WESTOVER METROPOLITAN AIRPORT/ WESTOVER AIR RESERVE BASE

Noise Exposure Map and Noise Compatibility Program Update

14 CFR Part 150

DRAFT | July 2014

Prepared for:

Westover Metropolitan Development Corporation

Prepared by:

Stantec HNTB

Westover Metropolitan Airport/ Westover Air Reserve Base

14 CFR Part 150

Draft

Noise Exposure Map

and
Noise Compatibility Program

July 2014

Prepared for:

Westover Metropolitan Development Corporation

Prepared by:

Stantec
HNTB Corporation

Mr. Richard Doucette
Environmental Program Manager
New England Region - Airports Division
AA New England Regional Office
12 New England Executive Park
Burlington, MA 01803

Subject: **Submission of 14 CFR Part 150 Study, including Noise Exposure Maps and an update to the Noise Compatibility Program for Westover Metropolitan Airport**

Dear Mr. Doucette,

The Westover Metropolitan Development Corporation (WMDC) is pleased to submit five (5) copies of the above referenced document for appropriate FAA determination. With this submission, the WMDC requests that the FAA review these figures and associated documentation to determine compliance with Part 150 requirements, and accept Figure NEM-1 as the official existing condition NEM and Figure NEM-2 as the official forecast condition NEM. The NEMs are revisions to the 2003 and 2008 NEM previously determined by the FAA to be in compliance with 14 CFR Part 150 in March 2004.

The Part 150 study process included the development of reasonable planning assumptions that have been incorporated into the development of the Existing (2014) NEM. Aircraft activity data was collected in 2012 and 2013 and the methodology used to generate noise exposure contours is consistent with Part 150 requirements. The Future (2019) NEM is also based on reasonable forecasts of aviation activity, and is a reasonable representation of noise conditions for the fifth year following the date of submission of this document.

The Noise Compatibility Program (NCP) was initially approved by the FAA in January 1996. This NCP Update includes a modification to one land use measure (the voluntary acquisition and relocation program which was initiated in 2005). Modifications to the NCP have been shared with the representatives of the cities and towns whose jurisdiction includes the potentially impacted properties.

On behalf of the WMDC, I would like to express appreciation to the FAA for its support in conducting this update to the Airport's Part 150 program. We look forward to an expeditious Federal review and approval of our revised plan, such that the WMDC can continue implementation of the mitigation program currently underway.

Sincerely,

Michael W. Bolton
Director of Civil Aviation
Westover Metropolitan Airport

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STATEMENT OF CERTIFICATION

This is to certify the following:

The Noise Exposure Maps and accompanying documentation for Westover Metropolitan Airport, submitted in accordance with 14 CFR Part 150 with the best available information are hereby certified as true and complete to the best of my knowledge and belief.

All interested persons have been afforded adequate opportunity to submit their views, data and comments concerning the correctness and adequacy of the draft noise exposure map and forecast operations. The record and description of consultation and opportunity for public comment as provided are hereby certified as true and complete to the best of my knowledge and belief.

By: _____

Michael W. Bolton
Director of Civil Aviation
Westover Metropolitan Airport

Date: _____

Airport Name: Westover Metropolitan Airport

Airport Operator: Westover Metropolitan Development Corporation (WMDC)

Address: 255 Padgette Street
Chicopee, MA 01022

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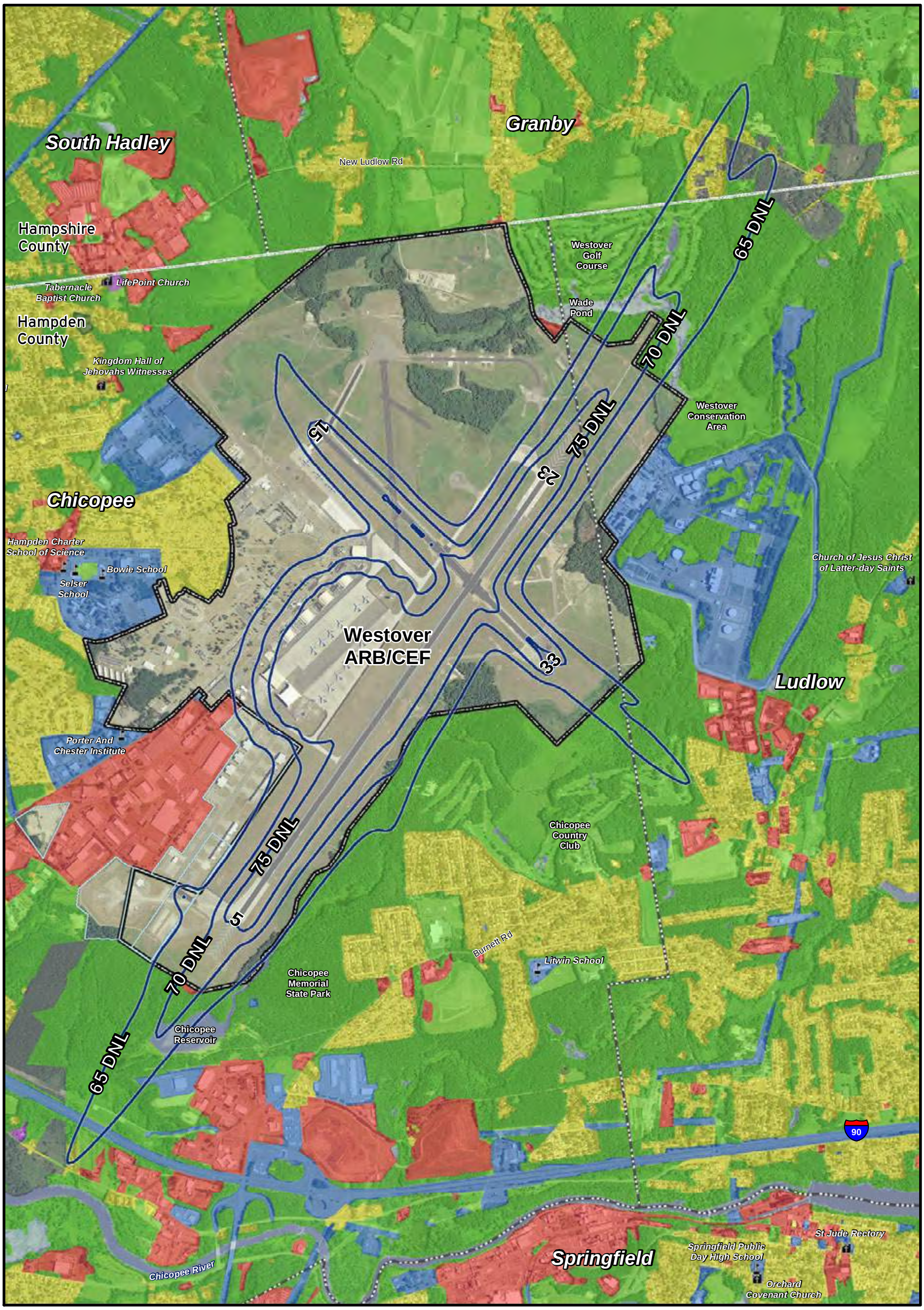

LEGEND

- 2014 DNL Noise Contour
- Commercial/Industrial
- Open/Agricultural/Recreational
- Public/Quasi-Public
- Residential
- Previously Acquired Property under the Voluntary Acquisition Program
- Cemetery
- Institutional
- Water
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary
- Place of Worship
- School

Existing (2014) Conditions Noise Exposure Map NEM-1

N

1" = 2,000'

0 500 1,000 2,000 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

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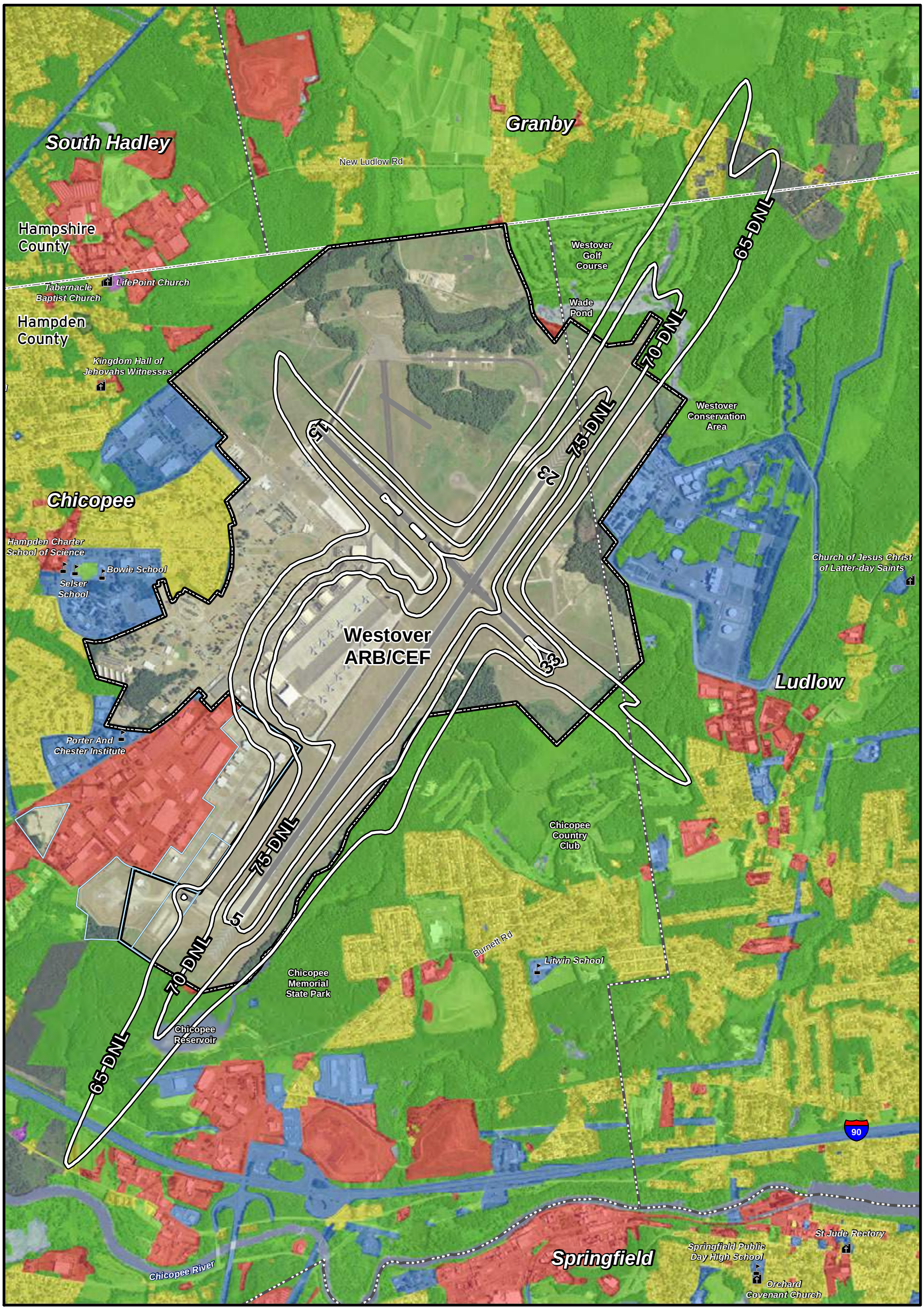

LEGEND

- 2019 DNL Noise Contour
- Commercial/Industrial
- Open/Agricultural/Recreational
- Public/Quasi-Public
- Residential
- Previously Acquired Property under the Voluntary Acquisition Program
- Cemetery
- Institutional
- Water
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary
- Place of Worship
- School

Future (2019) Conditions
Noise Exposure Map
NEM-2

N

1" = 2,000'

0 500 1,000 2,000 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

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APPENDICES

CHAPTER 1: Introduction

Title 14 of the Code of Federal Regulations (CFR) Part 150, "Airport Noise Compatibility Planning," sets forth standards for airport operators to use in documenting noise exposure in airport environs and establishing programs to minimize aircraft noise and land use incompatibilities. Federal Aviation Administration (FAA) Advisory Circular 150/5020-1, "Noise Control and Compatibility Planning," establishes the framework for conducting Part 150 studies, and notes that the goal of the study process is "to develop a balanced and cost-effective program to minimize and/or mitigate the airport's noise impact on local communities."

Section 1.1 of this chapter provides an overview of the Part 150 process. Section 1.2 reviews the requirements of Noise Exposure Map (NEM) submittals, Section 1.3 discusses Noise Compatibility Plan (NCP) measures, Section 1.4 discusses the project roles and responsibilities, and Section 1.5 explains the study goals.

Chapter Two presents the existing and forecast operations data used in determining the noise environment around Westover Metropolitan Airport (CEF). **Chapter Three** discusses land use and compatibility criteria. **Chapter Four** includes the updated NEMs for 2014 and 2019. **Chapter Five** details the impact to the existing NCP based on the forecast Future (2019) NEM, and **Chapter Six** provides a summary of consultation completed throughout the NEM/NCP Update process. **Appendices A through E** provide supporting material relevant to this study.

1.1 14 CFR Part 150

14 CFR Part 150 (referred to as Part 150 within this document) prescribes specific standards for the following:

- measuring aircraft noise;
- estimating cumulative aircraft noise exposure using computer models;
- describing aircraft noise exposure (including instantaneous, single event and cumulative levels);
- coordinating Noise Compatibility Program (NCP) development with local land use officials and other interested parties;
- documenting the analytical process and development of the compatibility program;
- submitting documentation to the FAA;
- FAA and public review processes; and
- FAA approval or disapproval of the submission.

A full Part 150 submission to the FAA consists of two elements: NEMs for an existing and forecast condition and an NCP. The Westover Metropolitan Development Corporation (WMDC) first completed an NEM and NCP under 14 CFR Part 150 for the Airport in 1994. An NEM Update was conducted in 2003; this document presents an update to the 2003 and 2008 NEMs and revisits the mitigation component of the 1996 NCP.

1.2 Noise Exposure Maps

The FAA developed a checklist for use in reviewing NEM submittals, which must be completed prior to submission of the final NEM. A copy of the FAA checklist is provided in ***Appendix A***. The checklist provides specific requirements for approval of NEMs, along with page and section references indicating the location in the document where the requirements are addressed.

The NEM document describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting aircraft noise and land use compatibility status. NEMs include graphic depictions of existing and forecast (i.e., future) noise exposure levels resulting from aircraft operations and land uses in the airport environs. The NEM documentation also describes the data collection and analyses undertaken in its development.

NEMs must address two time frames: the year of submission (the "existing condition") and the fifth calendar year following the year of submission (the "forecast condition"). The submission year for this NEM/NCP Update is 2014 and a Future (2019) NEM represents the 5-year forecast noise exposure. Upon acceptance by the FAA, the NEMs replace previously accepted maps from the 2003 NEM Update.

1.3 Noise Compatibility Program

A review of the Airport's FAA-approved NCP was conducted in order to evaluate the implementation of the recommended and approved NCP measures. The NCP analysis also considers the most recent NEMs and how implementation of the mitigation program would be affected. ***Appendix B*** provides the FAA's Record of Approval (ROA) of the 1996 NCP completed for the Airport. An NCP checklist is provided in *Appendix A* following the NEM checklist.

The NCP is essentially a list of the actions the airport operator, airport users, local governments, and FAA propose to undertake to minimize existing and future aircraft noise and land use incompatibility. The NCP documentation must recount the development of the program, including a description of all measures considered, the reasons that individual measures were accepted or rejected, how measures will be implemented and funded, and the predicted effectiveness of individual measures and the overall program.

1.4 Project Roles and Responsibilities

As discussed below, several groups had major roles in the Part 150 process, including the WMDC, the 439th Airlift Wing of the Air Force Reserve, Army Aviation Support Facility No. 2 of the Massachusetts Army National Guard, the project consultant team (Stantec and HNTB Corporation (HNTB)), the Pioneer Valley Planning Commission (PVPC), the Aeronautics Division of MassDOT, and the FAA.

The Airport hosts both civilian and military activity. WMDC manages civil operations at the Airport, while the Air Force Reserve manages military operations. The facility is operated under a joint use agreement with the Department of Defense (DoD) hosting the WMDC, a quasi-public non-profit development corporation established in 1974.

1.4.1 Westover Metropolitan Development Corporation

As the airport operator, WMDC is the project sponsor and has responsibility over the entire NEM/NCP Update. Using information provided by the consulting team,

the WMDC, in consultation with the FAA, also reviews the previous NCP with the updated NEMs to ensure that these two components of the Part 150 are aligned.

1.4.2 439th Airlift Wing of the Air Force Reserve

The 439th Airlift Wing is based at Westover and operates 16 C-5 Galaxy aircraft. As the primary user of the Airport, the 439th Airlift Wing provided information on military flight operations and procedures.

In February of 2013, the Air Force Reserve finalized an Air Installation Compatible Use Zone (AICUZ) Study update. The purpose of the AICUZ program is to promote compatible land development in areas subject to aircraft noise and accident potential. The Study reaffirmed Air Force policy of promoting public health, safety, and general welfare in areas surrounding the Airport. The report presented changes in flight operations since the previous AICUZ Study (1996), and provided current noise zones and future noise zones and compatible use guidelines for land areas.

The Westover Airport Traffic Control Tower (ATCT or Westover Tower) is operated by the DoD and provided significant input into several areas, including existing and future operational procedures and trends.

1.4.3 Pioneer Valley Planning Commission

The PVPC is the regional planning body for the jurisdictions surrounding the Airport. PVPC serves the member governments within its district, and provided land use compatibility assistance for this NEM/NCP Update.

1.4.4 Massachusetts Department of Transportation - Aeronautics Division

The Massachusetts Department of Transportation-Aeronautics Division provided funding assistance for this NEM/NCP Update and will provide review of documents.

1.4.5 Consultant

The WMDC retained Stantec and HNTB to conduct the technical work required to fulfill Part 150 analysis and documentation requirements. Stantec is responsible for the overall document submittal, as well as the forecasting effort. HNTB completed the development of the NEMs, and the analysis and update of the NCP program.

1.4.6 Federal Aviation Administration (FAA)

FAA has ultimate review authority over the NEMs submitted under Part 150. FAA review includes an assessment of both the adequacy of the technical documentation and the broader issues related to satisfying the Part 150 process requirements.

FAA involvement includes participation by staff from the local, regional, and national levels of the agency, as follows:

- When the Airport submits the Part 150 documentation to the FAA for review, the FAA's New England Region–Airports Division will conduct an initial, local review to determine if it satisfies all NEM and NCP checklist requirements.
- The FAA's New England Region – Airports Division is responsible for the final review of the NEM documentation for adequacy in satisfying technical and legal

requirements and approval of any revisions to the NCP.

1.5 NEM/NCP Update Study Goals

The overall goal of the NEM/NCP Update is to develop a current condition (2014) and a forecast future condition (2019) NEM, and to update the Airport's NCP thereby defining necessary continued implementation of mitigation programs currently underway. The previous NEMs represented existing (2003) and future (2008) conditions, and were accepted by the FAA in March 2004. The WMDC's ongoing voluntary acquisition program uses boundaries established in the existing (2003) NEM.

A number of goals have been identified to guide the development of the 14 CFR Part 150 NEM/NCP Update. These goals include:

- Develop an understanding of probable future noise levels including any potential changes to the C-5 mission;
- To characterize and present to the public, local jurisdictions, and other interested parties the existing and reasonably foreseeable future noise levels associated with aircraft activity at the Airport;
- To identify existing and potentially non-compatible land uses within the existing and future 65 and above Day-Night Average Sound Level (DNL) noise exposure contours;
- To identify the status of the measures that were recommended and previously approved in the Airport's NCP; and
- To identify boundaries for the continuation of the WMDC, MassDOT and FAA-sponsored voluntary acquisition program, based on the revised 65 DNL noise exposure contours and remaining within the context of Federal regulations and eligibility criteria, financial feasibility, and fairness to aviation and non-aviation interests.

CHAPTER 2: Existing and Forecast Flight Operations

This chapter describes existing and forecast aircraft operations at the Airport. Noise exposure is shown in the form of DNL noise contours. Part 150 requires the use of DNL noise contours to describe the noise environment around an airport.

The scope of this study is to quantify noise exposure for the following conditions:

- *Existing (2014) Conditions NEM*, which models anticipated conditions during the current year.
- *Future (2019) Conditions NEM*, which models future conditions in the fifth year following the year of submission.

The FAA requires the analyses of subsonic aircraft noise exposure around airports to be accomplished using the Integrated Noise Model (INM), a computer program distributed by the FAA. The latest version of INM (version 7.0d) was used for this study to model civilian aircraft and helicopter operations. The DoD maintains a noise modeling tool similar to INM (NOISEMAP) which the FAA accepts for the modeling of military aircraft and helicopter operations. The output from each noise model is combined to present DNL noise contours.

Both models use representative samples of actual data to develop noise exposure. Annual Average Day (AAD) operations are representative of all aircraft operations that occur over the course of a year, and represent annual operations divided by 365 days. Runway and flight track use is also averaged over the same time period.

Aircraft operations consist of departures and arrivals categorized by acoustical daytime and nighttime. For the purposes of noise modeling, acoustical daytime is defined as 7:00 a.m. to 9:59 p.m., and nighttime is defined as 10:00 p.m. to 6:59 a.m. The DNL metric applies a 10-decibel (dB) penalty to nighttime flights due to the added intrusiveness of nighttime operations. Runway use, flight track location and use, and aircraft profiles define the paths that aircraft use as they fly to and from the Airport.

The noise models compute noise exposure (i.e., DNL) at points on the ground around the Airport. From the grid of points generated by the models, contours of equal sound level are drawn and overlaid onto land use maps.

The use of computer-based noise modeling allows for the projection of future forecasted noise exposure, which could not be accomplished with noise monitoring that can only assess existing noise exposure at a limited number of locations. When the calculations are made in a consistent manner, noise models are most accurate for comparing “before-and-after” noise effects resulting from forecast changes or potential alternatives. The noise models allow noise predictions for such forecast change actions without the need for noise monitoring over an extended period of time, or actual implementation of any forecast changes. The noise models allow for the evaluation of aircraft noise exposure at many more points, thus permitting development of DNL contours.

2.1 Airport Location and Layout

2.1.1 General information

The Airport is located approximately three (3) miles northeast of downtown Chicopee, Massachusetts, and is a joint-use military (Westover Air Reserve Base, WARB, Base) and civilian airfield (Westover Metropolitan Airport) that consists of approximately 2,500 acres of land in the City of Chicopee and the Town of Ludlow. The facility is operated under a joint use agreement with the DoD hosting the WMDC. The Base is accessed via James Street from Route 33/Memorial Drive. The civilian terminal area can be accessed via Westover Road from Route 33/Memorial Drive. The Airport is accessible from the Massachusetts Turnpike (Interstate I-90) at Route 33 and Interstate 291. **Figure 2-1** presents the general location of the Airport.

2.1.2 Users

Westover ARB is the nation's largest Air Force Reserve base, and is home to the 439th Airlift Wing, which serves as the military host unit. The mission of the 439th Airlift Wing is to provide worldwide air movement of troops, supplies, equipment and medical patients. The Wing's flying unit is the 337th Airlift Squadron, which operates 16 Lockheed C-5 Galaxy (C-5B) model aircraft. The C-5 is used for missions involving outsized and oversized cargo that no other aircraft can carry.

The Base is also home to several tenant units including Marine Air Support Squadron Six; 4th Marine Aircraft Wing Reserve Training Center; Marine Air Support Squadron Six; the US Army Corps of Engineers; the US Armed Forces Reserve Training Center; Army Air Force Exchange Service; a Reserve Readiness and Mobility Squadron, the 226th Transportation Company (US Army Reserve); the Springfield Military Entrance Processing Station (MEPS); a Defense Contract Management Administration office and Naval Construction Battalion 27, US Navy Reserve. Transient military aircraft not assigned to one of the military tenants also frequent the facility.

The Airport is an FAA and Transportation Security Administration certified air carrier facility handling scheduled public charter flights and general aviation traffic. The WMDC has acquired and developed over 1,300 acres of surplus military property to form three industrial parks. The WMDC manages day-to-day operations at the Airport, and the continuing development of commercial and industrial real estate at each of the industrial parks. A 15,000 square foot passenger terminal and over 300,000 square feet of hangar space is available.

The Airport lies at an elevation of approximately 241 feet above mean sea level, and maintains two runways (Runway 05/23 and Runway 15/33). The primary runway (Runway 05/23) is oriented in a north-south direction with a length of 11,597 feet and a width of 300 feet. There is a displaced threshold on the Runway 05 end (to the south) of approximately 1,200 feet, meaning aircraft land approximately 1,200 feet from the end of the runway. Both Runway 05 and Runway 23 provide an Instrument Landing System for aircraft arriving in adverse weather.

The crosswind runway (Runway 15/33) is 7,082 feet long and 150 feet wide, oriented east-west. The Massachusetts State Police Air Wing is located on the airfield to the northwest of the Runway 05 end and conducts helicopter operations. A drop zone is utilized for some military training activity, located on the north side of the Airport.

