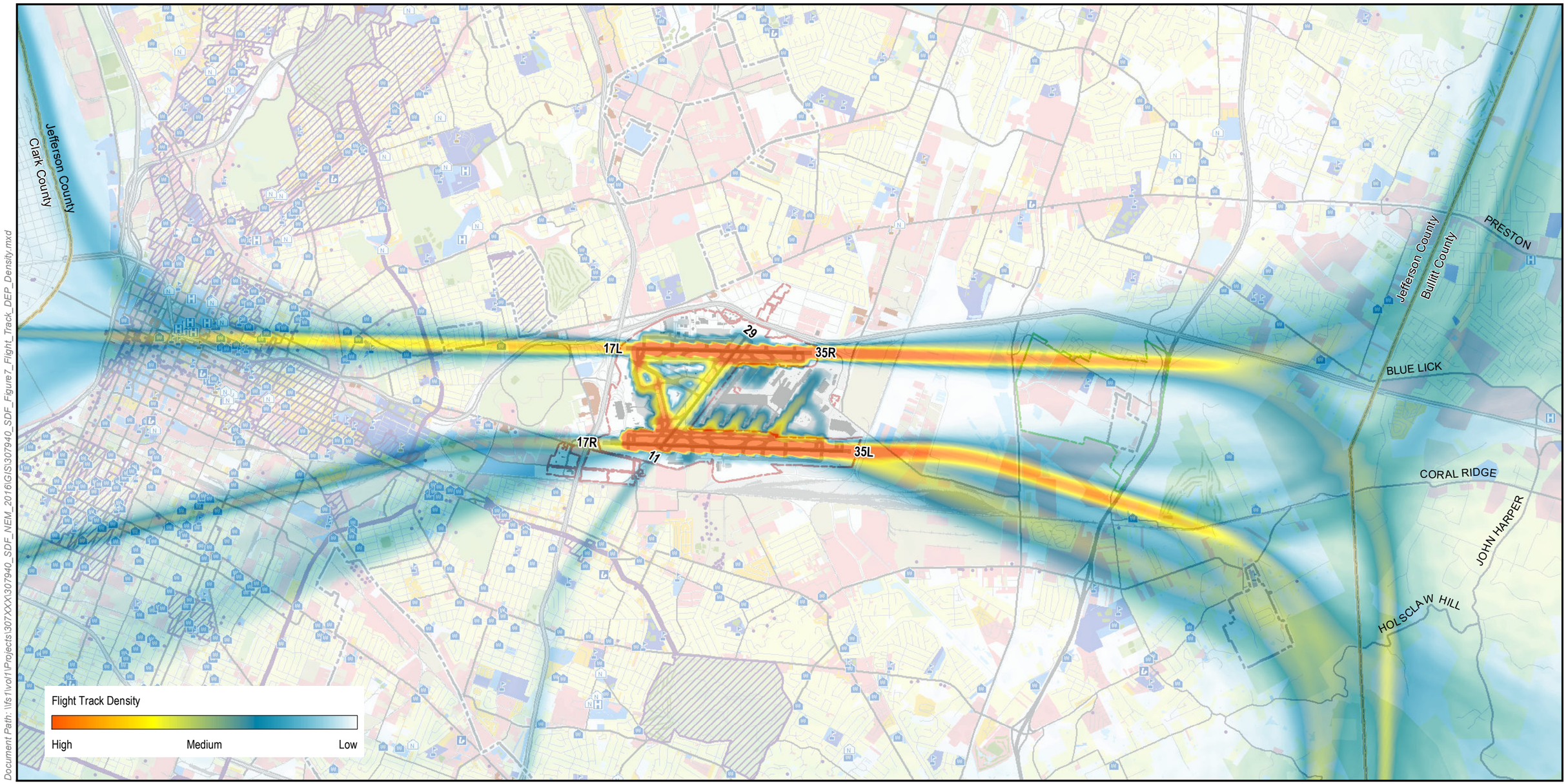
- Military Arrival Tracks
- Military Departure Tracks
- Airport Boundary
- Airport Relocation Area
- Runway
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: **9**