Westover Metropolitan Airport
NEM/NCP Update Study

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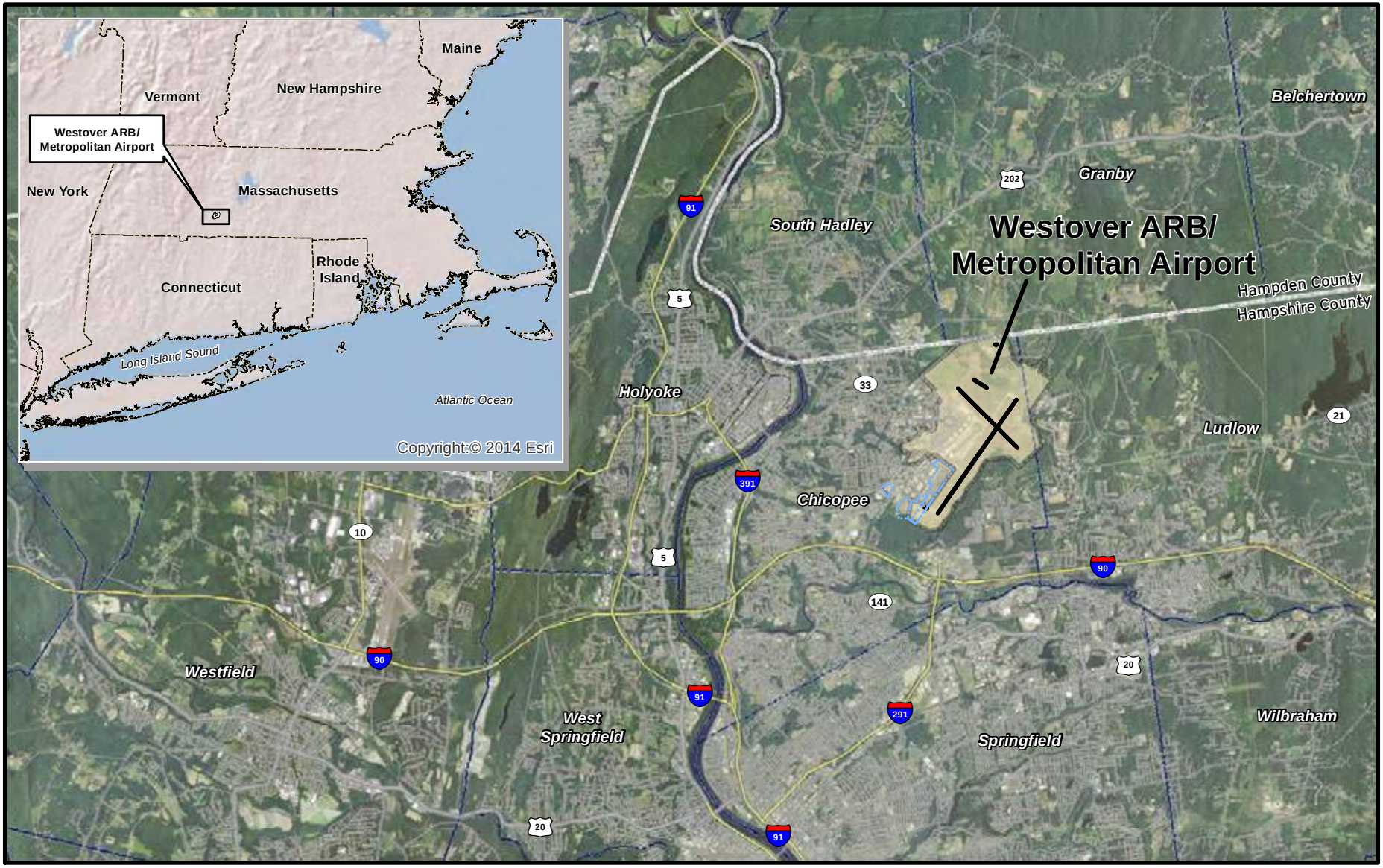

LEGEND

- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Vicinity Map
Figure 2-1

N

1" = 12,000'

0 3,000 6,000 12,000 Feet

Source: MassGIS, USDA, ESRI Data, WMDC, 2013

Figure 2-2 presents an illustration of the airfield layout, including the location of airport users, runways, and other facilities.

2.1.3 Weather and Climate

Runway use and the operational characteristics of aircraft are heavily influenced by weather conditions, including temperature, humidity and wind speed. Weather conditions also influence the propagation of sound. As the temperature increases, the density of air decreases; this reduces wing lift and engine thrust, which results in increased takeoff distance and a lower climb rate. Therefore, departing aircraft are at a lower altitude, and noise exposure generally increases. Conversely, noise exposure is decreased on cold days when aircraft have improved performance capabilities.

Humidity does not significantly impact aircraft performance, however in conjunction with temperature; humidity does impact the propagation of sound. In general, sound travels farther in more humid conditions. Humidity is highest at night and gradually drops during the day, generally reaching its lowest point in the afternoon.

Wind speed and direction primarily determine runway selection and operational flow. Aircraft generally takeoff and land into the wind (known as a headwind) whenever possible. Headwinds reduce an aircraft's takeoff and landing distance and increase climb rate. Aircraft can operate with considerable crosswinds (winds blowing to the side of the aircraft): up to about 20 knots for a typical large air carrier size aircraft. Aircraft can operate with limited tailwinds (winds blowing to the rear of the aircraft): up to 10 knots for a typical large air carrier size aircraft. Tailwinds increase takeoff and landing distance. Winds in excess of crosswind and tailwind limits generally force aircraft to use a different runway. The winds at the Airport are generally out of the south and north, and favor operations on the existing runways, which are aligned accordingly.

Average weather conditions in 2013 were used as input for each noise model. In 2013, weather conditions at the Airport averaged 51.6 degrees Fahrenheit and 75% relative humidity.

2.1.4 Airspace and Air Traffic Control

The airspace and air traffic control procedures in use at the Airport direct the flow of aircraft in and out of the area. As a result, they are an essential component in determining cumulative noise exposure. The Westover Tower, located near the geographic center of the airport northeast of the East Ramp, is generally staffed and operational between the hours of 7:00 a.m. to 11:00 p.m. Through prior arrangement, the Westover Tower may remain open to serve air traffic.

2.2 Existing (2014) Conditions

This section describes noise model operational inputs, including flight operations, aircraft database, flight profiles, runway use, and flight track location and use. Each noise model uses these inputs to compute noise exposure on the ground. The data in this section provides an overview of the aircraft operations included in the noise model.

2.2.1 Flight Operations and Fleet Mix

Flight (or aircraft) operations include the numbers of arrivals, departures, and closed pattern (touch-and-go) operations conducted by each type of aircraft. Operations are primarily flown by two groups of users: DoD users (including operations by the 439th Airlift Wing, other based users, and transient military aircraft),

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LEGEND

- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Airfield Layout
Figure 2-2

N

1" = 2,500'
0 625 1,250 2,500 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

and civilian operators, which include all other operations. Information on the types of aircraft, the time of operations, and other relevant noise model input was determined through consultation with the Westover Tower and other tenants as available.

The FAA and Westover Tower maintain records of flight operations that occur at the Airport and within certain airspace boundaries. Historic operations and consultation with the Westover Tower and airport users were undertaken in order to present a base year (2014) that is representative of the average conditions. In order to identify the number and type of aircraft operations that occur, a number of different sources were consulted. Overall operations were provided by the Westover Tower for 2013, which included operations that transverse through the local airspace but do not depart from or land at the Airport. The most recent data available also included a temporary relocation of F-15 aircraft associated with the Massachusetts Air National Guard stationed at Westfield Barnes Regional Airport (BAF), located eight miles west. These F-15 aircraft operations were temporarily located at the Airport in 2013 while runway work was completed at BAF and are therefore not considered representative of existing conditions.

Instrument Flight Rules (IFR) operations, which file a flight plan that indicates the aircraft type and arrival/departure information, were collected for a seven-month period in 2013. IFR operations account for approximately 26% of the baseline operations at the Airport. The remaining operations are considered visual flight rules (VFR) and the Westover Tower does not collect aircraft type information. The Westover Tower estimated the types and frequency of aircraft that represent VFR operations.

The noise models contain noise and performance data on nearly all aircraft types commonly flown in the US. Most of the military aircraft data used in INM comes from NOISEMAP, the Air Force's computer model for evaluating military aircraft noise exposure. The data is used to model an aircraft's departure and arrival flight profiles and resultant noise exposure. Aircraft that are not specifically included in the database (such as those with unique engine combinations) are modeled using appropriate substitution aircraft and criteria per the FAA's pre-approved substitution list. Coordination with the FAA's Office of Environment and Energy was undertaken to assist in the identification of appropriate aircraft to be used in the model when a pre-approved substitution was not available, and is included in ***Appendix C***.

The base year of operations is presented in **Table 2.1**. The table includes the identification of the fleet mix, its corresponding noise model aircraft type, and the number of average daily arrivals, departures, and closed pattern operations by day and night. On average, the Airport sees approximately 35 daily operations, which equates to an annual total of approximately 12,783 operations.

Overall, operations are predominantly flown by military aircraft (approximately 77%). A majority of aircraft activity at the Airport is flown by the 439th Airlift Wing, utilizing the C-5 aircraft, which fly approximately 260 days per year.

Table 2.1

2014 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	INM/NOISEMAP Aircraft	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Military	JET	A-10 Warthog	A-10A	0.02	0.00	0.02	0.00	-	-	0.04
Military	JET	Lockheed C-17 Globemaster	C-17	0.16	0.00	0.16	0.00	0.05	-	0.38
Military	JET	Lockheed C-5 Galaxy	C-5A	0.46	-	0.46	-	3.28	-	4.20
Military	JET	McDonnell-Douglas DC-10/KC-10	KC-10A	0.04	0.00	0.04	0.00	-	-	0.08
Military	JET	F-16 Fighting Falcon	F-16A	0.00	0.00	0.00	0.00	-	-	0.01
Military	JET	Boeing KC-135 Stratotanker	KC-135R	0.15	0.00	0.15	0.00	0.03	-	0.32
Military	MET	Lockheed C-130 Hercules	C-130H&N&P	0.87	0.01	0.87	0.01	2.28	-	4.03
Military	HEL	Sikorsky UH-60 Blackhawk	SK70(UH-60A) Blackhawk	3.25	0.03	3.25	0.03	11.15	-	17.73
Military	JET	F-18 Hornet	F-18	0.03	0.00	0.03	0.00	-	-	0.05
Military	SET	North American T-6 Texan	GASEPV	0.01	0.00	0.01	0.00	-	-	0.01
Military	MEP	North American B-25 Mitchell	DC3	0.01	0.00	0.01	0.00	-	-	0.02
Military	SEP	P-47 Thunderbolt	DC3	0.00	0.00	0.00	0.00	-	-	0.01
Military	HEL	Sikorsky S-58JT	S76	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET	Boeing 727-200	727EM1	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET		727EM2	0.00	0.00	0.00	0.00			0.01
Civil	JET	Boeing 737-400	737400	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Boeing 737-800	737800	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Boeing 747-200	747200	0.00	0.00	0.00	0.00	-	-	0.00
Civil	JET		74720A	0.00	0.00	0.00	0.00	-	-	0.00
Civil	JET		74720B	0.00	0.00	0.00	0.00	-	-	0.00
Civil	JET	Boeing 757	757300	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET		757PW	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET		757RR	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Boeing 777	777200	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET	Hawker 400	BEC400	0.05	0.00	0.05	0.00	-	-	0.11
Civil	JET	Cessna Citation 525B	CNA525C	0.01	0.00	0.01	0.00	-	-	0.03

Table 2.1

2014 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	INM/NOISEMAP Aircraft	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	JET	Cessna Citation 525A	CNA525C	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Cessna Citation II	CNA55B	0.02	0.00	0.02	0.00	-	-	0.04
Civil	JET		CNA550	0.02	0.00	0.02	0.00	-	-	0.04
Civil	JET	Citation V	CNA560E	0.01	0.00	0.01	0.00	-	-	0.03
Civil	JET		CNA560U	0.01	0.00	0.01	0.00	-	-	0.03
Civil	JET	Cessna Citation 56X	CNA560XL	0.11	0.00	0.11	0.00	-	-	0.22
Civil	JET	Cessna Citation 680	CNA680	0.04	0.00	0.04	0.00	-	-	0.09
Civil	JET	Cessna Citation X	CNA750	0.09	0.00	0.09	0.00	-	-	0.17
Civil	JET	Bombardier CL-300 Challenger	BD100	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Bombardier CL-600 Challenger	CL600	0.05	0.00	0.05	0.00	-	-	0.09
Civil	JET		CL601	0.05	0.00	0.05	0.00	-	-	0.09
Civil	JET	Embraer ERJ 135	EMB135	0.05	0.00	0.05	0.00	-	-	0.11
Civil	JET	Embraer 190	EMB190	0.07	0.00	0.07	0.00	-	-	0.15
Civil	JET	Embraer Phenom 100	CNA510	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Embraer Phenom 300	CNA560E	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Eclipse 500	ECLIPSE500	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Dassault Falcon 2000EX	FAL20A	0.07	0.00	0.07	0.00	-	-	0.15
Civil	JET	Dassault Falcon 7X	FAL900	0.05	0.00	0.05	0.00	-	-	0.11
Civil	JET	Dassault Falcon 900	FAL900	0.01	0.00	0.01	0.00			0.01
Civil	JET	Astra SPX (Gulfstream G100)	IA1125	0.06	0.00	0.06	0.00	-	-	0.12
Civil	JET	Gulfstream IV	GIV	0.07	0.00	0.07	0.00	-	-	0.14
Civil	JET	Gulfstream V	GV	0.05	0.00	0.05	0.00	-	-	0.10
Civil	JET	BAe 125-800	HS1258	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Hawker 850	HS1258	0.07	0.00	0.07	0.00	-	-	0.15
Civil	JET	Raytheon Hawker 800	HS1258	0.03	0.00	0.03	0.00	-	-	0.06
Civil	JET	Learjet 31	LEAR31	0.03	0.00	0.03	0.00	-	-	0.05
Civil	JET	Learjet 35	LEAR35	0.12	0.00	0.12	0.00	-	-	0.25

Table 2.1

2014 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	INM/NOISEMAP Aircraft	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	JET	Learjet 40	LEAR35	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Learjet 45	LEAR45	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Learjet 60	LEAR60	0.02	0.00	0.02	0.00	-	-	0.03
Civil	JET	Tupolev TU154	TU154	0.01	0.00	0.01	0.00	-	-	0.01
Civil	MET	Gulfstream 695A	AC95	0.01	0.00	0.01	0.00	-	-	0.01
Civil	MET	Beechcraft Super King Air 200	BEC200	0.09	0.00	0.09	0.00	-	-	0.19
Civil	MET	Beechcraft Super King Air 300	BEC300	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	CASA Persuader CN-35	CAN235	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	Piaggio Avanti	P180	0.02	0.00	0.02	0.00	-	-	0.03
Civil	MET	Merlin Swearingen SW-4	SAMER4	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SET	Piper PA-46 Malibu Meridian	PC12	0.02	0.00	0.02	0.00	-	-	0.04
Civil	SET	Pilatus PC-12	PC12	0.09	0.00	0.09	0.00	-	-	0.18
Civil	MEP	Beechcraft Baron	BEC55	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MEP		BEC58	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MEP	Cessna 310R	CNA310	0.03	0.00	0.03	0.00	-	-	0.07
Civil	MEP	Cessna 414	CNA414	0.03	0.00	0.03	0.00	0.00	-	0.05
Civil	MEP	Cessna 421c	CNA421	0.01	0.00	0.01	0.00	0.00	-	0.02
Civil	MEP	McDonnell-Douglas DC-3	DC3	0.00	0.00	0.00	0.00	-	-	0.01
Civil	MEP	Piper PA-30 Twin Commanche	PA30	0.00	0.00	0.00	0.00	-	-	0.01
Civil	MEP	Piper PA-31 Navajo	PA31	0.04	0.00	0.04	0.00	-	-	0.08
Civil	MEP	Piper PA-44 Seminole	PA44	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Raytheon A36	BECM35	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SEP	Beechcraft Bonanza	BECM35	0.06	0.00	0.06	0.00	-	-	0.13
Civil	SEP	Cessna 120	GASEPF	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cessna 140	GASEPF	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cessna 152	CNA152	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SEP	Cessna 305	CNA170	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cessna 172	CNA172	0.26	0.00	0.26	0.00	0.10	-	0.63

Table 2.1

2014 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	INM/NOISEMAP Aircraft	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	SEP	Cessna 182	CNA182	0.12	0.00	0.12	0.00	0.05	-	0.30
Civil	SEP	Cessna 206	CNA206	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cessna 210	CNA210	0.02	0.00	0.02	0.00	-	-	0.03
Civil	SEP	Aeropro Eurofox	GASEPF	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Experimental - Single Engine	GASEPV	0.07	0.00	0.07	0.00	-	-	0.15
Civil	SEP	Mooney M20	M20J	0.07	0.00	0.07	0.00	-	-	0.14
Civil	SEP	Piper PA-18 Super Cub	PA18	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Piper PA-22 Pacer	PA22TR	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Piper PA-24 Comanche	PA24	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Piper PA-28 Cherokee	PA28	0.09	0.00	0.09	0.00	-	-	0.18
Civil	SEP	Piper PA-32 Cherokee Six	PA32C6	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP		PA32LA	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP		PA32SG	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cirrus SR22	SR22	0.09	0.00	0.09	0.00	-	-	0.18
Civil	HEL	Eurocopter AS-355	SA355F	0.24	0.00	0.24	0.00	-	-	0.49
Civil	HEL	Eurocopter EC135	EC130	0.73	0.01	0.73	0.01	-	-	1.48
Civil	HEL	General Helicopters	S76	0.07	0.00	0.07	0.00	-	-	0.15
Civil	HEL	McDonnell-Douglas 369E	H500D	0.01	0.00	0.01	0.00	-	-	0.02
Civil	HEL	Robinson R22	R22	0.01	0.00	0.01	0.00	-	-	0.02
Civil	HEL	Sikorsky S-76C	S76	0.21	0.00	0.21	0.00	-	-	0.42
Total				***8.95***	***0.09***	***8.95***	***0.09***	***16.94***	***-***	***35.02***

Source: HNTB Analysis.

2.2.2 Aircraft Flight Profiles

Flight profiles model the vertical paths of aircraft during departure and arrival to determine the altitude, speed, and engine thrust of an aircraft at any point along a flight track. The noise model uses this information to calculate noise exposure on the ground.

Profiles are unique to each aircraft type and are based on operating procedures, temperature and aircraft operating weight. Detailed information on aircraft flight profiles, under varying conditions, is stored in the noise model aircraft database.

The climb rate and flight profile of departing aircraft can vary considerably. New, modern aircraft have higher thrust engines and improved wing designs which results in an increased climb rate as compared to older aircraft. Modern jet engines are also much quieter than their predecessors, even though they can produce more thrust. Temperature, takeoff weight and airline operating procedures are also important factors that affect climb rate.

The INM aircraft database groups aircraft-specific profiles by stage length, which refers to the length of the trip to be made by the aircraft type. For departures, INM assumes aircraft weight increases with stage, or trip length, due to the need for more fuel and that each aircraft type's takeoff distance and climb performance is different for each stage length. High-weight (long trip, high stage length) aircraft have increased takeoff distances and lower climb rates than lighter (short trip) aircraft for a given aircraft type.

Arriving civilian aircraft do not use stage lengths, as they are modeled using a standard three-degree approach path. INM has a database of standard arrival flight profiles for each modeled aircraft type.

NOISEMAP allows the input of custom flight profiles for military operations. Information for the operations flown by the C-5 aircraft were collected and modeled in the 2013 AICUZ study, which has been carried forward in this study. Westover aircrews perform tactical flight training for departures and approaches, adopted due to the focus on wartime and efficiency of C-5 operations. As compared to the operations flown by C-5 aircraft studied in previous noise studies at Westover, the C-5 tactical training requirements generally result in aircraft profiles with a higher rate of climb in a spiral pattern above the airport, fast arrivals with turns above the airport, and a steeper angle of descent before arrivals.

2.2.3 Runway Use

Runway use is determined by several factors, including safety, wind, weather, traffic demand, runway capacity, direction of flight, and prescribed runway use procedures. The Westover Tower assigns runway use with consideration to all of these factors. Runway use was evaluated based on a series of categories, including by military and civilian operations, and by aircraft type including jets, single and multi-engine turboprop, single- and multi-engine piston, and helicopter operations. **Table 2.2** presents the overall runway use, including military and civilian operations.

Table 2.2

Overall Runway Usage

Civil			
Operation Type	**Runway**	**Day**	**Night**
Arrival	05	20%	20%
	23	80%	80%
Departure	05	80%	80%
	23	20%	20%
Touch-and-Go	05	20%	0%
	23	80%	0%
Military			
Operation Type	**Runway**	**Day**	**Night**
Arrival	05	31%	25%
	23	56%	54%
	15	0%	0%
	33	5%	8%
	32DZ	8%	13%
Departure	05	37%	43%
	23	55%	49%
	15	1%	0%
	33	8%	8%
Touch-and-Go	05	16%	0%
	23	46%	0%
	15	2%	0%
	33	8%	0%
	32DZ	28%	0%

Notes: Total may not sum due to rounding.
32DZ denotes use of the Drop Zone (see Figure 2-2).

Sources: HNTB Analysis.

Civilian operations remain primarily on the main runway (Runway 05/23), and operations are predominantly to and from the north (arrivals to Runway 23, and departures from Runway 05). Military operations use both runways, but remain concentrated on the longer primary runway as well. The crosswind runway (Runway 15/33) includes a smaller number of arrivals, departures and closed pattern (touch-and-go) operations.

2.2.4 Flight Track Locations and Use

Modeled flight tracks depict the approximate paths, or ground tracks, that aircraft use as they travel to and from the airport. Flight tracks are intended to be representative of typical aircraft operations at the Airport. As with runway use, flight track use reflects the percentage of annual operations that use a specific flight route, grouped by arrival or departure and daytime or nighttime. **Figures 2-3 through 2-8** present the noise model representative flight tracks used by both civilian and military aircraft, including specific procedures flown by the C-5 aircraft.

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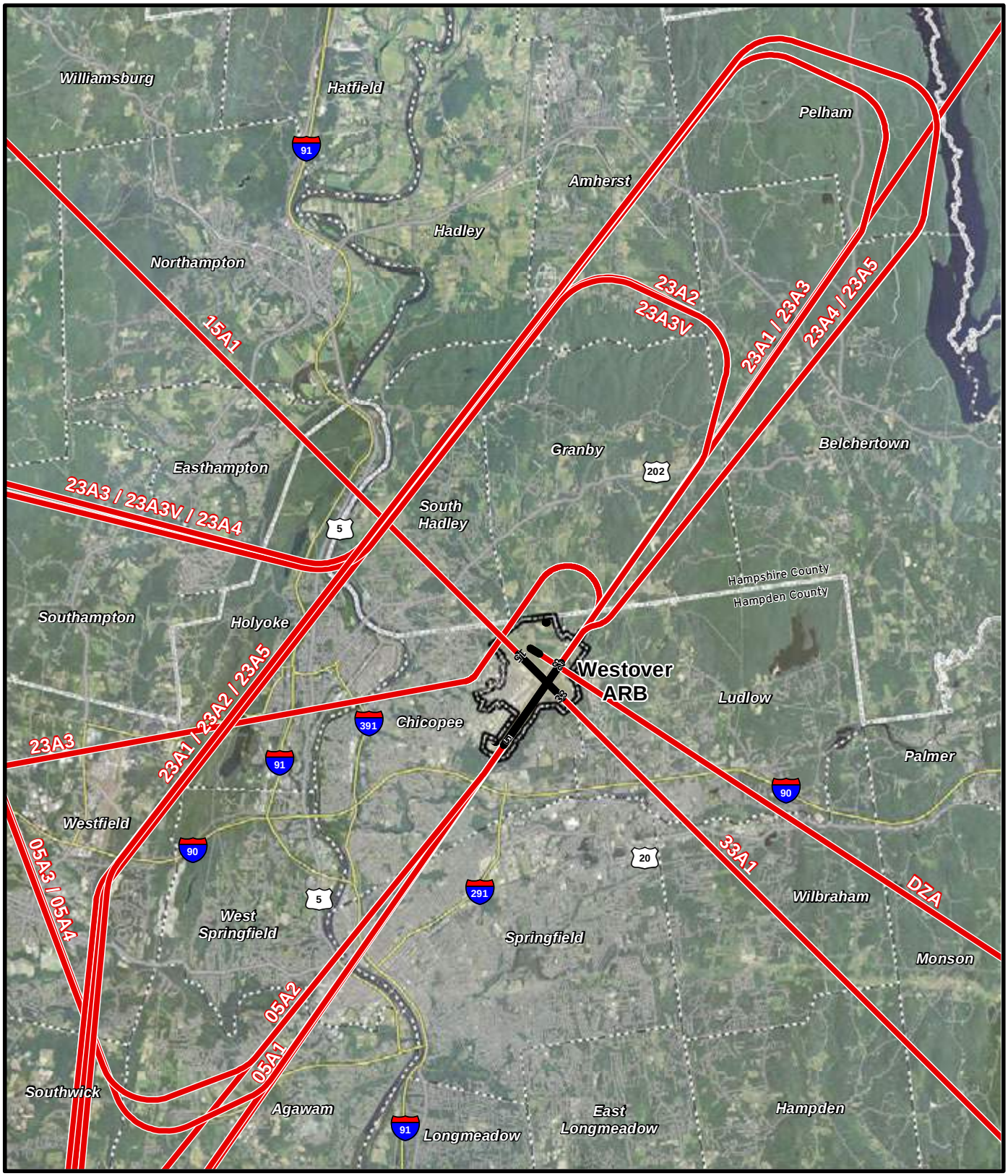


LEGEND

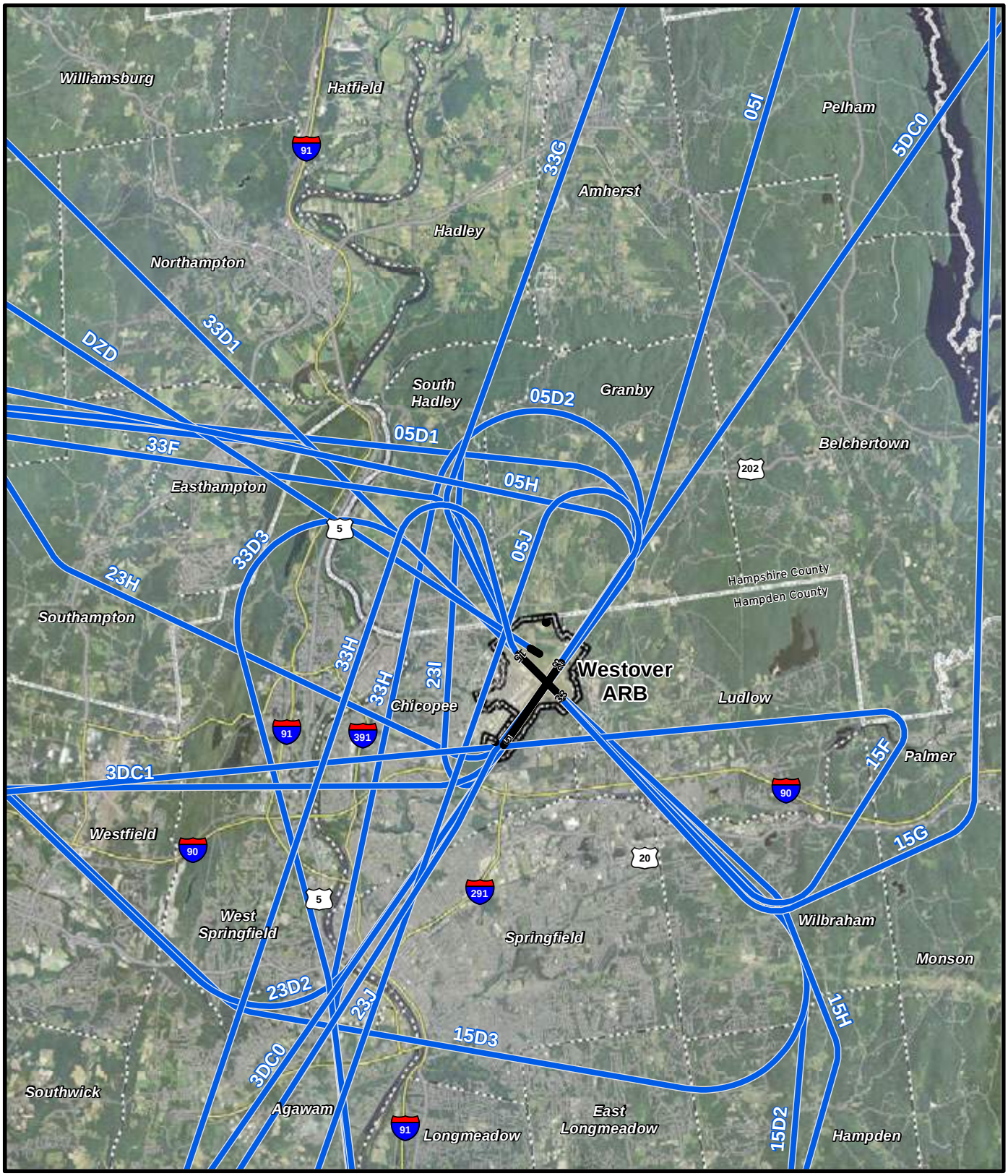
- Arrival Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Arrival Noise Model Flight Tracks
Figure 2-3

N

1" = 16,000'
0 4,000 8,000 16,000 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis



LEGEND

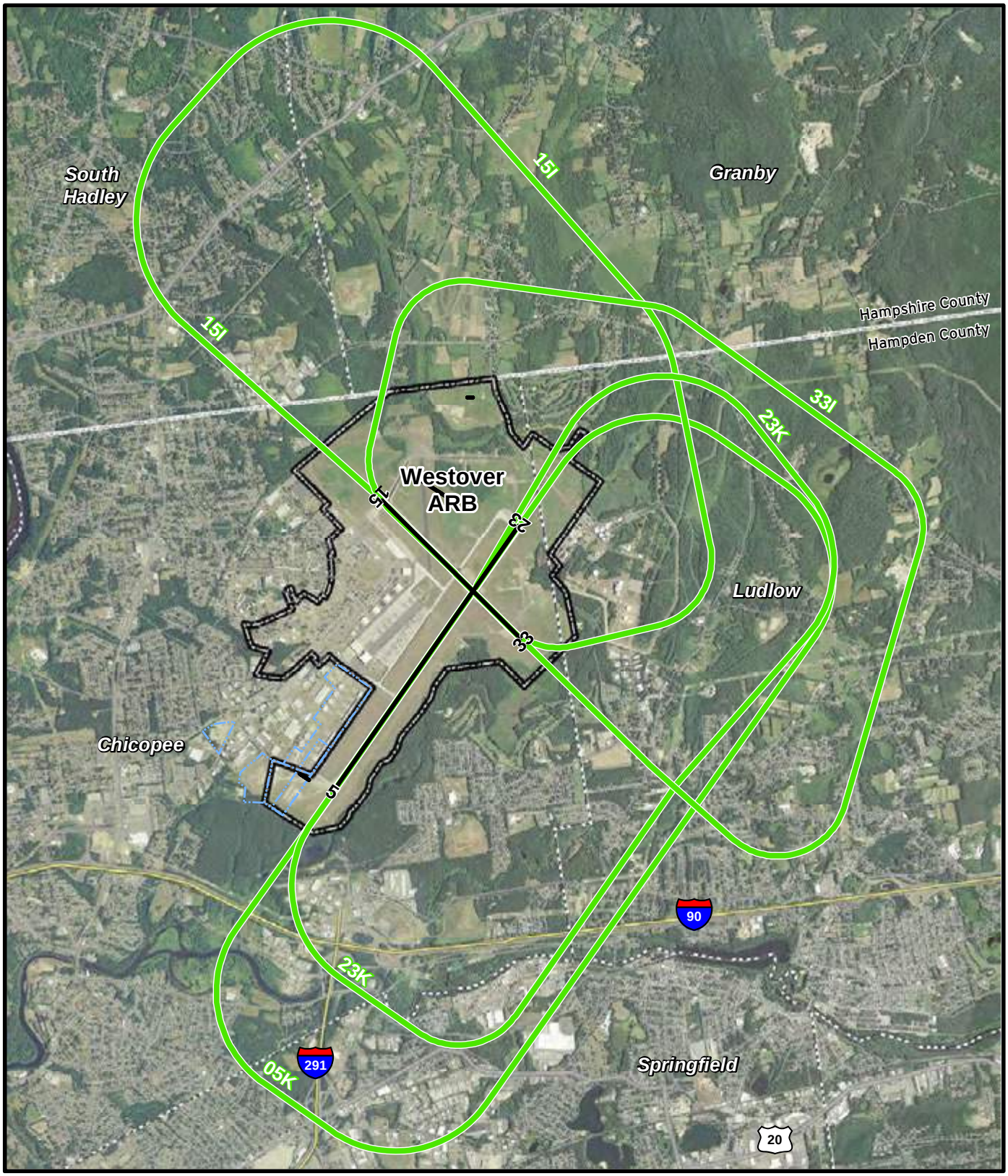
- Departure Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Departure Noise Model Flight Tracks
Figure 2-4

N

1" = 16,000'
0 3,950 7,900 15,800 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis



LEGEND

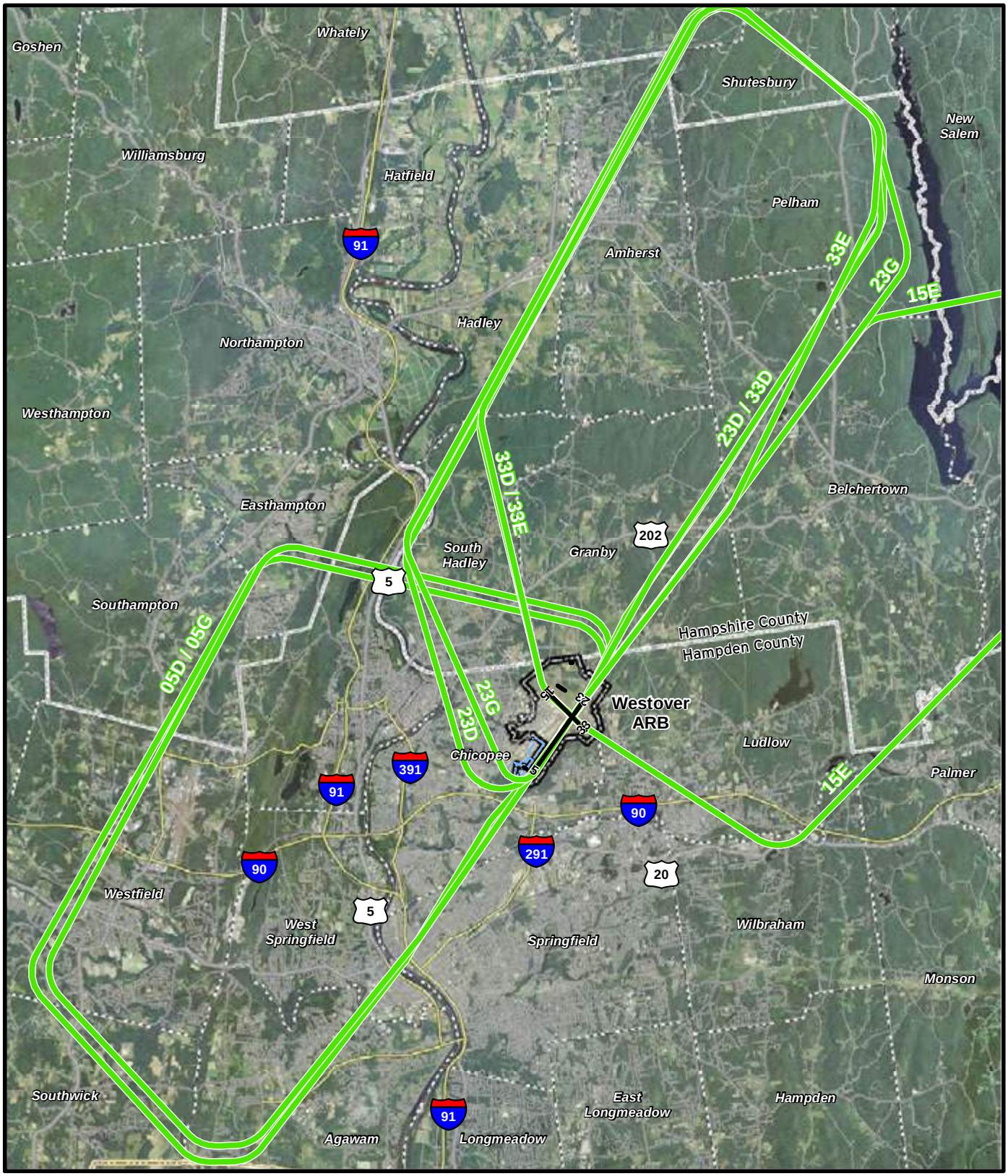
- Closed Pattern (C-5) Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Closed Pattern (C-5) Noise Model Flight Tracks
Figure 2-5

N

1" = 5,000'
0 1,250 2,500 5,000 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis



LEGEND

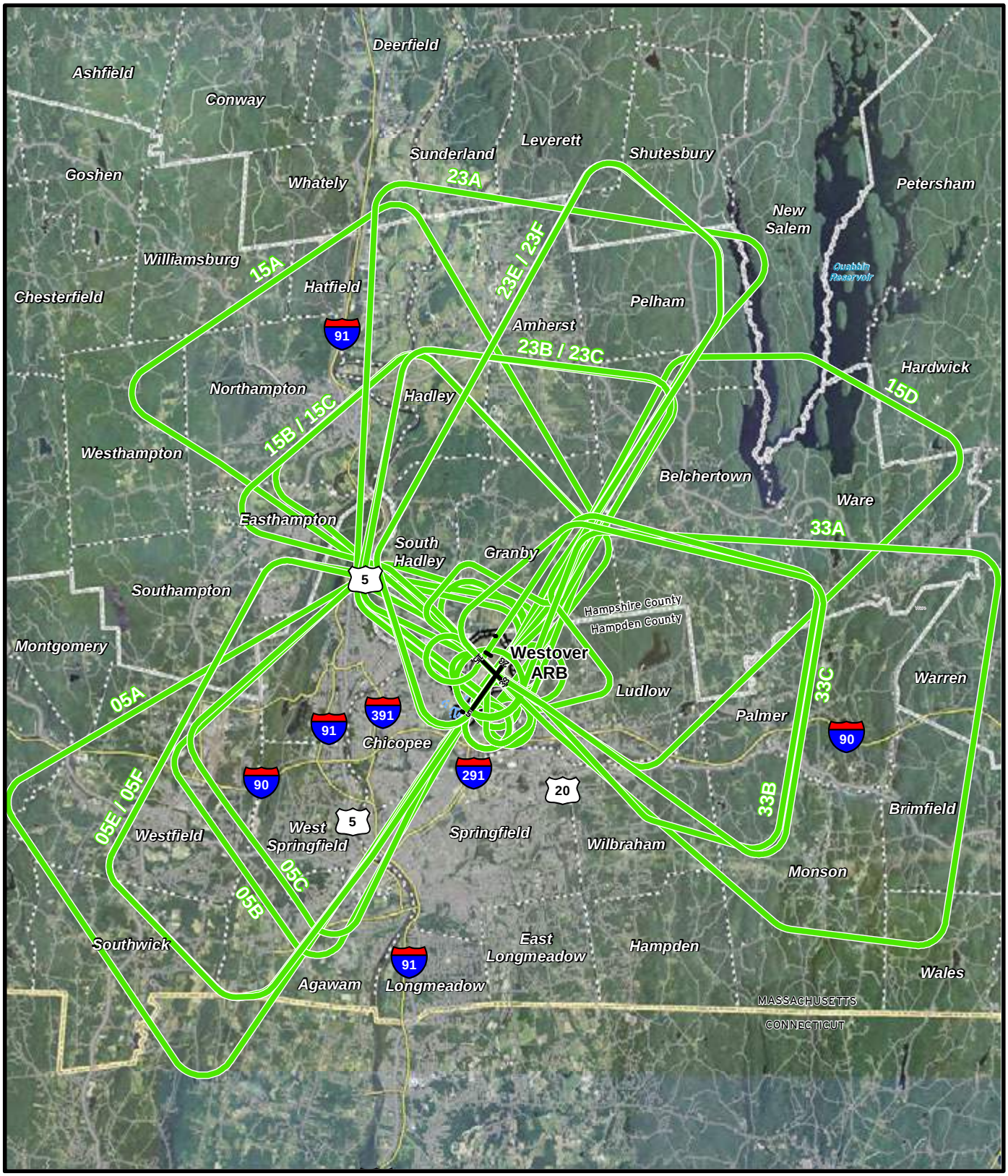
- Closed Pattern C-5 (Ground Control Approach Arrival) Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Closed Pattern C-5 (Ground Control Approach Arrivals) Noise Model Flight Tracks
Figure 2-6

N

1" = 18,000'
0 4,500 9,000 18,000 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis



LEGEND

- Closed Pattern C-5 (Tactical Approach) Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Closed Pattern C-5 (Tactical Approach) Noise Model Flight Tracks
Figure 2-7

N

1" = 25,000'

0 6,250 12,500 25,000 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis

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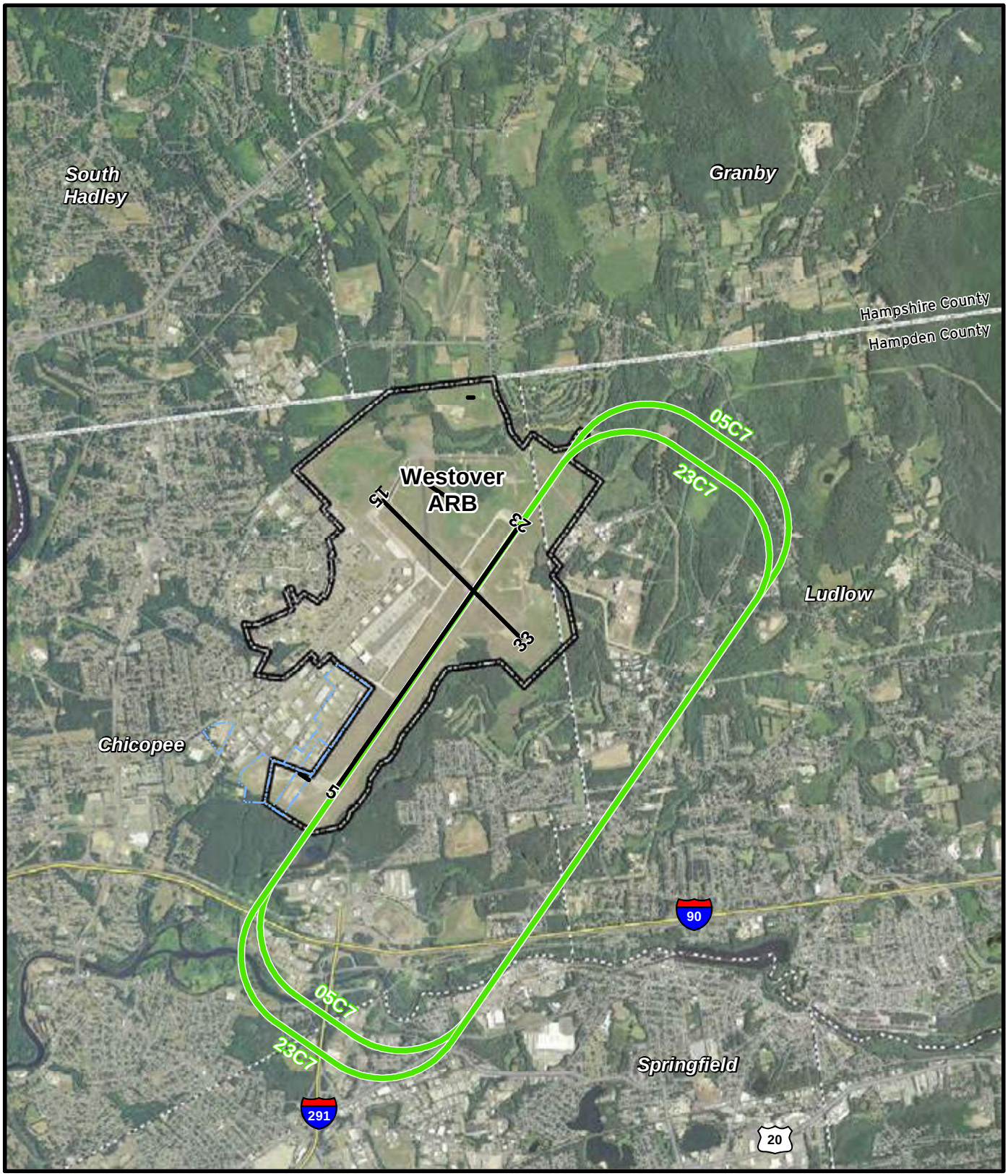

LEGEND

- Closed Pattern (Civilian) Flight Track
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Closed Pattern (Civilian) Noise Model Flight Tracks
Figure 2-8

N

1" = 5,000'
0 1,250 2,500 5,000 Feet

Source: MassGIS, ESRI Data, USDA and HNTB Analysis

2.2.5 Run-up/Maintenance Operations

Run-up operations increase the engine throttle while the aircraft is on the ground. Run-ups are usually not associated with arrival or departure operations, but are used as part of maintenance and engine warm-up procedures.

The Airport is one of three C-5 inspection/repair facilities for the Air Force, and conducts maintenance procedures on both based C-5 aircraft and on those assigned to other bases. For the AICUZ, C-5 maintenance activity was collected for a 12-month period from Base personnel and input into the noise model. Generally, run-ups are performed on the East Ramp with the aircraft oriented at 330 degrees, while a majority of engine run-up activity is conducted between the hours of 7:00 a.m. and 9:59 p.m.

2.3 Future (2019) Conditions

Part 150 regulations require that the forecast condition be representative of operations anticipated to occur five years following the year of submission. As such, conditions were forecast for the year 2019, and factors that influence noise exposure, including forecast operations, runway use, flight track locations and use, engine run-up activity, and any changes to the airfield were evaluated.

2.3.1 Flight Operations and Fleet Mix

Operations, including the types, frequencies, and time of day of operations, were forecast for 2019. The forecast included a zero growth rate over the next five years for military activity. Civilian operations were forecast to increase approximately one percent per year. Total operations in 2019 are forecast to be 12,931 annually, or approximately 35.4 on an average annual day. **Table 2.3** provides a summary of the forecast (2019) operations.

2.3.2 Aircraft Flight Profiles

There are no changes to the flight profiles used by aircraft in 2019.

2.3.3 Runway Use

Runway use in 2019 is forecast to remain unchanged from the existing (2014) condition.

2.3.4 Flight Track Locations and Use

The location and frequency of use of flight tracks is forecast to remain unchanged from the existing (2014) condition.

2.3.5 Run-up/Maintenance Operations

The run-up operations associated with the C-5 aircraft are forecast to remain unchanged from the existing (2014) condition.

Table 2.3

2019 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	Final INM/NOISEMAP Code	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Military	JET	A-10 Warthog	A-10A	0.02	0.00	0.02	0.00	-	-	0.04
Military	JET	Lockheed C-17 Globemaster	C-17	0.16	0.00	0.16	0.00	0.05	-	0.38
Military	JET	Lockheed C-5 Galaxy	C-5A	0.46	-	0.46	-	3.28	-	4.21
Military	JET	McDonnell-Douglas DC-10/KC-10	KC-10A	0.04	0.00	0.04	0.00	-	-	0.08
Military	JET	F-16 Fighting Falcon	F-16A	0.00	0.00	0.00	0.00	-	-	0.01
Military	JET	Boeing KC-135 Stratotanker	KC-135R	0.15	0.00	0.15	0.00	0.03	-	0.32
Military	MET	Lockheed C-130 Hercules	C-130H&N&P	0.87	0.01	0.87	0.01	2.28	-	4.03
Military	HEL	Sikorsky UH-60 Blackhawk	SK70(UH-60A) Blackhawk	3.25	0.03	3.25	0.03	11.15	-	17.73
Military	JET	F-18 Hornet	F-18	0.03	0.00	0.03	0.00	-	-	0.05
Military	SET	North American T-6 Texan	GASEPV	0.01	0.00	0.01	0.00	-	-	0.01
Military	MEP	North American B-25 Mitchell	DC3	0.01	0.00	0.01	0.00	-	-	0.02
Military	SEP	P-47 Thunderbolt	DC3	0.00	0.00	0.00	0.00	-	-	0.01
Military	HEL	Sikorsky S-58JT	S76	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET	Boeing 727-200	727EM1	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET		727EM2	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET	Boeing 737-400	737400	0.01	0.00	0.01	0.00	-	-	0.03
Civil	JET	Boeing 737-800	737800	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Boeing 747-200	747200	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET		74720A	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET		74720B	0.00	0.00	0.00	0.00	-	-	0.01
Civil	JET	Boeing 757	757300	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET		757PW	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET		757RR	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Boeing 777	777200	0.01	0.00	0.01	0.00	-	-	0.01
Civil	JET	Hawker 400	MU3001	0.06	0.00	0.06	0.00	-	-	0.11
Civil	JET	Cessna Citation 525B	CNA525C	0.01	0.00	0.01	0.00	-	-	0.03

Table 2.3

2019 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	Final INM/NOISEMAP Code	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	JET	Cessna Citation 525A	CNA525C	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Cessna Citation II	CNA55B	0.02	0.00	0.02	0.00	-	-	0.04
Civil	JET		CNA500	0.02	0.00	0.02	0.00	-	-	0.04
Civil	JET	Citation V	CNA560E	0.02	0.00	0.02	0.00	-	-	0.03
Civil	JET		CNA560U	0.02	0.00	0.02	0.00	-	-	0.03
Civil	JET	Cessna Citation 56X	CNA560XL	0.11	0.00	0.11	0.00	-	-	0.23
Civil	JET	Cessna Citation 680	CNA680	0.05	0.00	0.05	0.00	-	-	0.09
Civil	JET	Cessna Citation X	CNA750	0.09	0.00	0.09	0.00	-	-	0.18
Civil	JET	Bombardier CL-300 Challenger	CL601	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Bombardier CL-600 Challenger	CL600	0.05	0.00	0.05	0.00	-	-	0.10
Civil	JET		CL601	0.05	0.00	0.05	0.00	-	-	0.10
Civil	JET	Embraer ERJ 135	EMB145	0.05	0.00	0.05	0.00	-	-	0.11
Civil	JET	Embraer 190	EMB190	0.08	0.00	0.08	0.00	-	-	0.16
Civil	JET	Embraer Phenom 100	CNA510	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Embraer Phenom 300	CNA560E	0.01	0.00	0.01	0.00	-	-	0.03
Civil	JET	Eclipse 500	ECLIPSE500	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Dassault Falcon 2000EX	CL600	0.08	0.00	0.08	0.00	-	-	0.16
Civil	JET	Dassault Falcon 7X	F10062	0.06	0.00	0.06	0.00	-	-	0.11
Civil	JET	Dassault Falcon 900	F10062	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Astra SPX (Gulfstream G100)	IA1125	0.06	0.00	0.06	0.00	-	-	0.12
Civil	JET	Gulfstream IV	GIV	0.07	0.00	0.07	0.00	-	-	0.15
Civil	JET	Gulfstream V	GV	0.05	0.00	0.05	0.00	-	-	0.11
Civil	JET	BAe 125-800	LEAR35	0.01	0.00	0.01	0.00	-	-	0.02
Civil	JET	Hawker 850	LEAR35	0.08	0.00	0.08	0.00	-	-	0.15
Civil	JET	Raytheon Hawker 800	LEAR35	0.03	0.00	0.03	0.00	-	-	0.06
Civil	JET	Learjet 31	LEAR35	0.03	0.00	0.03	0.00	-	-	0.05

Table 2.3

2019 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	Final INM/NOISEMAP Code	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	JET	Learjet 35	LEAR35	0.13	0.00	0.13	0.00	-	-	0.26
Civil	JET	Learjet 40	LEAR35	0.01	0.00	0.01	0.00	-	-	0.03
Civil	JET	Learjet 45	LEAR35	0.04	0.00	0.04	0.00	-	-	0.08
Civil	JET	Learjet 60	CNA55B	0.02	0.00	0.02	0.00	-	-	0.03
Civil	JET	Tupolev TU154	727D17	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	Gulfstream 695A	CNA441	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	Beechcraft Super King Air 200	CNA441	0.10	0.00	0.10	0.00	-	-	0.20
Civil	MET	Beechcraft Super King Air 300	DO228	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	CASA Persuader CN-35	SF340	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MET	Piaggio Avanti	SD330	0.02	0.00	0.02	0.00	-	-	0.03
Civil	MET	Merlin Swearingen SW-4	DHC6	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SET	Piper PA-46 Malibu Meridian	CNA208	0.02	0.00	0.02	0.00	-	-	0.04
Civil	SET	Pilatus PC-12	CNA208	0.10	0.00	0.10	0.00	-	-	0.19
Civil	MEP	Beechcraft Baron	BEC58P	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MEP		BEC58P	0.01	0.00	0.01	0.00	-	-	0.02
Civil	MEP	Cessna 310R	BEC58P	0.03	0.00	0.03	0.00	-	-	0.07
Civil	MEP	Cessna 414	BEC58P	0.03	0.00	0.03	0.00	0.00	-	0.06
Civil	MEP	Cessna 421c	BEC58P	0.01	0.00	0.01	0.00	0.00	-	0.02
Civil	MEP	McDonnell-Douglas DC-3	DC3	0.01	0.00	0.01	0.00	-	-	0.01
Civil	MEP	Piper PA-30 Twin Commanche	PA30	0.01	0.00	0.01	0.00	-	-	0.01
Civil	MEP	Piper PA-31 Navajo	PA31	0.04	0.00	0.04	0.00	-	-	0.09
Civil	MEP	Piper PA-44 Seminole	BEC58P	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SEP	Raytheon A36	GASEPV	0.01	0.00	0.01	0.00	-	-	0.03
Civil	SEP	Beechcraft Bonanza	GASEPV	0.07	0.00	0.07	0.00	-	-	0.13
Civil	SEP	Cessna 120	GASEPF	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Cessna 140	GASEPF	0.01	0.00	0.01	0.00	-	-	0.01

Table 2.3

2019 Average Annual Day Fleet Mix

Civil / Military	Category	Aircraft Name	Final INM/NOISEMAP Code	AAD Arrivals		AAD Departures		AAD Closed Pattern		AAD Total
				Day	Night	Day	Night	Day	Night	
Civil	SEP	Cessna 152	CNA172	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SEP	Cessna 305	CNA172	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Cessna 172	CNA172	0.27	0.00	0.27	0.00	0.11	-	0.66
Civil	SEP	Cessna 182	CNA182	0.13	0.00	0.13	0.00	0.05	-	0.32
Civil	SEP	Cessna 206	CNA206	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Cessna 210	CNA206	0.02	0.00	0.02	0.00	-	-	0.04
Civil	SEP	Aeropro Eurofox	GASEPF	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Experimental - Single Engine	GASEPV	0.08	0.00	0.08	0.00	-	-	0.15
Civil	SEP	Mooney M20	GASEPV	0.07	0.00	0.07	0.00	-	-	0.15
Civil	SEP	Piper PA-18 Super Cub	GASEPF	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Piper PA-22 Pacer	GASEPF	0.01	0.00	0.01	0.00	-	-	0.01
Civil	SEP	Piper PA-24 Comanche	GASEPV	0.01	0.00	0.01	0.00	-	-	0.02
Civil	SEP	Piper PA-28 Cherokee	PA28	0.10	0.00	0.10	0.00	-	-	0.19
Civil	SEP	Piper PA-32 Cherokee Six	GASEPV	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP		GASEPV	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP		GASEPV	0.00	0.00	0.00	0.00	-	-	0.01
Civil	SEP	Cirrus SR22	GASEPV	0.09	0.00	0.09	0.00	-	-	0.19
Civil	HEL	Eurocopter AS-355	SA355F	0.26	0.00	0.26	0.00	-	-	0.52
Civil	HEL	Eurocopter EC135	EC130	0.77	0.01	0.77	0.01	-	-	1.55
Civil	HEL	General Helicopters	S76	0.08	0.00	0.08	0.00	-	-	0.15
Civil	HEL	McDonnell-Douglas 369E	H500D	0.01	0.00	0.01	0.00	-	-	0.02
Civil	HEL	Robinson R22	R22	0.01	0.00	0.01	0.00	-	-	0.03
Civil	HEL	Sikorsky S-76C	S76	0.22	0.00	0.22	0.00	-	-	0.44
Total				***9.15***	***0.09***	***9.15***	***0.09***	***16.96***	***-***	***35.43***

Source: HNTB Analysis.