Military Arrival and Departure Tracks



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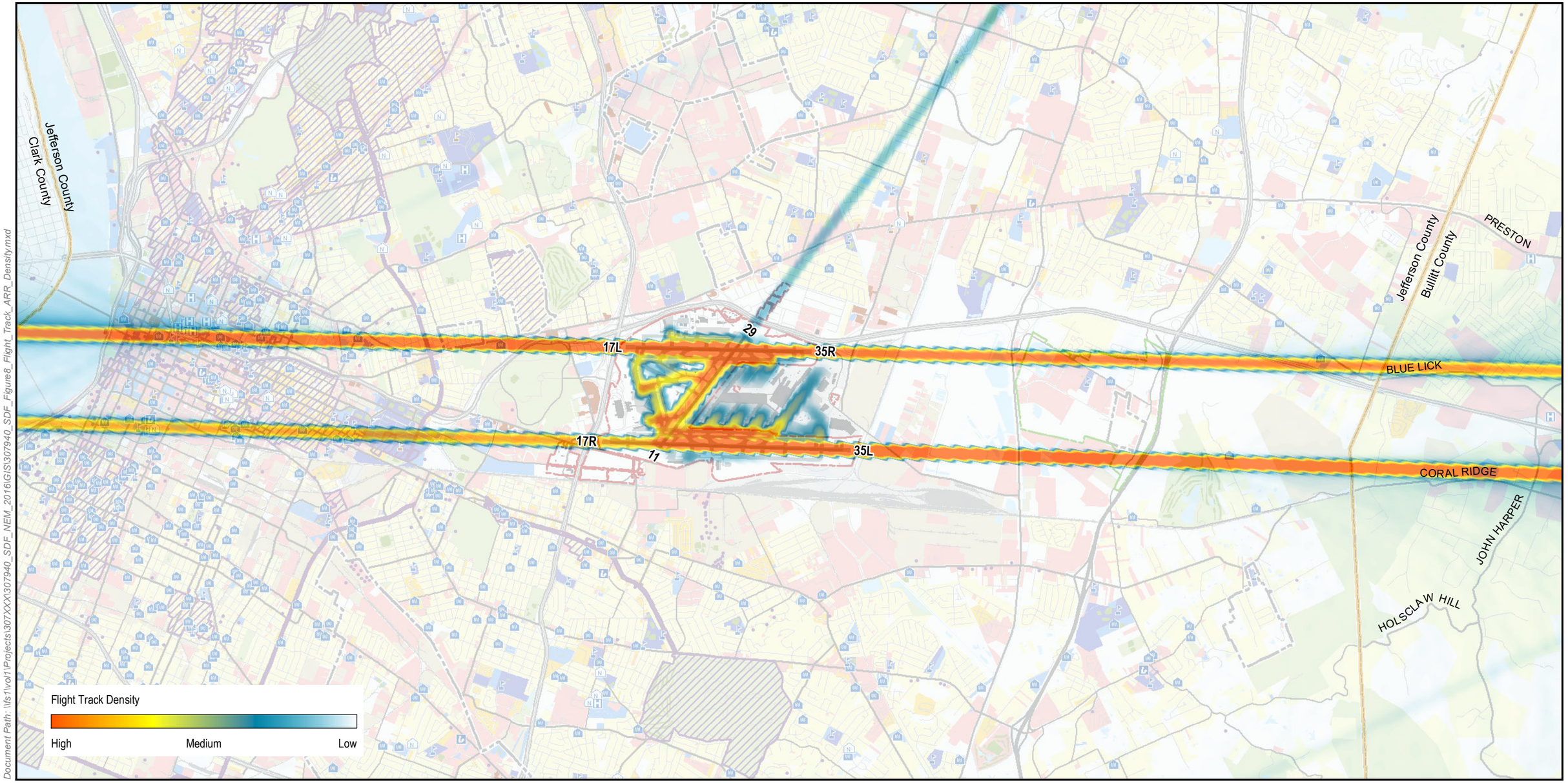
Legend

- Airport Boundary
- Airport Relocation Area
- Runway
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
- Nursing Home
- Library
- Place of Worship
- Historic District
- Non-District Historic Site
- Residential/Single Family
- Residential Multi-Family
- Commercial
- Manufacturing (Including Agriculture)
- Parks / Cemeteries / Recreation
- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: 10
Flight Track Density Plot
Jet Departures