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CHAPTER 3: Noise and Land Use Compatibility

This section reviews the Federal and local land use guidelines related to compatibility with aircraft noise exposure and aeronautical uses, and the development of land use data needed for the analyses required in Part 150. Note that ***Appendix D*** presents an introduction to the relevant fundamentals of acoustics and noise terminology and the effects of noise on human activity.

A discussion of existing and future land use compatibility relative to the Existing (2014) and Future (2019) NEMs is included in Chapter Four.

3.1 Land Use Guidelines

Land use guidelines provide the primary means of preventing new non-compatible development. The following sections provide a description of federal and local land use guidelines.

3.1.1 Federal Guidelines

The degree of annoyance that people experience from aircraft noise varies, depending on their activities at any given time. For example, people are usually less disturbed by aircraft noise when they are shopping, working, or driving than when they are at home. Transient hotel and motel residents seldom express as much concern with aircraft noise as do permanent residents of an area. The concept of "land use compatibility" has arisen from this systematic variation in community reaction to noise.

In a Part 150 study, DNL noise values have the following two principal uses:

- Provide a basis for comparing existing noise conditions to the effects of noise abatement procedures and/or forecast changes in airport activity; and
- Provide a quantitative basis for identifying potential noise impacts and mitigation.

Both of these functions require the application of objective criteria for evaluating noise impacts. Reproduced in **Table 3.1**, Part 150 provides the FAA's recommended guidelines for noise and land use compatibility evaluation. In setting the various compatibility guidelines, however, the regulations state that the designations do not constitute a Federal determination that any use of land covered by the [noise compatibility] 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 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.

The FAA's guidelines represent a compilation of the results of scientific research into noise-related activity interference and attitudinal response.

However, reviewers of DNL contours should recognize the highly subjective nature of an individual's response to noise, and that special circumstances can affect individual tolerances. For example, a high, non-aircraft background noise level can reduce the significance of aircraft noise, such as in areas constantly exposed to relatively high levels of vehicular traffic noise. Alternatively, residents of areas with unusually low background noise levels may find relatively low levels of aircraft noise annoying.

Response may also be affected by expectation and experience. People may become accustomed to a level of exposure that guidelines typically indicate may be unacceptable. Conversely, minor changes in exposure may generate a response that is far greater than that which the guidelines suggest.

Table 3.1
Part 150 Noise and Land Use Compatibility Guidelines

	Yearly Day-Night Average Sound Level, DNL, in Decibels					
Land Use	**<65**	**65-70**	**70-75**	**75-80**	**80-85**	**>85**
Residential Use						
Residential, other than mobile homes and transient lodgings	Y	N(a)	N(a)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(a)	N(a)	N(a)	N	N
Public Use						
Schools	Y	N(a)	N(a)	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(b)	Y(c)	Y(d)	Y(d)
Parking	Y	Y	Y(b)	Y(c)	Y(d)	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(b)	Y(c)	Y(d)	N
Retail trade--general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(b)	Y(c)	Y(d)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(b)	Y(c)	Y(d)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(f)	Y(g)	Y(h)	Y(h)	Y(h)
Livestock farming and breeding	Y	Y(f)	Y(g)	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(e)	Y(e)	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

Table 3.1
Part 150 Noise and Land Use Compatibility Guidelines

Key to Table 3.1	
SLUCM	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.

NOTE: 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 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.

Notes to Table 3.1

(a) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor 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 stated 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.

(b) 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.

(c) 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.

(d) 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.

(e) Land use compatible provided special sound reinforcement systems are installed.

(f) Residential buildings require an NLR of 25.

(g) Residential buildings require an NLR of 30.

(h) Residential buildings not permitted.

Source: 14 Code of Federal Regulations Part 150, *Airport Noise Compatibility Planning,* Appendix A, Table 1.

The cumulative nature of DNL means that the same level of noise exposure can be achieved in an infinite number of ways. For example, a reduction in a small number of relatively noisy operations may be counterbalanced by an increase in relatively quiet flights, with no net change in DNL. Residents of the area may be highly annoyed by the increased frequency of operations, despite the seeming maintenance of the noise *status quo*.

Part 150 guidelines specify that all uses are normally compatible with aircraft noise exposure levels at or below 65 DNL. This guideline is supported formally by standards adopted by the Department of Housing and Urban Development (HUD). HUD standards

address whether sites are eligible for Federal funding support. These standards, set forth in 24 CFR Part 51 *Environmental Criteria and Standards*, define areas with DNL exposure not exceeding 65 dB as acceptable for HUD assistance or subsidy. Areas exposed to noise levels between 65 and 75 DNL are "normally unacceptable," and require special abatement measures and review. Those areas at 75 DNL and above are "unacceptable" except under limited circumstances.

As with the previous Part 150 Study and NEM Updates, this NEM/NCP Update uses the Federal Part 150 guidelines to assist in identifying potential land use incompatibilities surrounding the Airport.

3.1.2 Local Land Use Guidelines

The Airport is located in the City of Chicopee and Town of Ludlow in Hampden County, Massachusetts and is bordered to the north by the towns of South Hadley and Granby in Hampshire County. The area was relatively undeveloped when the Westover Base was dedicated in 1946; however development has increased to the south and west, and industrial and low-to-medium density residential development has emerged to the north and east. The Airport is now located close to the largest population center in Western Massachusetts, but is also near rural areas that could be susceptible to sprawling residential development.

Each of the cities/towns has a municipal zoning ordinance to regulate land use. Despite recommendations in previous Part 150 studies and updates, the Town of Ludlow is the only community within the affected noise area (within the 65 DNL contours) with land use tools that have been implemented to mitigate or prevent non-compatible uses. Ludlow's overlay district prohibits the use of nursing homes, schools, hospitals, day care centers, auditoriums, places of worship and concert halls.

As stated in the 2013 Westover ARB AICUZ, local governments have implemented height restrictions in order to help maintain existing land use characteristics. While none of these height restrictions were designed specifically in accordance with FAA (i.e., FAR Part 77) obstruction limits, they tend to be compatible with them.

The Pioneer Valley Planning Commission (PVPC) serves as a regional planning agency for these jurisdictions, with the goal "to increase communication, cooperation, and coordination among all levels of government in its 43-member community, as well as the private business and civic sectors in order to benefit the Pioneer Valley region and to improve its residents' quality of life." [1] The PVPC provides planning guidance to communities and maintains general zoning data, but the agency does not regulate zoning or subdivision regulations.

3.2 Development of Land Use and Population Data

This section describes the development of land use and population data, and existing and future land use in the vicinity of the Airport. Land use and population data, and ultimately the noise impact analysis discussed in Chapter 4 was developed using a Geographic Information System (GIS). The GIS facilitated a detailed, comprehensive analysis of the geographical relationships and patterns emerging from the region surrounding the Airport.

Land use data and aerial photography were obtained from the Office of Geographic Information (MassGIS).[2] US Census Bureau

data (2010) was used to compile demographic information, such as housing units and population. Population estimates were developed using the population in the affected Census blocks in Hampden County and Hampshire County. Demographic data was correlated to land use data using GIS. This data served as the baseline land use database for the NEM/NCP Update.

3.3 Existing Generalized Land Use

Generalized land use was collected from MassGIS and was updated based on input from the AICUZ study and the WMDC. **Figure 3-1** depicts the types of existing land uses surrounding the Airport. Land uses were generalized into the following categories: Commercial/ Industrial, Open/ Agricultural/ Recreational, Public/ Quasi-Public, Residential, Cemetery, Institutional, and Water. Areas that have been acquired under the WMDC's voluntary acquisition program are also identified.

Land use north of the Airport, in Granby, is classified as Open/Agricultural/Recreational and Residential, with small pockets of Commercial/Industrial. In Ludlow to the east of the Airport, land use is predominantly Open/Agricultural/Recreational and Residential. On the west side of the Airport, nearest to the James Street Gate, land uses are a combination of Public/Quasi-Public and Residential. The area surrounding WMDC property includes airport uses and Commercial/Industrial uses. Further west of the Airport, land uses include more developed areas in Chicopee, predominantly residential with pockets of commercial. To the south, land uses in Chicopee are predominantly Open/ Agricultural/Recreational and Residential with interspersed Industrial and Commercial uses. Further south, Springfield is more developed with predominantly Industrial and Commercial land uses.

3.4 Existing Generalized Zoning

Zoning establishes permitted and non-permitted uses in areas within a town, municipality or county. A jurisdiction's zoning code, through an ordinance and a map, provides regulations pertaining to the types of uses allowed and elements of buildings such as height, density, and siting. A zoning code helps to promote orderly growth within a community. Each town in the vicinity of the Airport is responsible for the development of zoning regulations.

Generalized zoning was collected from the PVPC and is shown on **Figure 3-2**. The Airport and several areas immediately to the west and northwest are zoned General Industrial, including the WMDC Aviation Property. To the west, the area is zoned predominantly Single-Family, Multi-Family (low/mid-density) or Mixed Use, with the area along Memorial Drive and other roadways identified as Limited Business and Highway Business.

In Granby, land is predominantly zoned Single-Family Residential. The area beyond Runway 23 along the northeastern border of the Airport and immediately beyond in Ludlow (including the Westover Conservation Area) is zoned Residential-Agricultural. The area immediately east of the Airport is zoned Professional and Research Park. Land uses to the south, including the Chicopee Country Club and Chicopee Memorial State Park, are predominantly zoned Single-Family Residential. Areas zoned as General Industrial, Limited Business, and Highway Business are interspersed throughout the area to the south. Further to the south in the City of Springfield, which comprises the area's urban center, zoning classifications are more varied.

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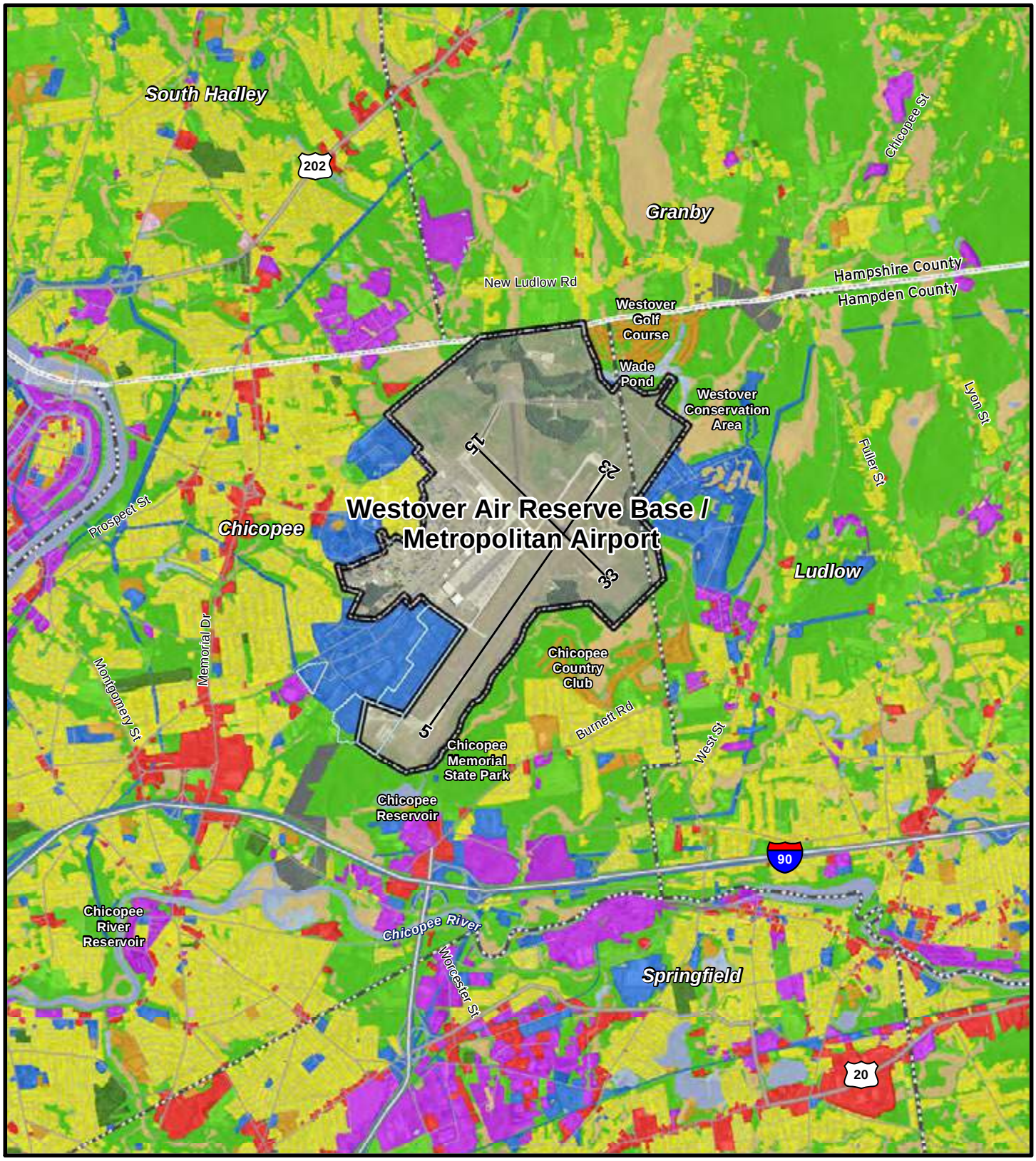

LEGEND

- Commercial
- Industrial
- Open/Agricultural
- Public/Quasi-Public
- Recreational
- Residential
- Previously Acquired Property under the Voluntary Acquisition Program
- Cemetery
- Institutional
- Water
- Wetland
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary

Generalized Existing Land Use
Figure 3-1

N

1" = 5,000'
0 1,250 2,500 5,000 Feet

Source: MassGIS, ESRI Data and HNTB Analysis

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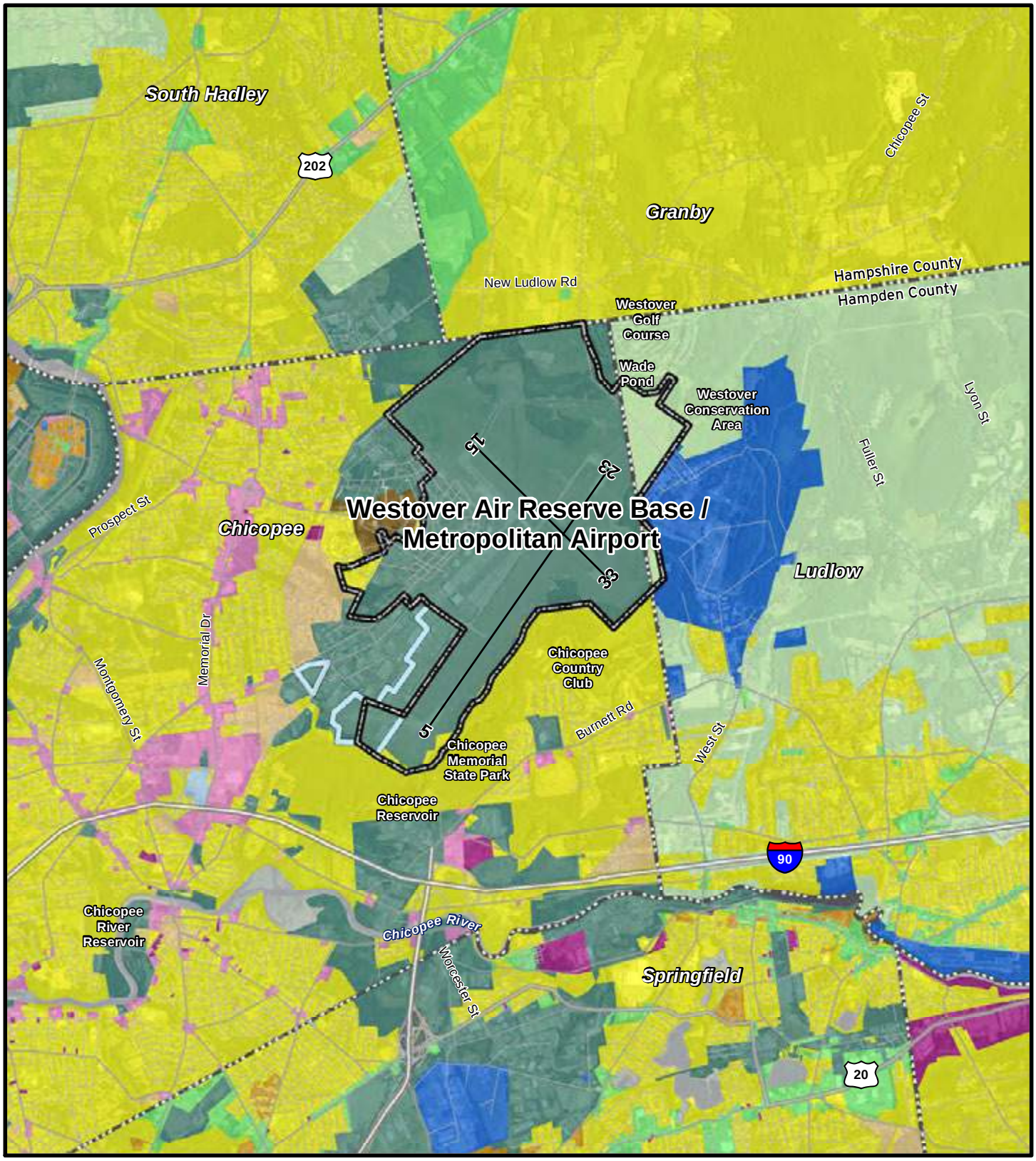

LEGEND

- WARB Installation Area
- WMDC Aviation Property
- Central Business
- General Business
- General Industrial
- Highway Business
- Limited Business
- Mixed Use
- Residential (Single Family)
- Residential (Muilti Family, Low/Med Density)
- Residential (Muilti Family, High Density)
- Residential-Agricultural
- Professional & Research Park
- Not Zoned

Generalized Zoning
Figure 3-2

N

1" = 5,000'
0 1,250 2,500 5,000 Feet

Source: MassGIS, ESRI Data, Pioneer Valley Planning Commission (2011) and HNTB Analysis

3.5 Future Land Use

Valley Vision 2 is the Pioneer Valley's regional land use plan developed by the PVPC. The land use plan is intended to serve as a general guide and planning tool for the communities and others in managing growth and development. The associated map [3] illustrates lands suitable for development at various densities, lands suitable for open space protection, and identifies areas that are suitable for study as Smart Growth Districts, and is shown in **Figure 3-3**. Land use in the vicinity of the Airport in the regional land use plan is primarily designated as Existing Developed Land area, with several areas of Land Suitable for Low Density Residential, Agriculture or Forestry.

Land in the north and east parts of the Airport are identified as Land Suitable for Protected Open space and Farmland. An area within the installation boundary near the Runway 05 end is classified as Developed Land Possibly Suitable for Infill.

In July 2011, the PVPC developed *Valley Vision: the Regional Land Use Plan for the Pioneer Valley Update Report ("Valley Vision Update")* as an update and supplement to *Valley Vision 2.* The *Valley Vision Update* supplements *Valley Vision 2* in providing a regional framework for planning future land use and "smart growth" in the region.[4]

Potential impacts to future land use within the Future (2019) NEM are discussed in Section 4.3.

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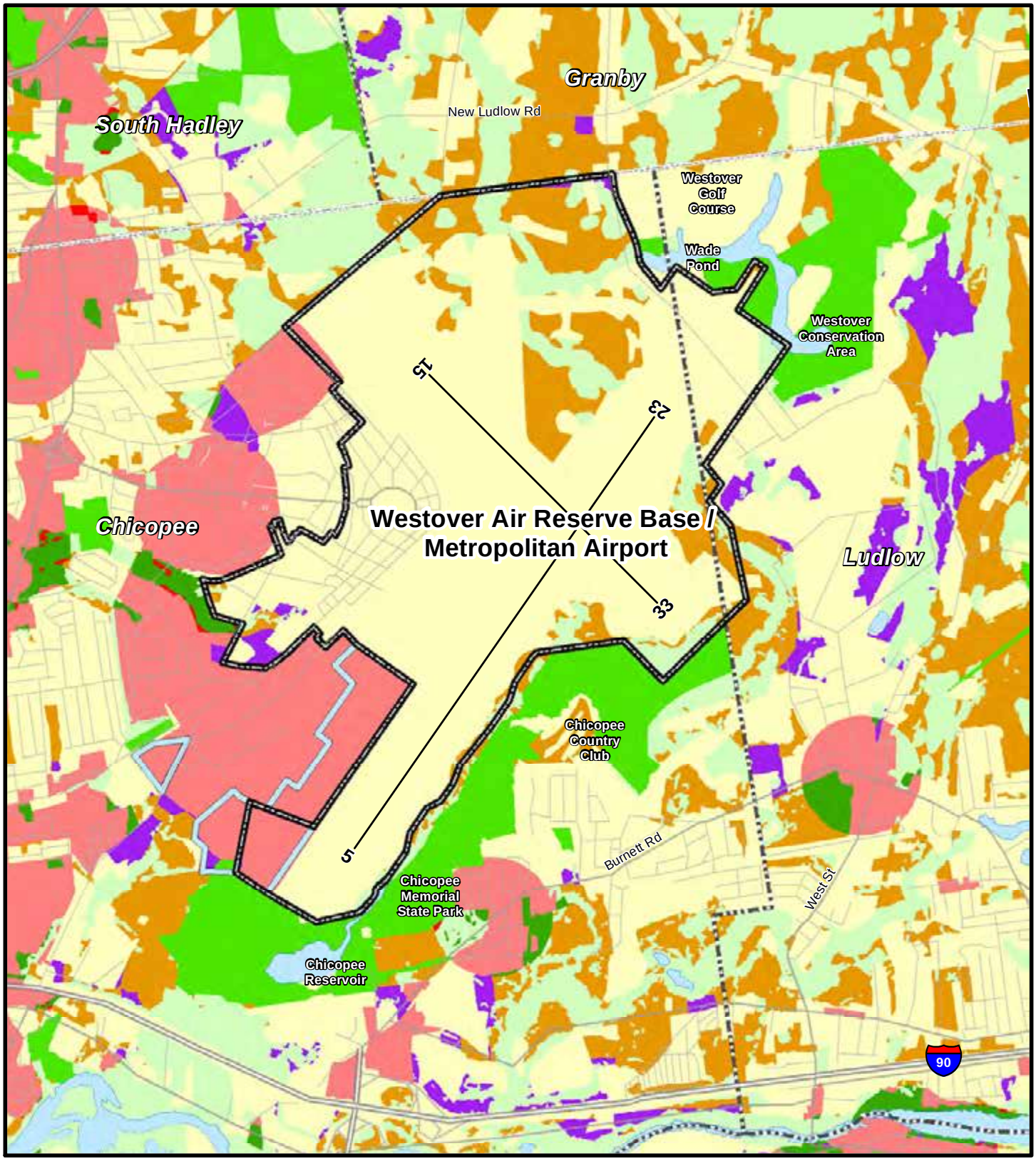

LEGEND

- WARB Installation Area
- WMDC Aviation Property
- Open Water
- Existing Developed Land
- Existing Protected Land
- Land Suitable for Protected Openspace & Farmland
- Land Suitable for Environmental Protection and Low Density Residential, Agriculture or Forestry
- Undeveloped Land Suitable for Smart Growth Districts
- Land Suitable for Industrial or Commercial Development
- Developed Land Possibly Suitable for Infill Development
- Sensitive Land Within Smart Growth Boundary
- County Boundary
- Town Boundary

Regional Land Use Plan Map (Valley Vision 2)
Figure 3-3

N

1" = 3,000'

0 750 1,500 3,000 Feet

Source: MassGIS, ESRI Data, Pioneer Valley Planning Commission and HNTB Analysis

CHAPTER 4: Noise Exposure Maps

This chapter presents the land use information for the geographic area within the 65 DNL contour for the Existing (2014) and Future (2019) NEMs.

Section 4.1 summarizes the development of the base map. Section 4.2 presents and discusses the graphic and tabular information for the Existing (2014) Condition noise exposure contours. Section 4.3 presents the graphic and tabular information for the Future (2019) NEM.

4.1 Land Use Base Map

Noise exposure contours, when superimposed on the land use map, allow assessment of the underlying land use compatibility for existing and forecast noise exposure conditions. As discussed in Section 3.2, land use data and aerial photography were obtained from MassGIS[5] and US Census Bureau data was used to compile demographic information, such as housing units and population. Demographic data was correlated to land use data using GIS.

As noted in Section 3.3, existing land uses in the vicinity of the Airport include Commercial, Industrial, Open/Agricultural/ Public/ Quasi-Public, Recreational, Residential, Cemetery, Institutional, Water and Wetland.

The land uses within the affected noise area (within the 65 DNL contours) fall within the jurisdictions of Chicopee, Ludlow, and Granby, in both Hampden and Hampshire counties.

As discussed in Section 3.2, GIS land use data for all of the jurisdictions was obtained from MassGIS.

4.2 Noise Exposure Map for Existing Conditions (2014)

Figure 4-1 represents the existing conditions for the year of submission (2014), with the existing aircraft flight procedures, airport layout, aircraft operations, and other noise modeling assumptions described in Chapter 2.

The 65 and above DNL noise exposure contours encompass approximately 1,537 acres (2.4 square miles) in total. **Table 4.1** presents the range of land uses encompassed by the 65 DNL noise exposure contour under the existing conditions. The 65-70 DNL noise exposure contour contains approximately 22 acres of residential land uses, nearly 15 acres of land previously acquired by the Airport for noise abatement, and 41 acres of recreational land uses. The entire 75+ DNL noise contour (approximately 403 acres/0.63 square miles) remains within the boundaries of the Airport, while within the 70-75 DNL noise exposure contour, there are no non-compatible land uses.

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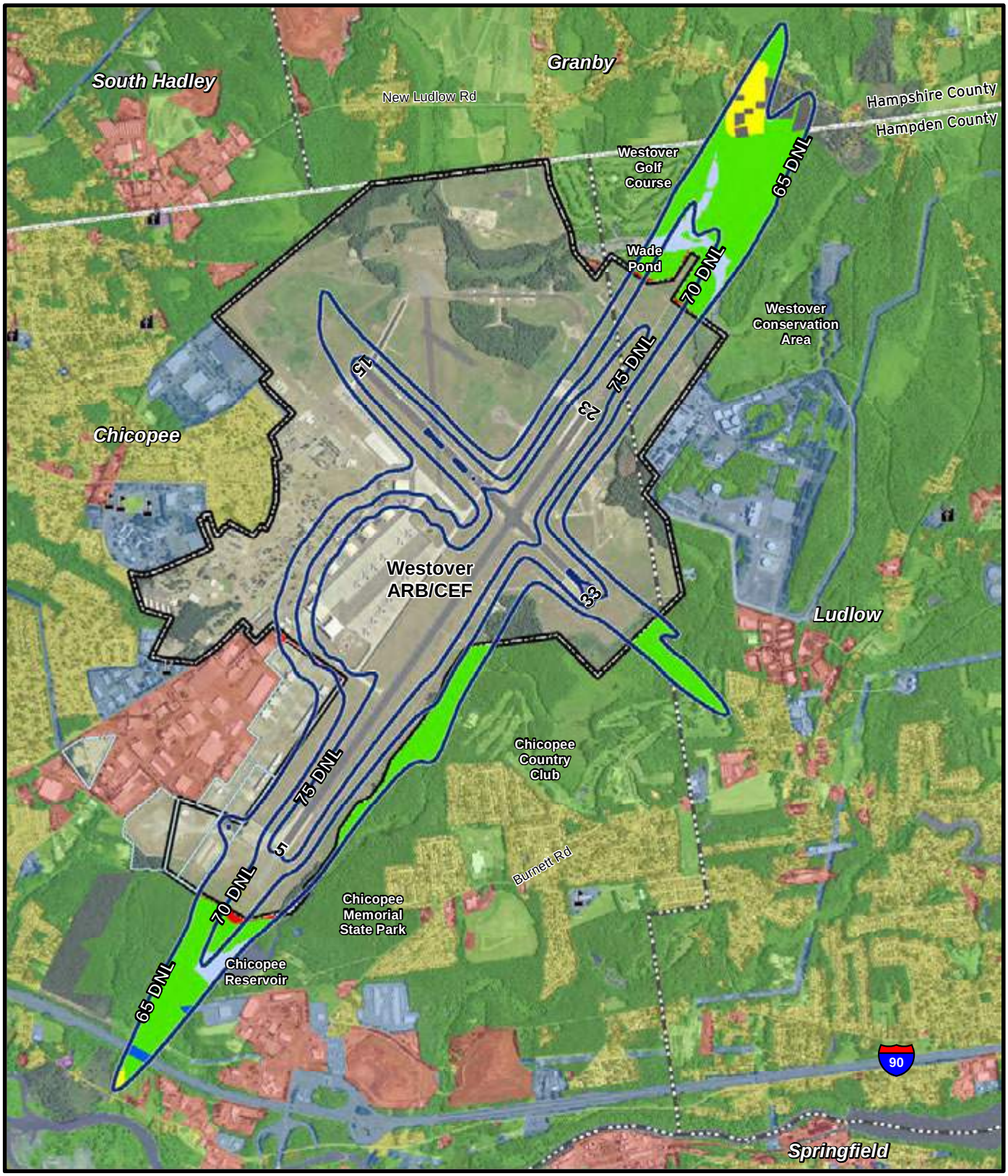

LEGEND

- 2014 DNL Noise Contour
- Commercial/Industrial
- Open/Agricultural/Recreational
- Public/Quasi-Public
- Residential
- Previously Acquired Property under the Voluntary Acquisition Program
- Cemetery
- Institutional
- Water
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary
- Place of Worship
- School

Existing (2014) Conditions Noise Exposure Map Figure 4-1

N

1" = 3,000'

0 700 1,400 2,800 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

Table 4.1
Generalized Land Uses within the Existing (2014) Conditions 65 DNL Noise Exposure Contour

Generalized Land Use	Land within Contour (acres)			
	65-70 DNL	70-75 DNL	75+ DNL	Total (65+ DNL)
Airport Property	385.1	334.0	402.9	**1,121.9**
Open/Agricultural	199.1	26.3		**225.5**
Recreational	41.3	0.3		**41.6**
Residential	21.9			**21.9**
Transportation/Utility	23.1	3.5		**26.6**
Voluntary Acquisition Property	14.9			**14.9**
Water	23.0	11.7		**34.6**
Wetland	48.7	1.5		**50.2**
Grand Total (acres)	**756.9**	**377.3**	**402.9**	**1,537.1**

Source: MassGIS, HNTB, 2014.

To further refine the potentially impacted residential population, a detailed housing count was performed. Estimated population within the 65 DNL noise exposure contours was determined by multiplying the affected housing units by estimated average household size based on 2010 Census blocks. Within the 65 DNL noise exposure contour, there are approximately 25 housing units and an estimated 63 residents. There are no known non-residential noise-sensitive land uses, such as hospitals, places of worship, schools, or nursing homes, within the 65 or above DNL contours.

4.3 Noise Exposure Map for Future Conditions (2019)

DNL noise exposure contours prepared for the Future (2019) NEM are shown in **Figure 4-2**. The overall size of the 65 DNL noise exposure contour increases by approximately 23 acres, due to an increase in operations. **Table 4.2** presents the existing land uses within the Future (2019) NEM.

The 65 DNL noise exposure contour encompasses approximately 23 acres of residential land uses. This property includes approximately 27 housing units accounting for an estimated population of 68 people.

Future land use impacts according to the Valley Vision 2 model include existing developed land, existing protected land, and open water, sensitive land within a Smart Growth boundary, and Land Suitable for Environmental Protection and Low Density Residential, Agriculture or Forestry.

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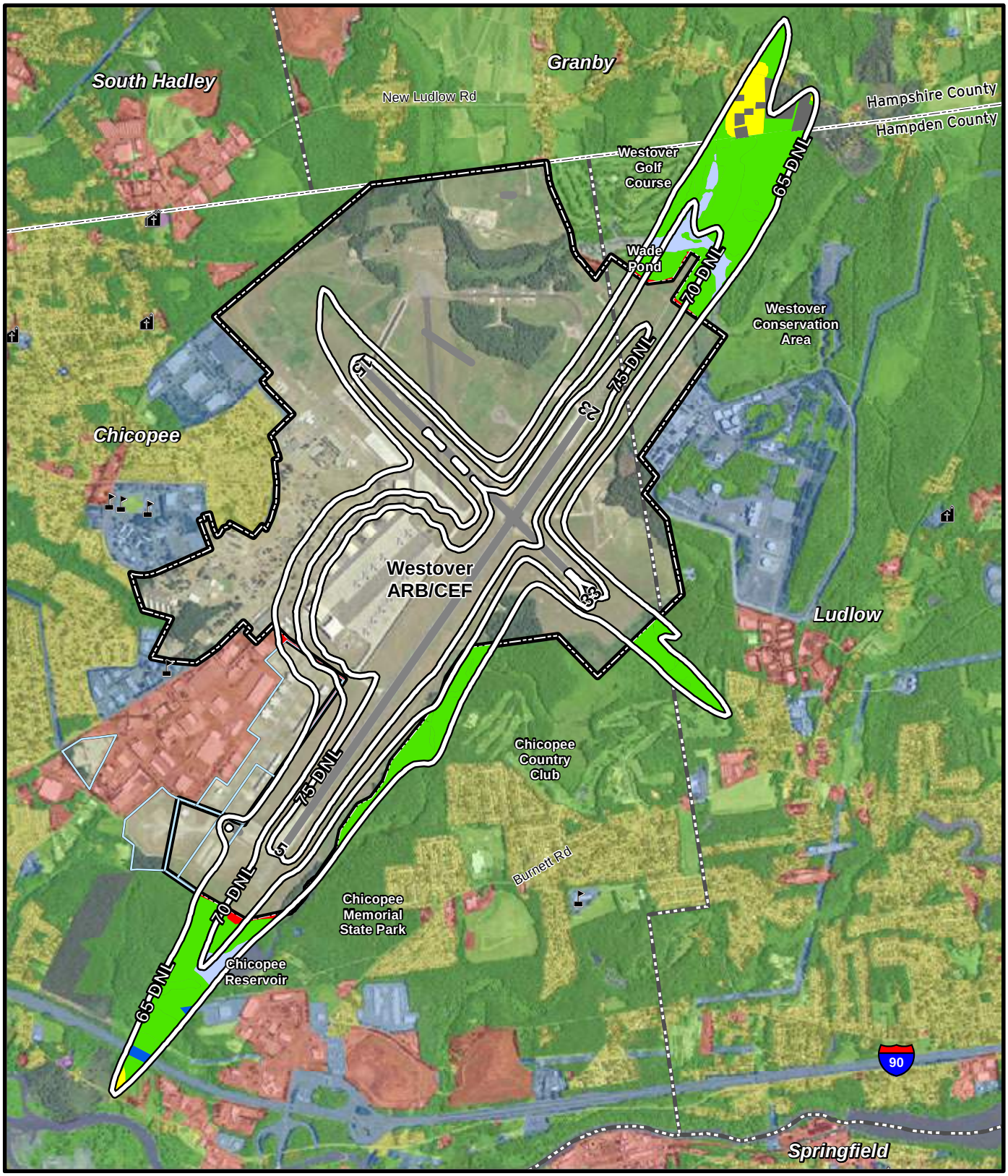

LEGEND

- 2019 DNL Noise Contour
- Commercial/Industrial
- Open/Agricultural/Recreational
- Public/Quasi-Public
- Residential
- Previously Acquired Property under the Voluntary Acquisition Program
- Cemetery
- Institutional
- Water
- WARB Installation Area
- WMDC Aviation Property
- County Boundary
- Town Boundary
- Place of Worship
- School

Future (2019) Conditions Noise Exposure Map Figure 4-2

N

1" = 3,000'

0 750 1,500 3,000 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

Table 4.2

Generalized Land Uses within the Future (2019) Conditions 65 DNL Noise Exposure Contour

Generalized Land Use	Land within Contour (acres)			
	65-70 DNL	**70-75 DNL**	**75+ DNL**	**Total (65+ DNL)**
Airport Property	406.7	338.5	405.8	**1,150.9**
Industrial/Commercial	2.2	2.3		**4.5**
Open/Agricultural	254.9	29.3		**284.1**
Recreational	41.4	0.5		**41.9**
Residential	23.3			**23.3**
Transportation/Utility	3.8			**3.8**
Voluntary Acquisition Property	16.5			**16.5**
Water	23.2	12.0		**35.2**
Total	**771.8**	**382.5**	**405.8**	**1,560.2**

Source: MassGIS, HNTB 2014.

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CHAPTER 5: Noise Compatibility Program

5.1 History of Noise Compatibility Planning at the Airport

Noise compatibility planning surrounding Westover began in earnest in the early 1990s through a series of joint studies. A Joint Land Use Study (JLUS) led by the Pioneer Valley Planning Commission was completed in 1995.

The JLUS was followed shortly thereafter by the Airport's first 14 CFR Part 150 Noise Compatibility Program study, sponsored by the WMDC. The JLUS recommendations were incorporated into the measures submitted to the FAA under the Part 150 NCP. The NEMs (for existing 1993 and forecast 1998 conditions) were completed in 1995. The FAA issued a Record of Approval of the NCP on January 26, 1996.

In 2001, a second JLUS (JLUS Update) was undertaken. The JLUS Update coincided with an update of NEMs, developed for the FAA by HNTB Corporation. The updated land compatibility maps in the JLUS Project include the results of the NEM update. Work began in December 2001 and the final report was completed in October 2004. NEMs under the Part 150 study were prepared for existing 2003 and forecast 2008 conditions.

The land use mitigation recommendations of the JLUS were included in the NEM Update for the Airport, consistent with the NCP that the FAA had reviewed in 1996. The FAA's responsibility for review of the NCP focused on the eligibility of the mitigation components (voluntary acquisition and sound insulation). The FAA's comments and approval status of each of the measures is discussed under the detailed description of each.

In 2013, the Department of Defense completed an AICUZ study, which included development of a 2009 Noise Exposure Contour and a 2014 Forecast Noise Exposure Contour. Following completion of the AICUZ, this NEM/NCP Update was initiated. The intent of this study was to develop Existing (2014) and forecast Future (2019) NEMs. The FAA is anticipated to accept the NEMs, and will approve the NCP, if applicable. The intent of resubmitting the NCP is to gain FAA approval of revising the voluntary acquisition program to include properties located in the forecast Future (2019) NEM.

It should be noted that this document only discusses those elements of the recommended NCP submitted in 1996. Other land use management strategies, as recommended by the JLUS Update or AICUZ, are not discussed in this document. It should also be noted that the FAA evaluation of these measures is done within the context of the Existing (2014) and forecast Future (2019) NEMs, and the reader should recognize that noise exposure can and will fluctuate based on the fleet mix at the airport as well as the types and frequency of operations.

Noise programs at the Airport are funded through a combination of Federal, State and local funding. Nearly $21 million has been used for noise studies and land acquisition through 2013. Of this funding amount, the

FAA has contributed $19.53 million, the MassDOT Aeronautics Division has contributed $824,000 and the WMDC has contributed $522,000.

5.2 1996 Noise Compatibility Program

In January 1996, the FAA completed its review of the WMDC's initial NCP, submitted following the FAA's acceptance of the NEMs. The FAA's Record of Approval, issued in January 1996, is reproduced as *Appendix B*.

The NCP included noise abatement measures, compatible land use measures, and program measures designed to abate and mitigate the impacts of aircraft noise surrounding the Airport. As part of the NCP, the FAA approved a voluntary land acquisition and relocation program, although the WMDC did not start the acquisition program until funding became available following the update of the 2003 NEM.

The following sections provide an overview and status update of each of the measures recommended in the NCP, including noise abatement, compatible land use planning, and program or implementation measures.

5.2.1 Noise Abatement Measures

Noise abatement measures are procedures or techniques used by aircraft to minimize the impact of noise on surrounding communities. Noise abatement measures are evaluated based on their feasibility, including regarding the aircraft's performance capabilities, the air traffic control environment, and their potential to reduce noise impacts within the 65 DNL noise contour.

The 1996 NCP evaluated and recommended several noise abatement measures. These measures were modeled and compared to the noise exposure contours developed under that study, and those which provided a benefit (a reduction in the number of residences and estimated population within the 65 DNL noise contour) were included in the Airport's recommended plan submitted to the FAA. Each of the four approved measures included consultation with the Westover Tower and Bradley Approach Control, the air traffic facility whose jurisdiction surrounds that of the Westover Tower.

Measures were proposed for both civilian and military operations. The following sections describe each of the measures, the FAA's conclusions at the time (approval or disapproval), and evaluates the procedure in the current environment.

Nighttime Preferential Runway Use for Civilian Aircraft

Description: This measure calls for civilian aircraft to use Runway 05 for departures and Runway 23 for arrivals to the maximum extent practicable. This preferential runway use was first adopted by the WMDC Board of Directors in 1987. Thus, the recommended pattern of civilian operations would be departures to the north and arrivals from the north, taking advantage of the lower density of residential land uses in Granby and Ludlow. If nighttime operations increased to levels predicted at the time, the WMDC would reevaluate the measure to achieve a more balanced level of runway use.

This non-mandatory measure was recommended in part to assist noise abatement efforts once the Westover Tower remained open for 24 hours per day. At the time, civilian operations could not operate at

the Airport when the Westover Tower was closed (11:00 p.m. to 7:00 a.m.) without prior arrangement. The 1996 NCP included the assumption that the Westover Tower would begin 24-hour operations, although this has not yet occurred. Implementing this measure was forecast to reduce the estimated population within the 65 DNL noise contour south of the Airport.

FAA Finding: The FAA approved this measure as voluntary, and suggested that a reevaluation of the measure would be needed in the future as conditions change.

Current Status: Preferential runway use for civilian operations remains consistent, mostly due to the location of the general aviation facilities (FBO/terminal area). Approximately 80% of civilian operations occur to or from the north. The Westover Tower remains closed to civilian operations from 11:00 p.m. to 7:00 a.m., although the WMDC can request a waiver for the Westover Tower to open prior to 7:00 a.m. or remain open past 11:00 p.m. if needed.

Noise Abatement Departure Procedures for Military Aircraft on Runway 23

The 1996 NCP proposed that select military C-5 departures from Runway 23 follow a noise abatement procedure. Military operations primarily depart from Runway 23 (south). At the time of the study, C-5 Runway 23 departures were required to climb on runway heading (approximately 230 degrees) until radar contact is confirmed with Bradley Approach Control, located 20 miles south of Westover. Due to the distance between the radar and aircraft, this sometimes resulted in the overflight of heavily populated areas until radar contact was established and aircraft were instructed to turn towards their destination. The proposed flight paths included earlier left or right turns, coordinated with the Bradley Approach Control.

FAA Finding: The FAA approved this measure as voluntary, as implementation was shown to reduce the estimated population within the 65 DNL noise contour.

Current Status: The military continues to use Runway 23 as the primary departure runway. Due to the change in the mission of C-5 aircraft, the types of operations flown have changed to meet wartime flying requirements. C-5 operations do use an early turn to the west to avoid overflight of more heavily populated areas.

Noise Abatement Departure Procedures for Civilian Aircraft on Runway 23

Description: This measure proposed that civilian aircraft, particularly larger and louder aircraft that depart from Runway 23, use a noise abatement heading of 205 or 255 degrees, rather than flying a runway heading (approximately 230 degrees).

FAA Finding: The FAA approved this measure as voluntary. Implementation of this measure would have, at the time, assisted in reducing the number of residences within the 65 DNL noise contour.

Current Status: Many of the larger aircraft that operated at the Airport prior to 2000, such as 727's or 737-200's, were phased out of the fleet through the passage of the Airport Noise and Capacity Act of 1990 (Stage 2 aircraft weighing less than 75,000 pounds will be prohibited from operating in 2015). As a result, the overall fleet of passenger aircraft is quieter. Noise modeling input data, developed in consultation with the Westover Tower, indicates that a majority (approximately 72%) of civilian departures from Runway 23

depart on a course that follows the runway heading (approximately 230 degrees), while approximately 28% depart from the runway and turn towards a heading of approximately 270 degrees.

In consideration of the current and forecast levels of civilian air traffic, the current types of aircraft in use at the airport, and the predominant noise characteristics of the military fleet, it is not expected that use of the noise abatement procedure would reduce the noise-sensitive land uses within the 65 DNL. As part of this study process, the WMDC is working with the Tower to increase the awareness and use of the procedure, on a voluntary basis and when feasible and practical. Although not frequently used under current conditions, the WMDC desires to continue recommendation of this measure and to encourage the voluntary use of the noise abatement turns. Withdrawal of the measure from the NCP could make the process for its reinstatement more difficult if the future fleet mix includes larger and louder aircraft and tangible benefits within the 65 DNL would result. As such, the WMDC recommends continued implementation of this measure.

Noise Abatement Departure Procedures for Civilian Aircraft on Runway 05

Description: The measure called for aircraft, upon departure from Runway 05 and once safely airborne, to tum to an ATC-assigned heading of 080 degrees, then follow instructions issued by Bradley Approach Control towards their respective navigation fix. This early turn of approximately 30 degrees would route departing aircraft further away from the Acrebrook subdivision, taking advantage of more compatible land uses. The measure was proposed to be applicable between the hours of 10:00 p.m. and 6:00 a.m. and was estimated to reduce potential noise impacts in the Acrebrook subdivision, which was also proposed for eligibility under the voluntary acquisition program. The measure was proposed contingent upon FAA approval of the voluntary acquisition program (discussed in Section 5.2.2) to reduce noise north of the Airport, specifically in the Acrebrook neighborhood.

FAA Finding: The FAA approved this measure as voluntary, as it would reduce the number of residences and estimated population within the 65 DNL noise contour.

Current Status: Generally, aircraft departures from Runway 05 fly a runway heading of approximately 50 degrees. In consideration of the current and forecast levels of civilian air traffic, the current types of aircraft in use at the airport, and the predominant noise characteristics of the military fleet, it is not expected that use of the noise abatement procedure would reduce the noise-sensitive land uses within the 65 DNL. As part of this study process, the WMDC is working with the Tower to increase the awareness and use of the procedure, on a voluntary basis and when feasible and practical. Although not frequently used under current conditions, the WMDC desires to continue recommendation of this measure and to encourage the voluntary use of the noise abatement turns. Withdrawal of the measure could make the process for its reinstatement more difficult if the future fleet mix includes larger and louder aircraft and tangible benefits within the 65 DNL would result. As such, the WMDC recommends continued implementation of this measure.

5.2.2 Land Use Measures

Land use measures seek to correct existing non-compatible land uses and to further inhibit the development of land uses that could be impacted by noise from aircraft operations. It is important to discuss the lines of authority for implementing any recommended measures. The WMDC does not control the land uses surrounding the Airport, but can make recommendations in consultation with local jurisdictions. The recommended land use measures include mitigation programs (voluntary acquisition and relocation, sound insulation) and preventive measures, which seek to limit the possibility of future non-compatible development.

Voluntary Land Acquisition and Relocation Program

Description: The intent of the voluntary purchase and relocation program is to eliminate or significantly reduce the number of people remaining in areas of high noise exposure. The 1996 NCP identified approximately 150 residences exposed to 70 DNL, which was updated under the 2004 NEM Update to include approximately 416 potentially eligible structures (single and multi-family structures) within the 70 DNL of the 2003 NEM. The WMDC received funding from the FAA to initiate the voluntary acquisition program in 2005.

FAA Finding: The FAA approved this measure as voluntary.

Current Status: **Figure 5-1** presents a map depicting those properties which have been acquired as of December 2013. These 48 properties, accounting for approximately 203 acres, have been acquired, the homes have been demolished (if present), and the land remains vacant (therefore compatible with aircraft operations). The WMDC is currently involved in negotiations with additional eligible properties.

Of the 48 total acquired properties, 39 properties are located in residential areas north of the airport; 23 properties in Granby and 16 properties in Ludlow, while the 9 remaining properties are located to the south of the Airport in Chicopee. For each acquired property, an aviation easement will be attached to the deed after parcel assembly is completed. Once acquired, the properties are maintained by the WMDC until a complete reuse and disposal plan is developed.

This NCP is proposing that residences exposed to noise levels above 65 DNL within the Future (2019) NEM be included in the voluntary acquisition program. The continuation of the program is discussed in Section 5.3.