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Legend

- Airport Boundary
- Airport Relocation Area
- Runway
- Municipal Boundary
- County Boundary
- Expressway
- Arterial
- Collector
- Local
- Railroad
- College/University
- Schools
- Hospital
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- Public / Government Use
- Educational
- Transportation
- Vacant / Undefined
- Water

0 5,000 10,000 Feet

Louisville INTERNATIONAL AIRPORT

Figure: **11**

Flight Track Density Plot
Jet Arrivals

hmmh

6 PUBLIC PARTICIPATION

The LRAA considers it essential to involve the interested stakeholders throughout the NEM Update. During the previous 14 CFR Part 150 study, the LRAA organized a Community Noise Forum (CNF) to monitor the implementation of the Noise Compatibility Program. The CNF is comprised of designated representatives from a broad spectrum of entities with interest in the 14 CFR Part 150 update process and its products. The public participation program for this NEM Update included scheduled CNF meetings and an informal public workshop open to the general public. The public participation program was active throughout the study process.

6.1 Community Noise Forum

The Community Noise Forum (CNF) is a group representative of the community, airport tenants, technicians, local and Federal agencies affected by and/or regulatory of airport operations and environs land use. These entities include the LRAA's Board of Directors, the LRAA Management, Louisville Air Traffic Control staff, Louisville Airport Affairs Committee, Kentucky Air National Guard, United Parcel Service, General Aviation community at SDF, University of Louisville, Louisville Metro Government, Airport Neighbors' Alliance, Southern Indiana, and community representatives from each quadrant bounding the airport. The LRAA expects CNF participants to take an active role in transmitting information on the study's progress to their constituencies.

The NEM process included bi-monthly meetings with the CNF to present and discuss progress. The first meeting, November 23, 2015, included an introduction to the consultant team selected by the LRAA to complete the project and a high-level overview of the NEM Update process. During the second meeting, held May 23, 2016 the consultant team and the LRAA provided a comprehensive overview to the NEM Update process, presented study goals and objectives, reviewed draft study input, and conveyed expectation to the CNF in terms of its roles and responsibilities. Appendix L presents copies of background material and summary minutes for each meeting for public consultation efforts related to the NEM element of the 14 CFR Part 150 update process. During third meeting, held September 26, 2016 the consultant team and the LRAA discussed study progress, reviewed the comprehensive set of modeling assumptions, and discussed the noise modeling tools. During a supplemental meeting on Thursday, October 26, 2016, the airport staff gave interested CNF members the opportunity to review the draft NEMs and accompanying report. HMMH was available via teleconference to answer any questions from the group.

The CNF members were responsible for representing their constituents throughout the study process, including commenting on the adequacy and accuracy of collected data, simplifying assumptions, and technical analyses. The CNF also provided a forum for discussion of complex subjects and the sharing of differing perspectives on aircraft noise issues. After a review of the draft NEM by the CNF, the Airport Staff presented the NEM project to the LRAA Board.

6.2 Other meetings

On March 10 and 11, 2016 the consulting team and LRAA met with airport users and other stakeholders to seek input on study assumptions. The meetings were used to verify user specific modeling input and solicit information regarding operational changes anticipated in the 2016-2025 timeframe. In some cases, the meetings were followed up with phone calls to clarify input parameters or request additional input and validation.

6.3 Public Workshop

The study included a Public Workshop on November 29, 2016 to ensure that every interested party had the opportunity to obtain information on the study process and results. The workshop was held at the Fourth Presbyterian Church on Preston Highway and was advertised through public notices in the local newspaper. The workshop with consisted of five information stations and an additional station for written comments. Appendix N presents the materials related to the Public Workshop.

6.4 Public Input Received during the Study Process

The draft documentation was available for public review from November 4, 2016 to December 4, 2016 at the following locations:

- Main Library
  301 York St
  Louisville, KY 40203
- Airport Administrative Offices (during normal business hours, call for appointment)

The draft documents were also available on the airport website: www.flylouisville.com

The document availability provided opportunity for the interested public to review and submit any comments in accordance with 14 CFR Part 150 §150.21(b).

All public comments received during the review period and at the public workshop are included in Appendix L of the final document. A total of 13 comments were received; they are included in Appendix L in a comment matrix with responses, as well as scanned versions of the original comments.