Voluntary Sound Insulation Program

Description: A sound insulation program is a voluntary program with the goal of providing acoustic treatment to eligible homes to reach a 5 dB improvement compared to existing indoor levels. FAA guidelines for sound insulation programs aim for an interior noise level of 45 dB.

The sound insulation program was initially identified to include those residences within the 65 DNL noise contour, in addition to residences located in the 70 DNL noise contour that declined participation in the voluntary acquisition program. In exchange for the installation of sound insulating materials, which typically include acoustically-rated windows and doors, and could include upgrades to mechanical systems, the property owner would be required to grant a noise easement.

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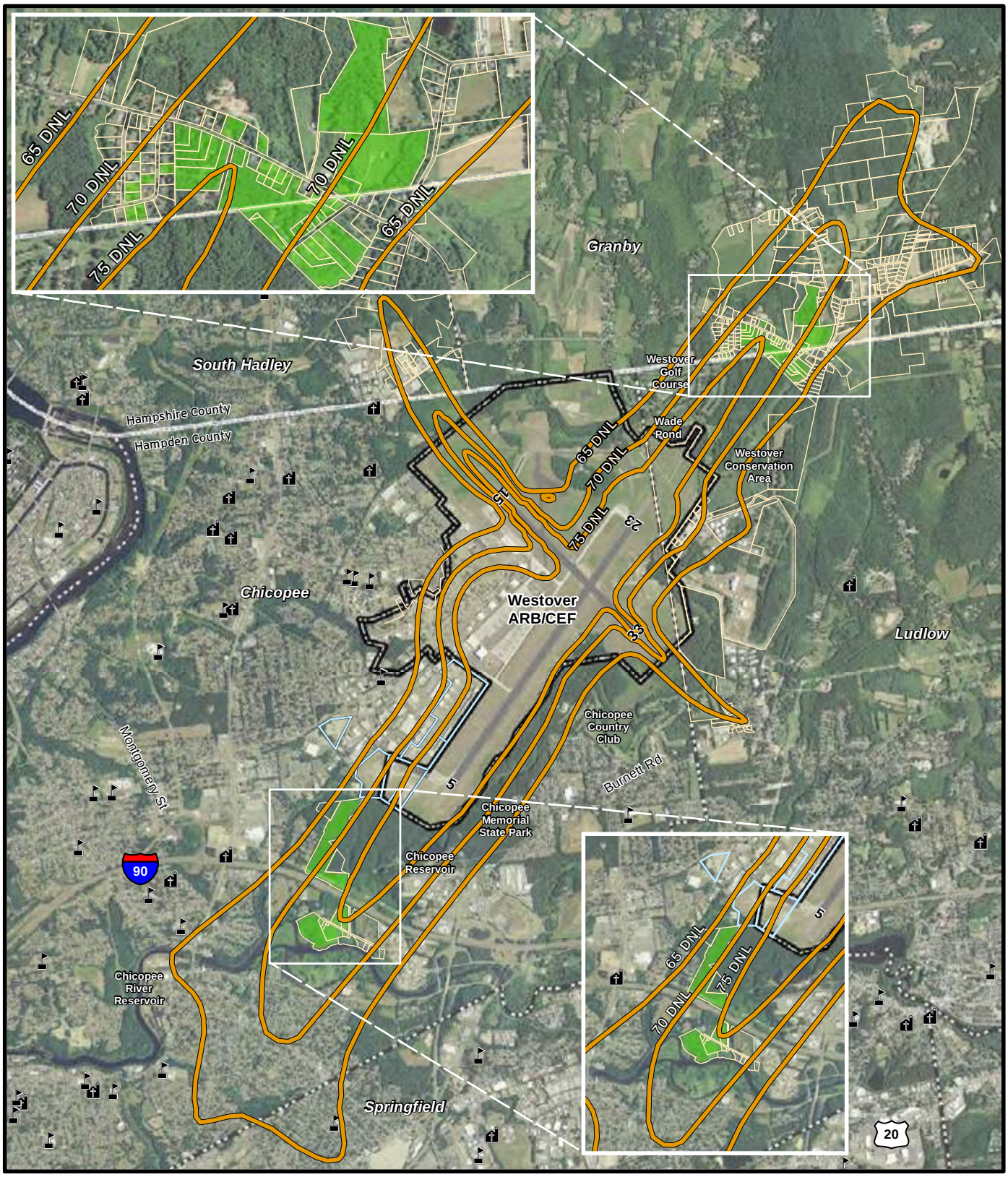


LEGEND

- 2003 DNL Noise Contour
- WARB Installation Area
- WMDC Aviation Property
- Parcel Boundary
- Previously Acquired Property under the Voluntary Acquisition Program
- County Boundary
- Town Boundary
- Place of Worship
- School

Voluntary Acquisition Program under the 2003 NEM
Figure 5-1

1" = 5,000'
0 1,250 2,500 5,000 Feet

N

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

FAA Finding: The FAA approved this program.

Current Status: A sound insulation program has not been implemented. The WMDC began the voluntary acquisition program once funding became available for homes that experienced higher noise levels. This NCP is proposing that residences exposed to noise levels above 65 DNL within the Future (2019) NEM be included in the voluntary acquisition program. The WMDC prefers to complete the voluntary acquisition program prior to initiating a voluntary sound insulation program.

Compatible Use Zoning

Description: Zoning for compatible land uses includes rezoning land that may be developed with noise-sensitive land uses, such as residences, places of worship, or schools. Rezoning would change the development potential of the land to a use that is more compatible with aircraft operations, such as industrial or open space. The 1996 NCP included specific recommendations for each city or town in order to minimize chances that new noncompatible land uses will be developed within the 65 DNL contour. The 1996 NCP suggested that Chicopee, Granby and Ludlow maintain their existing zoning but consider adopting overlay zoning, and that Springfield and South Hadley maintain their existing industrial zoning classifications.

FAA Finding: The FAA, although it has no jurisdiction in local land use affairs, approved this measure for the purposes of Part 150.

Current Status: Based on zoning information provided by MassGIS, portions of the Future (2019) NEM 65 DNL contour include residential zoning in Granby, residential-agricultural zoning in Ludlow, and general industrial and residential zoning in Chicopee. The 65 DNL noise contour does not include land within South Hadley or Springfield, although aircraft do overfly these areas. The WMDC will continue to work with each jurisdiction through this study process to determine the feasibility of implementing this measure.

Airport Overlay District

Description: An overlay district is a zoning technique which identifies additional restrictions on development in addition to the underlying zoning, by modifying (but not eliminating) the underlying zoning. Overlay districts offer an option to provide a more flexible development control than that of changing the allowed uses in entire zoning districts and focusing on only the portion of the community with potential non-compatible land uses.

Since 1992, the Town of Ludlow has had an Aircraft Flight Overlay District (AFD) intended to protect the public health, safety, and general welfare, and to protect human life and property from hazards of aircraft noise and accident potential created by the Town's proximity to Westover Base.

By 1996, the Town of Ludlow had implemented the aircraft flight overlay district, encompassing the noise and accident potential zones from the AICUZ. At that time, hospitals, nursing homes, auditoriums and concert halls were prohibited within the overlay districts. Educational and religious institutions are permitted by right in all districts according to the Massachusetts Zoning Enabling Act, and the Town had sought and received home rule authority from the state legislature to allow restriction of development of schools, day care centers,

and houses of worship within accident potential zones. The existing overlay district does not prohibit residential land uses or impose sound insulating requirements on residential lands.

The initial NCP recommended that Chicopee and Granby adopt an airport overlay district which encompasses land within the 65 DNL contour, and that the town of Ludlow change the boundaries of its airport overlay district to include all of the land within the forecasted 1998 contour.

FAA Finding: The FAA, although it has no jurisdiction in local land use affairs, approved this measure for the purposes of Part 150.

Current Status: No further changes to the Town of Ludlow's overlay district have been implemented, and no other jurisdictions have developed an overlay district to date. The 65 DNL noise contour of the Future (2019) NEM extends into Ludlow, Granby and Chicopee. The WMDC will continue to work with each jurisdiction through this study process to determine the feasibility of implementing this measure.

Subdivision Regulations

Description: Subdivision regulations describe the procedures and standards for the division of parcels of land, most notably for sale or development as smaller parcels. The use of subdivision regulations by a municipality prescribes certain conditions that must be met by a developer prior to receipt and recordation of a plat. Generally, amending subdivision regulations is most practical when large amounts of undeveloped land are present.

The 1996 NCP recommended that the Town of Granby, as the jurisdiction with the most notable assemblage of undeveloped land within the 65 DNL noise contour, amend their subdivision regulations to require noise easements to be obtained on newly created lots within the 65 DNL noise contour.

FAA Finding: The FAA, although it has no jurisdiction in local land use affairs, approved this measure for the purposes of Part 150.

Current Status: The Town of Granby has not included the recommendations requiring noise easements into their subdivision regulations. The 65 DNL noise exposure contour of the Future (2019) NEM extends into Granby, in areas in which the WMDC is currently offering voluntary acquisition. The WMDC will continue to work with Granby through this study process to determine the feasibility of implementing this measure.

5.2.3 Implementation, Monitoring, and Review Measures

Implementation, monitoring, and review measures are those that can be undertaken by the WMDC to track the progress of the recommended noise compatibility program. They include measures that are designed to increase awareness of noise abatement and mitigation, and provisions for the continued monitoring of noise surrounding an Airport.

The 1996 NCP identified four measures for inclusion in the program, as described in the following sections.

Pilot Awareness Program

Description: This measure identified that the WMDC would publish a pamphlet of noise abatement practices to be distributed to civilian pilots through the aviation services provider and WMDC's airport management. The pamphlet would include a map of noise sensitive areas around the airport and describe the operational measures which

WMDC has adopted for noise abatement, including use of noise abatement departure procedures recommended by the National Business Aircraft Association or by individual aircraft manufacturers. The measure suggested that the WMDC would install signs in all terminal areas frequented by civilian pilots and along ramp and taxiway areas controlled by WMDC, instructing pilots to follow noise abatement procedures.

FAA Finding: This measure was approved by the FAA, with the caveat that the location and content of signs may be subject to FAA approval.

Current Status: The WMDC has installed signs in the terminal area pilot lounge and in areas leading to airside facilities directing pilots to be aware of noise-sensitive locations around the Airport. The WMDC is further evaluating the feasibility of installing more permanent signs encouraging the use of the noise abatement procedures for civilian aircraft from Runways 5 and 23.

Public Awareness Program

Description: This measure served to increase public awareness in the surrounding communities regarding the latest developments in the noise compatibility program.

FAA Finding: The FAA approved this measure.

Current Status: WMDC currently offers a voluntary acquisition and relocation program to property owners within the updated 2003 NEM. As part of that practice, the WMDC maintains contact with property owners within the 65 DNL noise contours.

Monitoring Nighttime Operations and Runway Use

Description: This measure was intended to assist in the identification and quantification of nighttime aircraft activity, specifically during the hours in which the Westover Tower was closed. Information to be collected included the time, type aircraft, registration/flight number, landing or take-off, runway used, and wind and weather conditions. The information would be used to determine compliance with WMDC's nighttime noise rule and to help provide guidance to Air Force contract tower personnel to determine compliance with the preferential runway use program.

FAA Finding: The FAA approved in part and disapproved in part this measure. The FAA stated that using the data to ensure compliance with any rules that would essentially limit aircraft operations would require an additional noise study.

Current Status: The Westover Tower tracks operations during hours the tower is open. Minimum operations occur during nighttime hours (10:00 p.m. to 7:00 a.m.).

Periodic Updates of Noise Exposure

Description: This measure recommended the ongoing monitoring of changes in noise exposure at the Airport, primarily by focusing on the changes that would likely have the greatest impact to cause an increase in cumulative noise exposure. The original measure identified, as primary potential drivers of noise exposure, any planned changes in scheduled jet operations by civilian aircraft, any planned changes in nighttime operations by civil aircraft, or annual changes in total civil operations. Further, once noise exposure reached levels forecasted in the original NEM, the WMDC would update the Part 150 study.

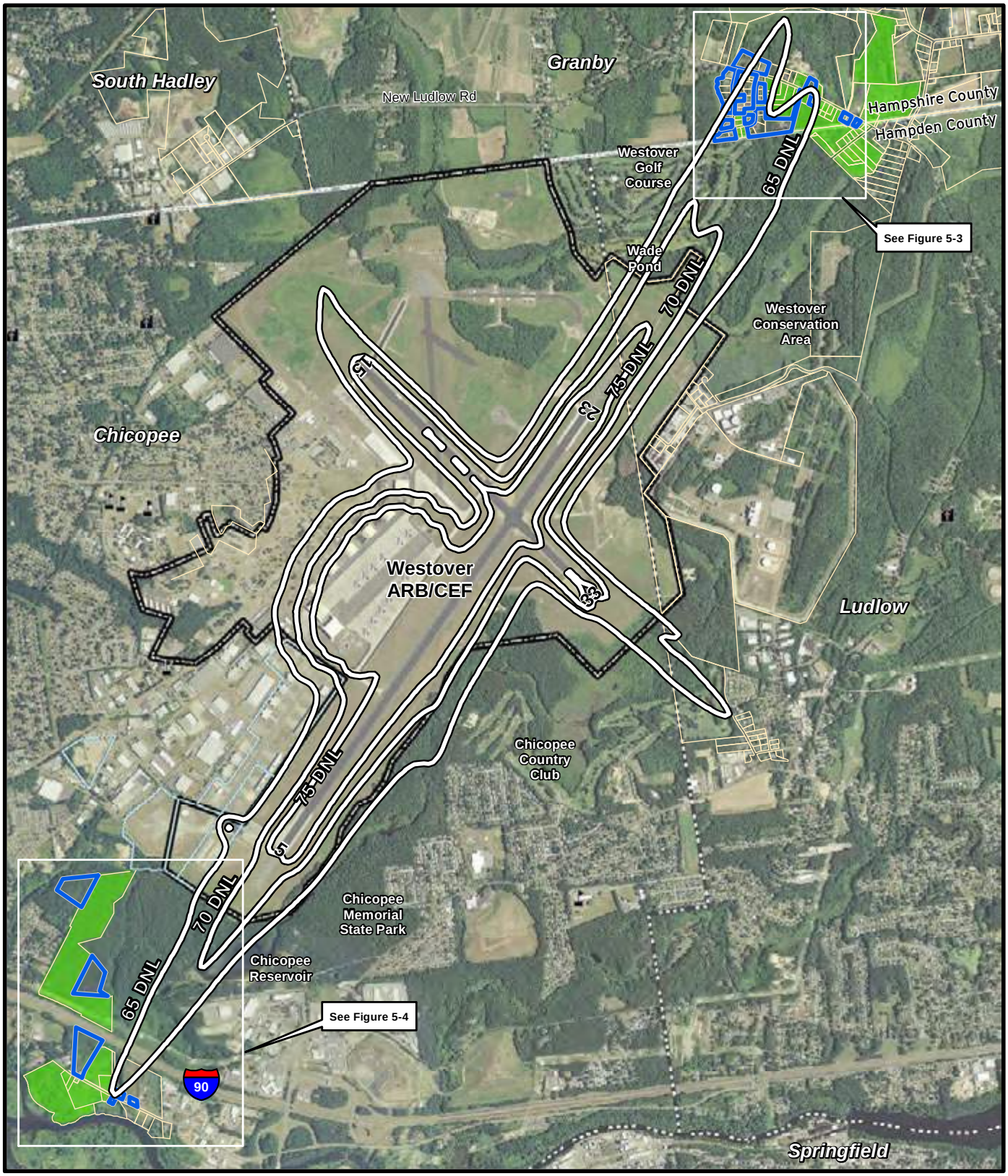
FAA Finding: The FAA approved this measure.

Current Status: As indicated in the introduction to the NCP in this chapter, the WMDC has completed or supported multiple evaluations of noise exposure as a result of changes in operations, including this update.

5.3 Voluntary Acquisition under the Future (2019) NEM

Upon submission and FAA acceptance of the Future (2019) NEM, the boundaries for participation in the voluntary purchase and relocation program, as well as the sound insulation program defined in *Appendix C*, will be modified. **Figures 5-2**, **5-3**, and **5-4** present the Future (2019) NEM and identify potentially eligible properties.

Overall, the WMDC has identified approximately 48 parcels for continued participation in the voluntary acquisition program. Approximately 43 parcels are located in Granby and are impacted by or immediately adjacent to the 65 DNL noise exposure contour. 40 parcels are residential land uses. All are recommended for inclusion in the Airport's ongoing mitigation program. Five parcels are located south of Runway 05/23 in Chicopee. The WMDC is involved in ongoing mitigation in this area under the current program. The continuation of the voluntary acquisition program in these areas promotes the continuation of compatible land use planning and allows the WMDC the most viable strategy to ensure long term land use compatibility through reuse in these areas.



LEGEND

- 2019 DNL Noise Contour
- WARB Installation Area
- WMDC Aviation Property
- Parcel Boundary
- Previously Acquired Property under the Voluntary Acquisition Program
- Recommended Mitigation Program Boundary
- County Boundary
- Town Boundary
- Place of Worship
- School

Proposed Voluntary Acquisition Program under the Future (2019) NEM
Figure 5-2

N

1" = 3,000'
0 750 1,500 3,000 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

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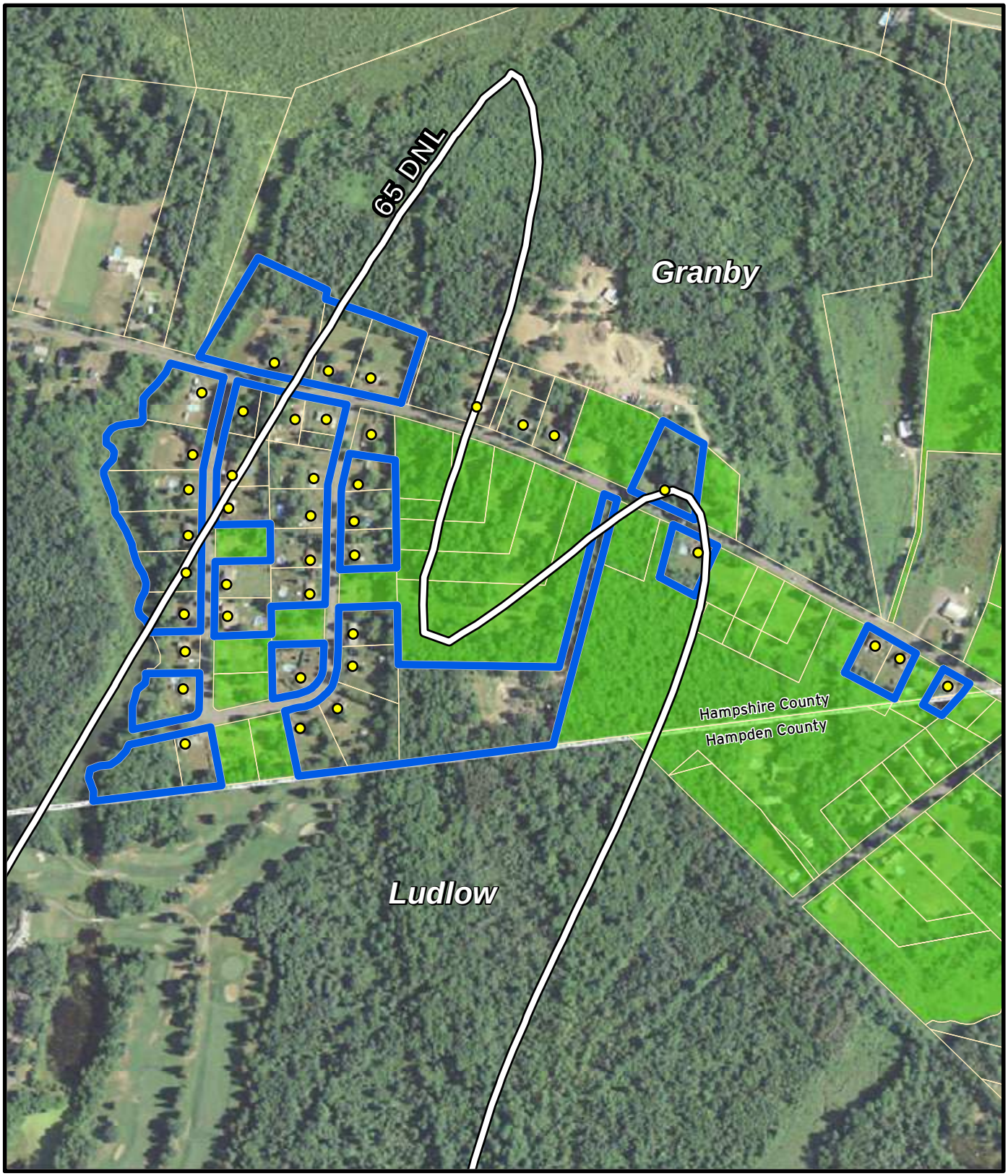

LEGEND

- 2019 DNL Noise Contour
- Parcel Boundary
- Housing Unit
- Previously Acquired Property under the Voluntary Acquisition Program
- Recommended Mitigation Program Boundary
- County Boundary
- Town Boundary

Proposed Voluntary Acquisition Program (North) under the Future (2019) NEM
Figure 5-3

N

1" = 500'

0 125 250 500 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

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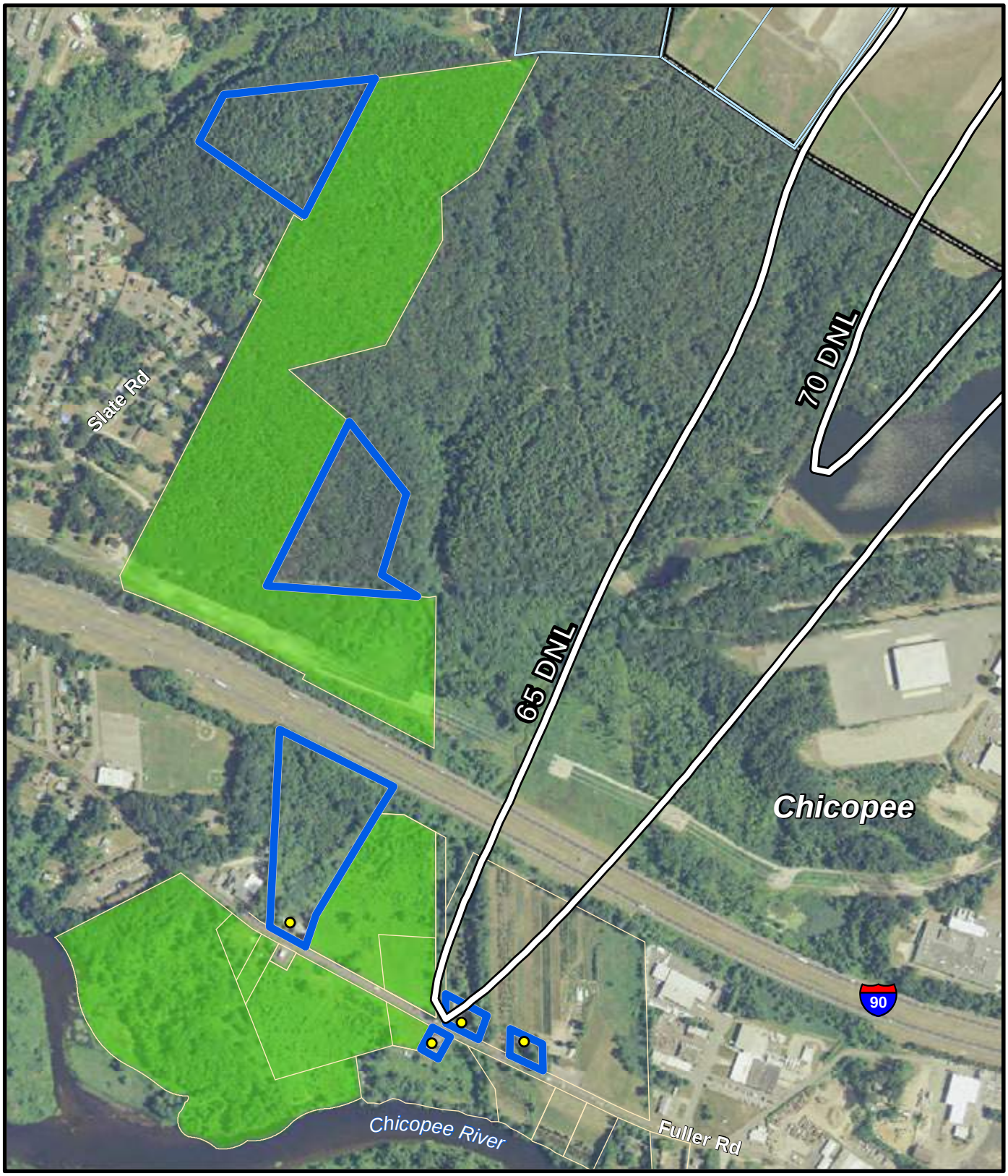

LEGEND

- 2019 DNL Noise Contour
- Parcel Boundary
- Housing Unit
- Previously Acquired Property under the Voluntary Acquisition Program
- Recommended Mitigation Program Boundary
- WARB Installation Area
- WMDC Aviation Property

Proposed Voluntary Acquisition Program (South) under the Future (2019) NEM
Figure 5-4

N

1" = 700'
0 175 350 700 Feet

Source: MassGIS, USDA, ESRI Data and HNTB Analysis

CHAPTER 6: Record of Consultation

The following sections describe the consultation with various parties as required by 14 CFR Part 150, including coordination meetings and plans for public involvement via public review of the Draft NEM/NCP Update document and a subsequent public meeting.

6.1 Meetings and Coordination

Multiple meetings and teleconferences were held throughout the development of the NEMs and update to the NCP in order to obtain and share information to ensure the most accurate information was available and incorporated into the NEMs. Consultation was undertaken with the 439th Airlift Wing to ensure data from the recently completed 2013 AICUZ study remained accurate. Site visits and multiple teleconferences were held with the Westover Tower to collect data on aircraft operations, including the frequency, types, and times of day of operations. Consultation was undertaken with other operators at the Airport, including the Massachusetts State Police Air Wing.

6.2 Draft NEM/NCP Update Document

The updated NEMs, NCP, and related study data will be made available to the public for review and comment in order to satisfy Part 150 public involvement requirements. This opportunity for comment on the NEMs and NCP will be provided with publication of this draft NEM/NCP Update document and at a subsequent public meeting. Copies of the NEM/NCP Update will also be available at the WMDC's office and local libraries, as well as on the WMDC's website at http://www.wmass-arptcef.com/.

6.3 Public Information Workshop

Information regarding the public information workshop will be provided in the Final NEM/NCP Update document. ***Appendix E*** will include copies of sign-in sheets, newspaper advertisements, meeting handouts, meeting summaries, each comment received, and the response provided to each comment.

Notes

[1] Pioneer Valley Planning Commission, “What is the Pioneer Valley Planning Commission?” http://www.pvpc.org/about/whatispvpc.shtml, accessed 1/22/14.

[2] Executive Office for Administration and Finance, MassGIS Datalayers, http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/layerlist.html, Land Use (2005); USGS Color Ortho Imagery (2013) accessed 1/3/14.

[3] Pioneer Valley Planning Commission, “Valley Vision 2 Land Use Map,” http://pvpc.org/val_vision/html/toolbox/Valley%20Vision%20Maps/Regional%20Map.pdf, accessed 4/1/2014.

[4] Pioneer Valley Planning Commission, “Valley Vision Update,” http://www.pvpc.org/activities/val-vision2.shtml, accessed 4/1/2014.

[5] Executive Office for Administration and Finance, MassGIS Datalayers, http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/layerlist.html, Land Use (2005); USGS Color Ortho Imagery (2013) accessed 1/3/14.

APPENDIX A

Part 150 NEM and NCP Checklists

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PART 150 NEM CHECKLIST – PART I

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
I. Submitting And Identifying The NEM:			
A. Submission is properly identified:			
1. 14 C.F.R. Part 150 NEM?		✓	
2. NEM and NCP together?	✓		Letter of Transmittal, Sponsor Certification
3. Revision to NEMs FAA previously determined to be in compliance with Part 150?	✓		Chapter 1, Section 1.2
B. Airport and Airport Operator's name are identified?	✓		Letter of Transmittal, Sponsor Certification, Chapter 1, Section 1.4
C. NCP is transmitted by airport operator's dated cover letter, describing it as a Part 150 submittal and requesting appropriate FAA determination?	✓		Letter of Transmittal,
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?	✓		Chapter 6, Appendix E
B. Identification of consulted parties:			
1. Are the consulted parties identified?	✓		Chapter 6
2. Do they include all those required by 150.21(b) and A150.105(a)?	✓		Chapter 6
3. Agencies in 2, above, correspond to those indicated on the NEM?	✓		Chapter 6
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)?	✓		Sponsor Certification, Chapter 6 and Appendix E
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?	✓		Chapter 6, Appendix E
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)?	✓		Figures 4-1 and 4-2, Figures NEM-1 and NEM-2
B. Map currency:			
1. Does the year on the face of the existing condition map graphic match the year on the airport operator's NEM submittal letter?	✓		Sponsor Certification, Figure 4-1, Figure NEM-2
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?	✓		Section 4.3, Figure 4-2, Figure NEM-2
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:			
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?	✓		Chapter 4
2. If the forecast year map is based on program implementation:			
a. Are the specific program measures that are reflected on the map identified?	✓		Chapter 5
b. Does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	✓		Chapter 5
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))			N/A
IV. Map Scale, Graphics, And Data Requirements: [A150.101, A150.103, A150.105, 150.21(a)]			
A. Are the maps of sufficient scale to be clear and readable (they must 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*	✓		NEM-1, NEM-2

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)*			
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)	✓		NEM-1, NEM-2
C. Depiction of the airport and its environs:			
1. Is the following graphically depicted to scale on both the existing condition and forecast year maps?			
a. Airport boundaries	✓		NEM-1, NEM-2
b. Runway configurations with runway end numbers	✓		NEM-1, NEM-2
2. Does the depiction of the off-airport data include?			
a. A land use base map depicting streets and other identifiable geographic features	✓		NEM-1, NEM-2
b. The area within the DNL[1] 65 dB (or beyond, at local discretion)	✓		NEM-1, NEM-2
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)	✓		NEM-1, NEM-2
D. 1.Continuous contours for at least the DNL 65, 70, and 75 dB?	✓		NEM-1, NEM-2
2. Has the local land use jurisdiction(s) adopted a lower local standard and if so, has the sponsor depicted this on the NEMs?		✓	
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?	✓		NEM-1, NEM-2, Chapter 2
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?	✓		Chapter 2, Figures 2-3 through 2-8
F. Locations of any noise monitoring sites (these may be on			N/A

supplemental graphics which must use the same land use base map and scale as the official NEMs)			
G. Noncompatible land use identification:			
1. Are noncompatible land uses within at least the DNL 65 dB noise contour depicted on the map graphics?	✓		NEM-1, NEM-2
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.)			None within 65 DNL contour, Chapter 4- Page 28
3. Are the noncompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	✓		NEM-1, NEM-2
4. Are compatible land uses, which would normally be considered noncompatible, explained in the accompanying narrative?	✓		Yes, voluntary acquisition
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?	✓		Chapter 2
2. Are the underlying technical data and planning assumptions reasonable?	✓		Sponsor Certification
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	✓		Chapter 2
a. Is it FAA approved?	✓		Section 2.2
b. Was the same model used for both maps? *(Note: The same model also must be used for NCP submittals associated 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.)*	✓		Section 2.2
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	✓		Section 2.2, Appendix C

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?			
b. If so, does this have written approval from AEE, and is that written approval included in the submitted document?	✓		Section 2.2, Appendix C
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
C. Noncompatible 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?	✓		Section 4.2
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	✓		Section 4.2
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 noncompatible land use identifications consider non-airport and non-aircraft noise sources?			N/A
4. Where normally noncompatible land uses			N/A

are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?			
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?	✓		Section 4.3
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?	✓		Sponsor Certification
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. § 1001?	✓		Sponsor Certification

PART 150 NCP CHECKLIST – PART I

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
I. Submitting And Identifying The NCP:			
A. Submission is properly identified:			
1. 14 C.F.R. Part 150 NCP?		✓	Letter of Transmittal, Sponsor Certification
2. NEM and NCP together?	✓		Letter of Transmittal, Sponsor Certification
3. Program revision? (To what extent has it been revised?)	✓		Letter of Transmittal
B. Airport and Airport sponsor's name are identified?	✓		Letter of Transmittal, Sponsor Certification, Chapter 1, Section 1.4
C. NCP is transmitted by airport sponsor's cover letter?	✓		Letter of Transmittal
II. Consultation: (including public participation): [150.23]			
A. Documentation includes narrative of public participation and consultation process?	✓		Chapter 6, Appendix E
B. Identification of consulted parties:			
1. All parties in 150.23(c) consulted?	✓		Chapter 6
2. Public and planning agencies identified?	✓		Chapter 6
3. Agencies in 2, above, correspond to those affected by the NEM noise contours?	✓		Chapter 6
C. Satisfies 150.23(d) requirements by:			
1. Documentation shows active and direct participation of parties in B., above?	✓		Chapter 6
2. Active and direct participation of general public and opportunity to submit their views, data, and comments on the formulation and adequacy of the NCP?	✓		Chapter 6
3. Participation was prior to and during development of NCP and prior to submittal to FAA?	✓		Chapter 6
4. Indicates adequate opportunity afforded to all consulted parties to submit views, data, etc.?	✓		Chapter 6
D. Evidence is included there was notice and opportunity for a public hearing on the final NCP?	✓		Chapter 6
E. Documentation of comments:			
1. Includes summary of public hearing comments, if hearing was	✓		Chapter 6

held?			
2. Includes copy of all written material submitted to operator?	✓		Chapter 6, Appendix E
3. Includes operator's responses/disposition of written and verbal comments?	✓		Chapter 6, Appendix E
F. Is there written evidence from the appropriate office within the FAA that the sponsor received informal agreement to carry out proposed flight procedures?			N/A
III. Noise Exposure Maps: [150.23, B150.3; 150.35(f)] *(This section of the checklist is not a substitute for the Noise Exposure Map checklist. It deals with maps in the context of the Noise Compatibility Program submission.)*			
A. Inclusion of NEMs and supporting documentation:			
1. Map documentation either included or incorporated by reference?	✓		Chapter 3
2. Maps previously found in compliance by FAA?			NEMs submitted with NCP
3. FAA's compliance determination still valid?			
a. Existing condition NEM represents conditions at the airport at the time of submittal of the NCP for FAA approval?	✓		Letter of Transmittal, NEM-1, Chapter 4
b. Forecast condition NEM represents conditions at the airport at least 5 years into the future from the date of submittal of the NCP to the FAA for approval?	✓		Letter of Transmittal, NEM-1, Chapter 4
c. Sponsor letter confirming elements (a) and (b), above, if date of submission is either different than the year of submittal of the previously approved NEMs or over 12 months from the date shown on the face of the NEM?			N/A
d. If (a) through (c) cannot be validated, the NEMs must be redone and resubmitted as per 150.21.			N/A
4. Does 180-day period have to wait for map compliance finding?	✓		
B. Revised NEMs submitted with program: (Review using NEM checklist if map revisions included in NCP submittal. Report the applicable findings in the spaces below after a full review using the NEM checklist and narrative.)			
1. Revised NEMs included with program?		✓	No changes in DNL with NCP
2. Has airport sponsor requested in writing that FAA make a determination on the NEM(s), showing NCP measures in place, when NCP		✓	

approval is made?			
C. If program analysis uses noise modeling:			
1. INM, HNM, or FAA-approved equivalent?	✓		Chapter 4
2. Monitoring in accordance with A150.5?			N/A
D. One existing condition and one forecast-year map clearly identified as the official NEMs?	✓		NEM-1, NEM-2
IV. Consideration of Alternatives: [B150.7, 150.23(e)(2)]			
A. At a minimum, were the alternatives below considered, or if they were rejected was the reason for rejection reasonable and based on accurate technical information and local circumstances?			
1. Land acquisition and interests therein, including air rights, easements, and development rights?	✓		NCP Update only, Chapter 5
2. Barriers, acoustical shielding, public building soundproofing		✓	NCP Update only, Chapter 5
3. Preferential runway system	✓		NCP Update only, Chapter 5
4. Voluntary flight procedures	✓		NCP Update only, Chapter 5
5. Restrictions described in B 150.7 (taking into account Part 161 requirements)		✓	NCP Update only, Chapter 5
6. Other actions with beneficial impact not listed in the regulation		✓	NCP Update only, Chapter 5
7. Other FAA recommendations (see D, below)		✓	NCP Update only, Chapter 5
B. Responsible implementing authority identified for each considered alternative?	✓		Chapter 5
C. Analysis of alternative measures:			
1. Measures clearly described?	✓		Chapter 5
2. Measures adequately analyzed?	✓		Chapter 5
3. Adequate reasoning for rejecting alternatives?			N/A
D. Other actions recommended by the FAA: As the FAA staff person familiar with the local airport circumstances, determine whether other actions should be added? *(List separately, or on back, actions and describe discussions with airport sponsor to have them included prior to the start of the 180-day cycle. New measures recommended by the airport sponsor must meet applicable public participation and consultation with officials before they can be submitted to the FAA for action. See E., below.)*			N/A

V. Alternatives Recommended for Implementation: [150.23(e), B150.7(c); 150.35(b), B150.5]			
A. Document clearly indicates:			
1. Alternatives that are recommended for implementation?	✓		Chapter 5
2. Final recommendations are airport sponsor's, not those of consultant or third party?	✓		Letter of Transmittal
B. Do all program recommendations:			
1. Relate directly or indirectly to reduction of noise and noncompatible land uses? *(Note: All program recommendations, regardless of whether previously approved by the FAA in an earlier Part 150 study, must demonstrate a noise benefit if the airport sponsor wants FAA to consider the measure for approval in a program update. See E., below.)*	✓		Chapter 5
2. Contain description of each measure's relative contribution to overall effectiveness of program?	✓		Chapter 5
3. Noise/land use benefits quantified to extent possible to be quantified? *(Note: some program management measures cannot be readily quantified and should be described in other terms to show their implementation contributes to overall effectiveness of the program.)*	✓		Chapter 5
4. Does each alternative include actual/anticipated effect on reducing noise exposure within noncompatible area shown on NEM?	✓		Chapter 5
5. Effects based on relevant and reasonable expressed assumptions?	✓		Chapter 5
6. Does the document have adequate supporting data that the measure contributes to noise/land use compatibility?	✓		Chapter 5
C. Analysis appears to support program standards set forth in 150.35(b) and B150.5?	✓		Chapter 5
D. When use restrictions are recommended for approval by the FAA:			
1. Does (or could) the restriction affect Stage 2 or Stage 3 aircraft operations *(regardless of whether they presently operate at the airport)*? *(If the restriction affects Stage 2 helicopters, Part 161 also applies.)*			N/A
2. If the answer to D.1 is yes, has the			N/A

airport sponsor completed the Part 161 process and received FAA Part 161 approval for a restriction affecting Stage 3 aircraft? Is the FAA's approval documented? For restrictions affecting only Stage 2 aircraft, has the airport sponsor successfully completed the Stage 2 analysis and consultation process required by Part 161 and met the regulatory requirements, and is there evidenced by letter from FAA stating this fact?			
3. Are non-restrictive alternatives with potentially significant noise/compatible land use benefits thoroughly analyzed so that appropriate comparisons and conclusions among all alternatives can be made?			N/A
4. Did the FAA regional or ADO reviewer coordinate the use restriction with APP-400 prior to making determination on start of 180-days?			N/A
E. Do the following also meet Part 150 analytical standards?			
1. Recommendations that continue existing practices and that are submitted for FAA re-approval? *(Note: An airport sponsor does not have to request FAA re-approval if noise compatibility measures are in place from previously approved Part 150 studies. If the airport has implemented the measures as approved in the previous NCP, the measures may be reported and modeled as baseline conditions at the airport.)*			N/A
2. New recommendations or changes proposed at the end of the Part 150 process?		✓	
F. Documentation indicates how recommendations may change previously adopted noise compatibility plans, programs, or measures?	✓		Chapter 5
G. Documentation also:			
1. Identifies agencies that are responsible for implementing each recommendation?	✓		Chapter 5
2. Indicates whether those agencies have agreed to implement?	✓		Chapter 5
3. Indicates essential government actions necessary to implement recommendations?	✓		Chapter 5

H. Timeframe:			
1. Includes agreed-upon schedule to implement alternatives?	✓		Chapter 5
2. Indicates period covered by the program?	✓		Chapter 5
I. Funding/Costs:			
1. Includes costs to implement alternatives?	✓		Chapter 5
2. Includes anticipated funding sources?	✓		Chapter 5
VI. Program Revision: [150.23(e)(9)] Supporting documentation includes provision for revision? *(Note: Revision should occur when it is likely a change has taken place at the airport that will cause a significant increase or decrease in the DNL noise contour of 1.5 dB or greater over noncompatible land uses. See §150.21(d))*	✓		Letter of Transmittal

APPENDIX B

1996 FAA Record of Approval (ROA)

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Part 150: Records of Approval

Westover Air Reserve Base, Chicopee Falls, Massachusetts

Approved on 1/26/96

1.0 INTRODUCTION

The Westover Metropolitan Development Corporation sponsored an Airport Noise Compatibility Planning Study under a Federal Aviation Administration (FAA) grant, in compliance with Federal Aviation Regulations (FAR), Part 150. The Noise Exposure Maps (NEM) were developed and submitted to FAA on January 26, 1994. The NEM was determined to be in compliance on July 31, 1995. The determination was announced in the Federal Register on August 11, 1995. The Noise Compatibility Program (NCP) was submitted to FAA for review and approval on June 2, 1995 and notice of FAA's review of the NCP was announced concurrently in the August 11, 1995, Federal Register.

The Part 150 Study was closely monitored by an advisory committee which represented area municipalities, airport users, and community residents. A series of advisory committee meetings was held, with the airport's consultant presenting material and findings. Two public information meetings were held. The consultant addressed comments at all of these meetings, and subsequent written comments as well.

The study focused on defining an optimum set of noise and land use mitigation measures to improve compatibility between airport operations and community land use, presently and in the future.

The resultant program is described in detail in the "Noise Compatibility Program" section of the study, sections 2 and 3. Section 2 describes the NCP elements and Section 3 analyzes alternatives and contains an implementation plan. The program elements below summarize as closely as possible the airport operator's recommendations in the noise compatibility program and are cross-referenced to the program. The statements contained within the summarized recommendations and before the indicated FAA approval, disapproval, or other determinations do not represent the opinions or decisions of the FAA.

The approvals which follow include actions which the Westover Metropolitan Development Corporation recommends be taken by FAA. It should be noted that these approvals indicate only that the actions would, if implemented, be consistent with the purposes of Part 150. These approvals do not constitute decisions to implement the actions. Later decisions concerning possible implementation of these actions may be subject to applicable environmental or other procedures or requirements.

2.0 PROGRAM ELEMENTS

2.1 Noise Abatement Elements

2.1.1. Extension of Existing Civil Aircraft Preferential Runway (Runway 5 for departures and Runway 23 for landings) when the tower begins operations on a full 24-hour schedule. Use from

11 pm to 7 am, until Forecasted 1998 operations of 3-4 nighttime turbojet (above 75,000 pounds) operations occur (sections 2.1.1 and 3.1.1) (identified as “Original 1998 Forecast” in Table 3.2). This measure is recommended in combination with the next noise abatement element.

Approved as voluntary. There are currently no civil operations between 11 pm and 7 am, since the airport is closed. The hours of operation of the ATCT and airport (7 am to 11 pm) are established by the Air Force Reserve. A noise abatement benefit of approximately 1.5 DNL would conservatively accrue to occur to up to 2400 people who reside in more densely populated areas to the south of the airport within the 65-75 DNL contour areas (Figure 3.1 and Tables 3.1 and 3.2). A reevaluation of this measure will be needed in order to compare continued preferential use with implementation of the related land use measure to acquire or soundproof residences.

2.1.2. Noise Abatement Departure Procedures for Military Aircraft on Runway 23 (sections 2.1.2 and 3.1.2). The Air Force operates mainly to the south due to placement of NAVAIDS. As part of noise mitigation for the flow of military operations for C-5s that remain in the local area, Air Force and Bradley Tower (the parent FAA air traffic control facility for Westover) would develop procedures for a right turn after take-off or missed approach to a heading of approximately 360 degrees at an altitude of 600 feet above ground level. Traffic permitting, Bradley would provide individual clearances through Westover Tower. After the initial right turn and upon positive radar contact, aircraft would be vectored by Bradley along a downwind leg and then cleared to turn inbound to intercept a final approach course of one of the instrument approaches used for training in the local area. For C-5s or other military aircraft departing the local area ATC would provide a clearance to turn after takeoff based on aircraft destination--either to a heading of 205 degrees (a 25 degree left turn) for aircraft departing towards the Hartford, Dream, Putnam, Norwich, Gardner, and Madison navigational fixes, or to an initial heading of 255 degrees (25 degree right turn) towards Keene, Pawling, Chester, and Barnes. As above, individual clearances would be through Westover Tower prior to take-off. Following positive radio and radar contact with Bradley, aircraft would be vectored on course. Noise abatement headings could be expected between 10 pm (2200) and 6 am (0600). During other hours, it is recommended that Westover Tower request a noise abatement heading, recognizing that each military jet aircraft cleared to turn will be left to the discretion of Bradley Approach Control.

Approved as voluntary. C-5 aircraft SEL contour analysis indicates that, given the Air Force Reserve right-hand local traffic pattern, noise exposure can be minimized with earlier turns (Figure 3.2). For traffic departing the local area, this analysis indicates that, given the need to avoid traffic conflicts within the Bradley Approach Control area and the need to vector aircraft somewhat in accordance with flight plan routes, earlier turns to the left or right can reduce population exposure (Figure 3.2).

2.1.3. Noise Abatement Departure Procedures for Civilian Aircraft on Runway 23. When civil aircraft operate to the south, the Air Force and Bradley Approach Control would develop IFR procedures that would permit civil aircraft to make early turns to 205 or 255 degrees after take-off from Runway 23. As in the previous noise abatement measure, assigned headings would be based on aircraft route of flight, issued to pilots by Westover Tower so that turns may be initiated prior to radar contact with Bradley, and expected between 10 pm (2200) and 6 am (0600). At other times Westover Tower would request the noise abatement headings for Stage 2 aircraft and it would be issued at Bradley’s discretion, traffic permitting.

Approved as voluntary. This noise abatement element, in conjunction with the next noise abatement element, Noise Abatement Departure Procedures for Civilian Aircraft on Runway 5, would reduce noise exposure to approximately 200 people within the DNL 65-75 contour areas (Figure 3.3 and Table 3.3).

2.1.4. Noise Abatement Departure Procedures for Civilian Aircraft on Runway 5. This measure is proposed in conjunction with the voluntary acquisition and relocation program proposed below. It

would be applicable between 10 pm (2200) and 6 am (0600) and consists of a departure heading of 080 degrees, extended as practical to 205 or 255 degrees for traffic with clearance toward Hartford and Pawling, respectively. Traffic with clearance toward Chester would be given a subsequent left turn when at least 3 DME from the Westover VOR (in order to remain clear of the Acrebrook subdivision). Clearances would be issued by Westover Tower after agreement on departure clearance procedures with Bradley Approach Control. They would be issued by Westover Tower to pilots prior to take-off so that turns may be initiated as soon as possible , prior to radar contact with Bradley.

Approved as voluntary. As stated in the approval of the previous measure, this noise abatement element, in conjunction with Noise Abatement Departure Procedures for Civilian Aircraft on Runway 23, would reduce noise exposure to approximately 200 people within the 65-75 DNL contour areas (Figure 3.3 and Table 3.3).

2.2 Land Use Elements

2.2.1. Voluntary Land Acquisition and Relocation Program. For approximately 150 residences exposed to 70 DNL or above, the Westover Metropolitan Development Corporation (WMDC) proposes to implement a voluntary purchase and relocation program to eliminate or significantly reduce the number of people remaining in areas of high noise exposure after implementation of all other operational noise abatement elements. WMDC would consider including additional homes in the purchase program on a case-by-case basis. A noise easement would be secured on all acquired property.

Approved. It is not considered within the meaning of the Uniform Act, to be a “voluntary” transaction if the homeowners’ property is destroyed and converted to other compatible land uses. If the property’s use will be the same, it is considered a voluntary transaction under the Uniform Act, but the homeowner does not qualify for relocation payments. Only tenant occupants would be eligible for relocation payments.

2.2.2. Voluntary Sound Insulation Program. This measure would apply to approximately 900 residences within the 65 DNL contour, as well as those within the 70 DNL contour but not sold under the voluntary acquisition program. A noise easement would be acquired in exchange for sound insulation.

Approved.

2.2.3. Compatible Use Zoning. To minimize chances that new noncompatible land uses will be developed within the DNL 65 dB contour, it is proposed that each of the five communities of Chicopee, Granby, Ludlow, Springfield, and South Hadley consider adopting suitable zoning to limit residential use in high noise exposed areas. **Approved.** FAA strongly discourages new noncompatible development within the DNL 65 dB contour, and new development may not be eligible for future mitigation using Federal funding.

2.2.4. Airport Overlay District. WMDC would recommend that the communities of Chicopee and Granby adopt an airport overlay district which encompasses land within the 65 DNL contour. They would also recommend that the town of Ludlow change the boundaries of its airport overlay district to include all of the land within the forecasted 1998 contour.

Approved.

Subdivision Regulations. WMDC would recommend that the town of Granby amend its subdivision regulations to require noise easements on all newly created lots within the airport’s 65

DNL contour. WMDC would work with town officials in preparing amendments to the Bylaws of the Town of Granby, Volume IV, Chapter XXII.

Approved. FAA strongly discourages new noncompatible development within the DNL 65 dB contour, and new development may not be eligible for future mitigation using Federal funding.

2.3 Implementation, Monitoring, and Review Elements

2.3.1 Pilot Awareness Program. WMDC would publish a pamphlet of noise abatement practices to be distributed to civilian pilots through the Fixed Base Operator and WMDC's airport management. The pamphlet would include a map of noise sensitive areas around the airport and describe the operational measures which WMDC has adopted for noise abatement, including use of noise abatement departure procedures recommended by the National Business Aircraft Association or by individual aircraft manufacturers. WMDC would also install signs in all terminal areas frequented by civilian pilots and along ramp and taxiway areas controlled by WMDC, instructing pilots to follow noise abatement procedures.

Approved. The content and location of airfield signs are subject to specific approval by appropriate FAA officials outside of the Part 150 process and are not approved in advance by this action. Such signs must not be construed as mandatory air traffic procedures.

2.3.2 Public Awareness Program. To promote good public relations WMDC would issue from time to time public releases, which it would send to local papers, town libraries, and other public facilities, describing the latest developments in its noise compatibility program.

Approved.

2.3.3 Monitoring Nighttime Operations and Runway Use. WMDC would log nighttime activity between 10 pm (2200) and 7 am (0700). Logs would include time, type aircraft, registration/flight number, landing or take-off, runway used, and wind and weather conditions. The information would be used to determine compliance with WMDC's nighttime noise rule and to help provide guidance to Air Force contract tower personnel to determine compliance with the preferential runway use program.

Approved in part; disapproved in part, pending submission of additional information to make an informed analysis. This measure is approved for purposes of Part 150, except with respect to the information being used to determine compliance with the nighttime noise rule. The WMDC has not submitted for review under Part 150 either the current nighttime restriction or the proposed amendments to its nighttime noise rule (pages 13-15 and 39-42 of the NCP). There is insufficient information for the FAA to determine whether compliance with the noise rule would meet the approval standards contained in 14 CFR Part 150.

Airport noise and access restrictions proposed after October 1, 1990, must be adopted in compliance with the Airport Noise and Capacity Act of 1990 (recodified at P.L. 103-272), 49 USC 47521 (hereinafter referred to as "ANCA"), as implemented by 14 CFR Part 161.

2.3.4 Using a basic spreadsheet program, WMDC would compute estimates of changes in noise exposure related to changes in scheduled civil jet operations, changes in civil nighttime operations, or changes in total nighttime civil operations. WMDC would submit an Environmental Notification Form (ENF) to the Massachusetts Secretary of Environmental Affairs for any change in noise exposure greater than 1.5 dBA above the forecasted exposure included in the noise compatibility planning program and would initiate a review of its Noise Compatibility Program. Finally, if noise exposure reaches that forecasted in the noise exposure map, WMDC would initiate an update to the noise compatibility planning study in 1999 and 5-year intervals thereafter.

Each update would address fully the noise exposure and incompatible land use existing at the time.

Approved. A basic spreadsheet program may be used as a screening tool. A screening tool, such as the FAA's Area Equivalent Method, may be a useful indicator as to whether there has been a significant change in the noise environment warranting a revision to the NEM per section 150.21 of Part 150.

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APPENDIX C

AEE Coordination

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HNTB

To
Richard Doucette
Environmental Program Manager
New England Region
Federal Aviation Administration
12 New England Executive Park
Burlington, MA 01803

From
Royce Bassarab, HNTB

Cc
Lisa Lesperance, FAA
Gordon Hutchinson, WMDC
Ervin Deck, Stantec

Subject
Request for Non-standard Substitution Aircraft for Westover Air Reserve/Metropolitan Airport Noise Exposure Map Update

Date
December 19th, 2013

The Westover Metropolitan Development Corporation (WMDC) has initiated a Noise Exposure Map Update Study for Westover Air Reserve Base (WARB)/Metropolitan Airport (CEF), with the assistance of Stantec Consulting Services and HNTB Corporation. The WMDC oversees civilian operations at Westover Metropolitan Airport. The Airport is also home to the Massachusetts Air Force Reserve 439th Airlift Wing, which operates Lockheed C-5 Galaxy aircraft. Westover ARB is one of three C-5 isochronal inspection/repair facilities in the United States.

HNTB is preparing noise exposure contours representative of existing conditions in 2014 and forecast conditions in 2019. The WMDC intends to use the FAA's Integrated Noise Model (INM, version 7.0d) to represent civilian operations. Eleven aircraft identified in the existing and forecast fleet mix do not have pre-approved INM substitutions, as shown in **Table 1**. Operations include arrivals and departures for a small number of historic aircraft types likely associated with the air show events that have been held at CEF.

Table 1
Recommended Substitute Aircraft

Aircraft Code	Aircraft	Description	Suggested INM Substitute	Suggested INM Substitute Description
EFOX	Aeropro Eurofox	Two-seat light high-wing aircraft equipped with one Rotax 912S engine rated at 100 hp and MTOW of 1,232 lbs.	GASEPF	Generic 1985 single engine propeller with fixed pitch and MTOW of 2,200 lbs.

Aircraft Code	Aircraft	Description	Suggested INM Substitute	Suggested INM Substitute Description
C120	Cessna 120	Two-seat light aircraft equipped with one Continental C-85 engine rated at 85hp and MTOW of 1,500 lbs. Does not include wing flaps.	GASEPF	Generic 1985 single engine propeller with fixed pitch. MTOW of 2,200 lbs.
C140	Cessna 140	Two-seat light aircraft equipped with one Continental C-85 engine rated at 85hp and MTOW of 1,500 lbs. Includes wing flaps.	GASEPF	Generic 1985 single engine propeller with fixed pitch. MTOW of 2,200 lbs.
FA7X	Dassault Falcon 7X	Larger version of the Falcon 900, a long range business jet equipped with three Pratt & Whitney PW307A turbofans each producing 6,400 lbs of thrust. MTOW of 70,000 lbs.	FAL900	Long range business jet equipped with three Honeywell TFE 7313-5AR-1C engines each producing 4,750 lbs of thrust. MTOW of 45,503 lbs.
E50P	Embraer Phenom 100	Very light jet equipped with two Pratt & Whitney PW617F-E turbofan engines with a maximum thrust of 1,695 lbs each. MTOW of 10,472 lbs.	CNA510	Light jet equipped with two Pratt & Whitney PW615F turbofan engines with a maximum thrust of 1,466 lbs. MTOW of 8,645 lbs.
E55P	Embraer Phonem 300	Very light jet equipped with two Pratt & Whitney PW535E engines rated at 3,200 lbs each. MTOW of 17,529 lbs.	CNA560E	Business jet with 7-8 passengers seats, powered by two Pratt & Whitney PW535A engines rated at 3,400 lbs. MTOW of 16,630 lbs.
LJ40	Learjet 40	Light business jet aircraft equipped with either two Honeywell TFE731-20AR or Honeywell TFE731-20BR engines with a maximum thrust of 3,500 lbs each. MTOW of 21,000 lbs.	LEAR35	Business jet powered by two Garrett TFE731-2 turbofan engines rated at 3,500 lbs each. MTOW of 18,300 lbs.
P46T	Piper PA-46 Malibu Meridian	Turbo-prop powered version of the PA-46 Malibu. Equipped with one Pratt & Whitney PT6A-42A engine of 500 hp. MTOW of 5,092 lbs.	PC12	Single engine turboprop equipped with one Pratt & Whitney PT6A-67B or 67P engine of 1,200 hp. MTOW of 10,450 lbs.
P-47	P-47 Thunderbolt	Single engine piston fighter aircraft used by the U.S. Air Forces in World War II. Powered by one Pratt & Whitney Canada R-2800 piston engine rated at 2,535 hp. MTOW of 17,500 lbs.	DC3	Uses two R-2800 piston engines.
B-25	B-25 Mitchell	Medium-range bomber used during World War II. Equipped with two Wright R-2600-92 piston engines rated at 1,700 hp each. MTOW of 35,000 lbs.	DC3	Uses two R-2800 piston engines. (R-2800 represents similar family of engine type, with increased horsepower.)
S58T	Sikorsky S-58 Turbo-shaft conversion	Turbo-shaft conversion of the Sikorsky S-58 (H-34). Equipped with Pratt & Whitney PT6T-3 twin-pac engine. MTOW of 14,000 lbs.	B212	Twin-engine medium helicopter equipped with two PT6T-3 engines. MTOW of 11,200 lbs.

Source: HNTB 2013.

The WMDC intends to model operations and flight profile data associated with the WARB by using the FAA-approved U.S. Air Force NOISEMAP model. In 2013, the WARB completed an Air Installation Compatible Use Zone (AICUZ) study, which included operations flown by both military and civilian aircraft. As part of the development of noise exposure contours for the AICUZ, detailed flight profiles representing the range of operations flown by the C-5, including tactical flight training for departures and approaches, were developed and used for noise modeling. NOISEMAP will be used to model operations flown by the C-130, UH-60, KC-135, C-17, A-10 and others. The WMDC proposes no changes to the types of operations or flight profiles used in the AICUZ. The results of each noise model will be combined to present noise exposure contours for an existing 2014 and forecast 2019 noise exposure map.

This request is in accordance with the required protocol to obtain approval of non-standard procedures related to the INM[1]. On behalf of the WMDC, HNTB requests AEE review of the following list of recommended substitute aircraft or the provision of a suitable alternative. Your help with this matter is greatly appreciated. Should you have any questions regarding the methodology and assumptions provided herein, please do not hesitate to contact me.

Sincerely,

K. Royce Bassarab
Aviation Environmental Project Manager

[1] AEE and Airports Coordination Policy for Non-Standard Modeling Procedures and Methodology, FAA July 28, 2009.

U.S. Department
of Transportation
Federal Aviation Administration

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

January 31, 2014

Richard Doucette
Environmental Program Manager
New England Region
Federal Aviation Administration
12 New England Executive Park
Burlington, MA 01803

Dear Richard,

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard Integrated Noise Model (INM) aircraft substitutions for the Westover Air Reserve Base (WARB)/Metropolitan Airport (CEF) Noise Exposure Map (NEM) Update.

HNTB Corporation is assisting the Westover Metropolitan Development Corporation with the NEM Update for WARB/CEF. The civilian operations for the updated NEM will be modeled using the most current release of the INM; i.e., Version 7.0d. HNTB has proposed substitutions for 11 aircraft types that currently do not have standard substitutions in the INM aircraft database. The proposed substitutions and the corresponding AEE recommendations are summarized in the table below.

Aircraft	HNTB Proposed Substitution	AEE Recommendation
Aeropro Eurofox	GASEPF	Concur
Cessna 120	GASEPF	Concur
Cessna 140	GASEPF	Concur
Dassault Falcon 7X	FAL900	**Concur (F10062)**
Embraer EMB-500 Phenom 100	CNA510	Concur
Embraer EMB-505 Phenom 300	CNA560E	Concur
Learjet 40	LEAR35	Concur
Piper Malibu Meridian	PC12	**Concur (CNA208)**
P-47 Thunderbolt	DC3	Concur
B-25 Mitchell	DC3	Concur
Sikorsky S-58	B212	**S76**

AEE concurs with all but one of the recommended substitutions. AEE recommends the INM type S76 (Sikorsky S-76) as the substitute for the Sikorsky S-58 rather than the B212.

The Sikorsky S-76 is a better match than the B212 to the S-58 in terms of disc loading and number of rotor blades and therefore would be a better substitute for noise modeling.

AEE also notes that the FAL900 and PC12 are not INM aircraft but are included in the INM substitution list. The substitutions for these aircraft are the INM types F10062 and CNA208 respectively. The F10062 and the CNA208 are the recommended substitutions for the Falcon 7X and Piper Malibu Meridian, therefore AEE concurs with these recommendations.

In addition, the military operations associated with the WARB will be modeled with NOISEMAP. The results of the NOISEMAP modeling will be combined with the results of the INM modeling of civilian aircraft to present noise exposure contours for an existing 2014 and forecast 2019 NEM. AEE concurs with the use of NOISEMAP for the military aircraft noise modeling and combining the results with the civilian noise contours from INM.

Please understand that this approval is limited to this particular NEM Update for WARB/CEF. Any additional projects or non-standard INM input at WARB/CEF or any other site will require separate approval.

Sincerely,

Rebecca Cointin, Manager
AEE/Noise Division

cc: Jim Byers, APP-400

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APPENDIX D

Noise and Its Effect on People

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APPENDIX D
Noise and Its Effect on People

Aircraft noise exposure in this document is primarily addressed using the Day-Night Average Sound Level (DNL) metric. This study also involves the use of supplemental noise metrics in addition to DNL to provide comprehensive analysis for quantifying a specific situation. To assist reviewers in interpreting complex noise metrics, this appendix presents an introduction to the relevant fundamentals of acoustics and noise terminology, and the effects of noise on human activity.

D.1 Noise and its Metrics

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in an urban or suburban surrounding, where interstate and local roadway traffic, rail, industrial and neighborhood sources may also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

A "metric" is defined as something "of, involving, or used in measurement." As used in environmental noise analyses, a metric refers to the unit or quantity that quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics used by individual researchers who have attempted to understand and represent the effects of noise. As a result, literature describing environmental noise or environmental noise abatement has included many different metrics.

Various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents. Furthermore, the Federal Aviation Administration (FAA) has specified which metrics, such as DNL, should be used for federal aviation noise assessments.

This section discusses the following acoustic terms and metrics:

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Maximum Sound Level (L_{max})
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Day-Night Average Sound Level (DNL)
- Time-Above a Specified Level (TA)

D.1.1 The Decibel (dB)

All sounds come from a sound source—a musical instrument, a speaking voice, or an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in sound waves—tiny, quick oscillations of pressure just above and just below atmospheric

pressure. These oscillations, or sound pressures, impinge on the ear creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sound that we hear without pain has about one trillion times more energy than the quietest sounds we hear. On a linear scale, this range is unwieldy. Therefore we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL) and its logarithmic unit of decibel (dB).

SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). Decibels are logarithmic quantities —logarithms of the ratio of the two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs less than or equal to about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they require logarithmic math and not simple (linear) addition and subtraction. For example, if two sound sources each produce 100 dB and are operated together, they produce only 103 dB—not 200 dB as might be expected. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL (of all of the sources combined) increases another three decibels. A ten-fold increase in the number of sources makes the SPL increase by 10 dB. A hundredfold increase makes the level increase by 20 dB, and it takes a thousand equal sources to increase the level by 30 dB.

If one source is much louder than another, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produce 100 dB when operating together. The louder source “masks” the quieter one. But if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level 3 decibels above the sound level of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total.

There are two useful rules of thumb to remember when comparing SPLs: (1) most of us perceive a 6 to 10 dB increase in the SPL to be an approximate doubling of loudness, and (2) changes in SPL of less than about 3 dB are not readily detectable outside of a laboratory environment.

D.1.2 A-Weighted Decibel (dBA)

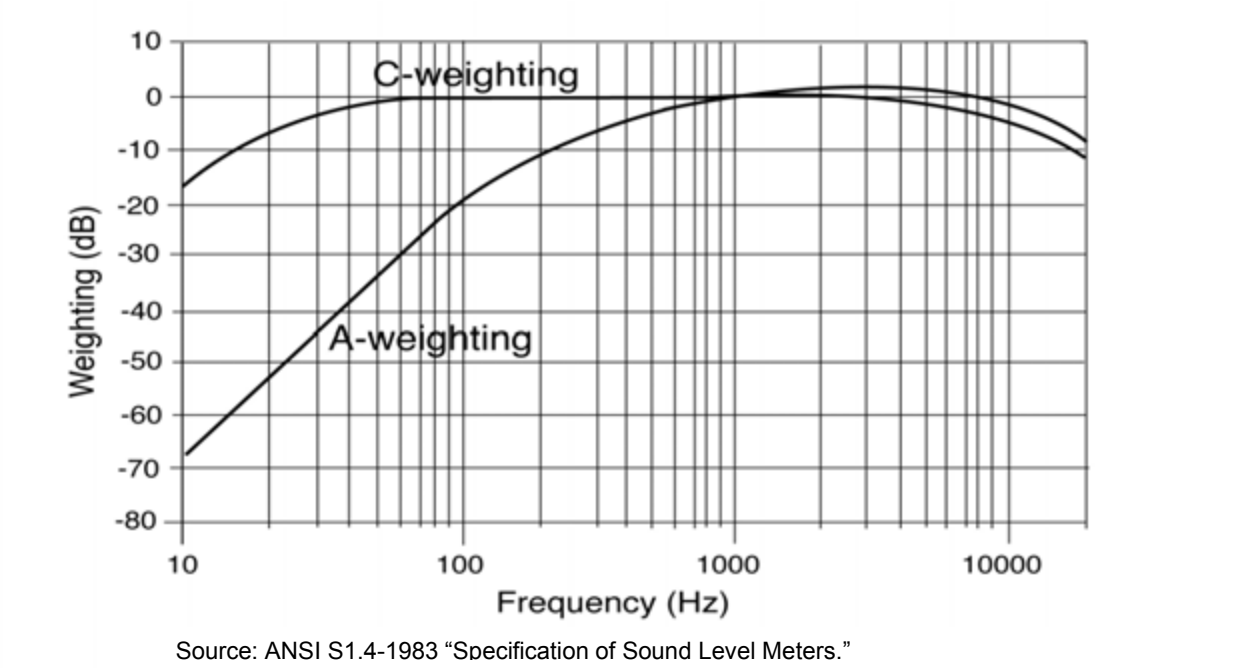
Another important characteristic of sound is its frequency, or “pitch.” This is the rate of repetition of the sound pressure oscillations as they reach our ear. Frequency can be expressed in units of cycles per second (cps) or Hertz (Hz). Although cps and Hz are equivalent, Hz is the preferred scientific unit and terminology.

A very good ear can hear sounds with frequencies from 16 Hz to 20,000 Hz. However, most people hear from approximately 20 Hz to approximately 10,000-15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 4,000 Hz. Acousticians have developed and applied "filters" or "weightings" to SPLs to match our ears' sensitivity to the pitch of sounds and to help us judge the relative loudness of sounds made up of different frequencies. Two such filters, "A" and "C," are most applicable to environmental noises.

A-weighting significantly de-emphasizes noise at low and high frequencies (below approximately 500 Hz and above approximately 10,000 Hz) where we do not hear as well. The filter has little or no effect at intervening frequencies where our hearing is most efficient. **Figure D-1** shows a graph of the A-weighting as a function of frequency and its aforementioned characteristics. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged to be louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. Therefore, A-weighted sound levels are normally used to evaluate environmental noise. SPLs measured through this filter are referred to as A-weighted decibels (dBA).

Figure D-1

Frequency Response Characteristics of Various Weighting Networks



Source: ANSI S1.4-1983 "Specification of Sound Level Meters."

As shown in Figure D-1, C-weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing the low frequency noise. C-weighted levels are not used as frequently as A-weighted levels, but they may be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, perceptible vibrations or other factors that can cause annoyance and complaints. Uses include the evaluation of blasting noise, artillery fire, sonic boom, and in some cases, aircraft noise inside buildings. SPLs measured through this filter are referred to as C-weighted decibels (dBC).

Other weighting networks have been developed to correspond to the sensitivity and perception of other types of sounds, such as the "B" and "D" filters. However, A-weighting has been adopted as the basic measure of community environmental noise by the U.S. Environmental Protection Agency (EPA) and nearly every other agency concerned with aircraft noise throughout the United States.

Figure D-2 presents typical A-weighted sound levels of several common environmental sources. Sound levels measured (or computed) using A-weighting are most properly called "A-weighted sound levels" while sound levels measured without any frequency weighting are most properly called "sound levels." However, since this document deals only with A-weighted sound levels, the adjective "A-weighted" will be hereafter omitted, with A-weighted sound levels referred to simply as sound levels. As long as the use of A-weighting is understood, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the dB or dBA units.

An additional dimension to environmental noise is that sound levels vary with time and typically have a limited duration, as shown in **Figure D-3**. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (although even the background varies as birds chirp, the wind blows or a vehicle passes by). Sounds can be classified by their duration as continuous like a waterfall, impulsive like a firecracker or sonic boom or intermittent like an aircraft overflight or vehicle passby.

D.1.3 Maximum Sound Level (L_{max})

The variation in sound level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. For the aircraft overflight event in Figure D-3, the L_{max} is approximately 67 dBA.

Figure D-4 shows L_{max} values for a variety of common aircraft from the FAA's Integrated Noise Model (INM) database. These L_{max} values for each aircraft type are for aircraft performing a maximum stage (trip) length departure on a day with standard atmospheric conditions at a reference distance of 3.5 nautical miles (NM) from their brake release point. Of the dozen aircraft types listed on the figure, the Concorde has the highest L_{max} and the Saab 340 (SF340) has the lowest L_{max}.

The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical maxima may produce very different total exposures. One may be of short duration, while the other may continue for an extended period. The metric, discussed later in this appendix, corrects for this deficiency.

Figure D-2

Sound Levels of Typical Noise Sources (dBA)

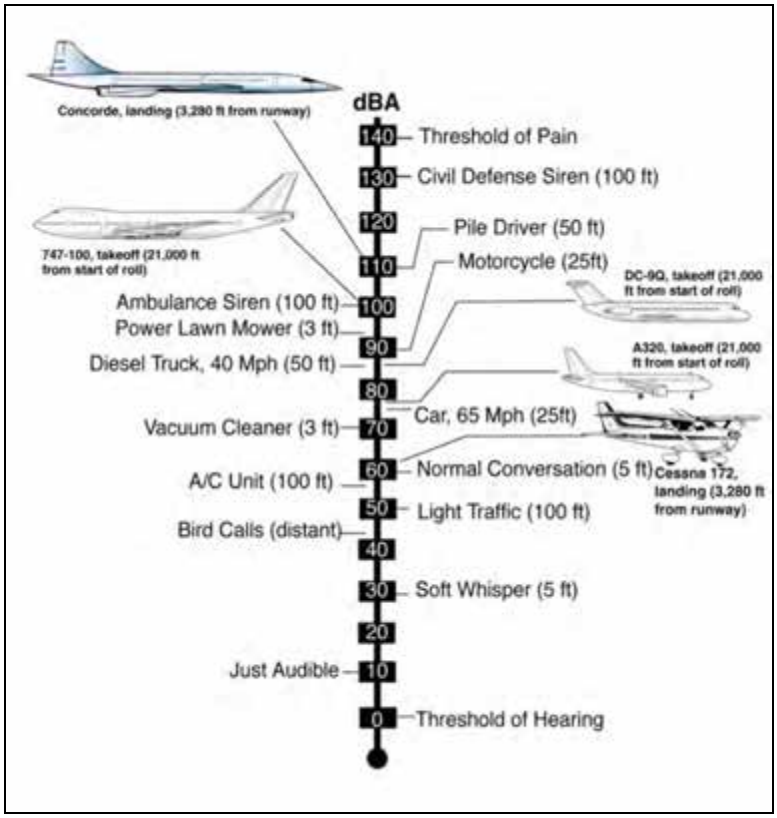
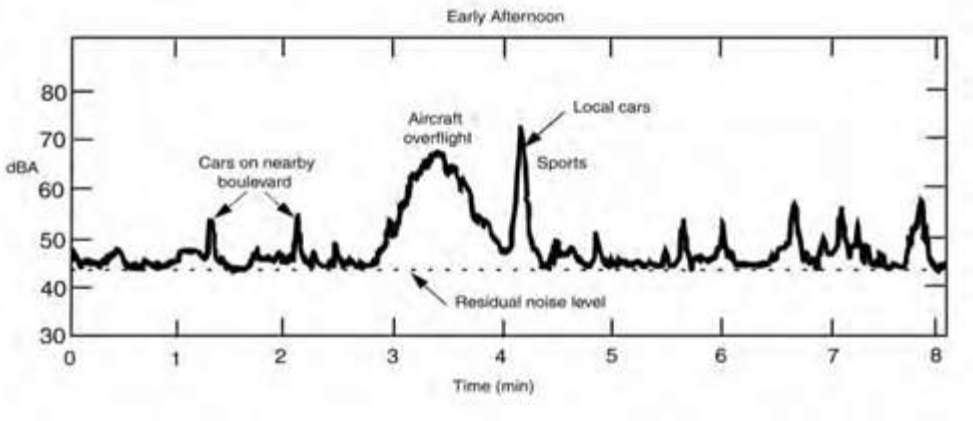


Figure D-3

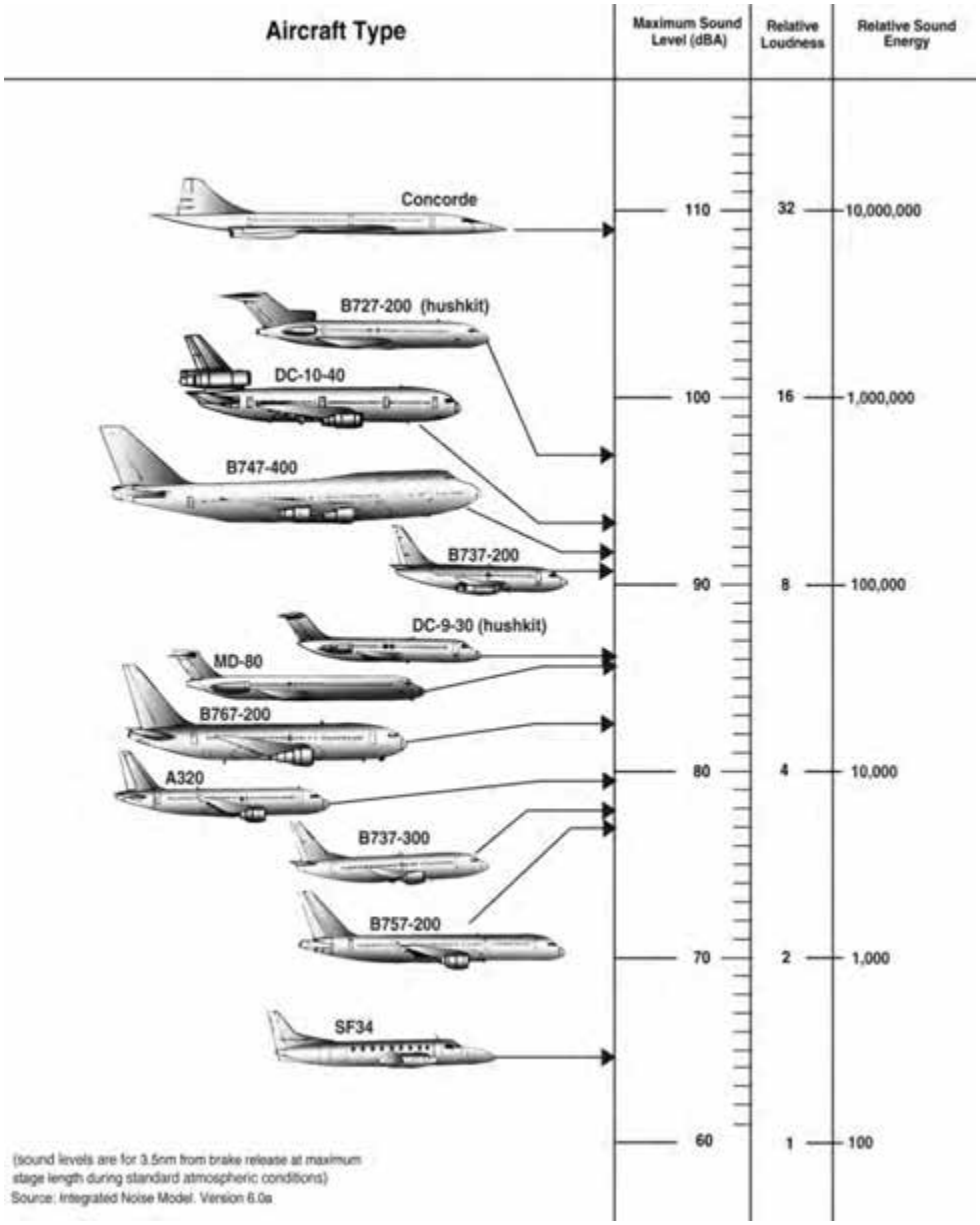
Variation of Community Noise in a Suburban Neighborhood



Source: "Community Noise," NTID 300.3 EPA, December 1971.

Figure D-4

Common Aircraft Departure Noise Levels



D.1.4 Sound Exposure Level (SEL)

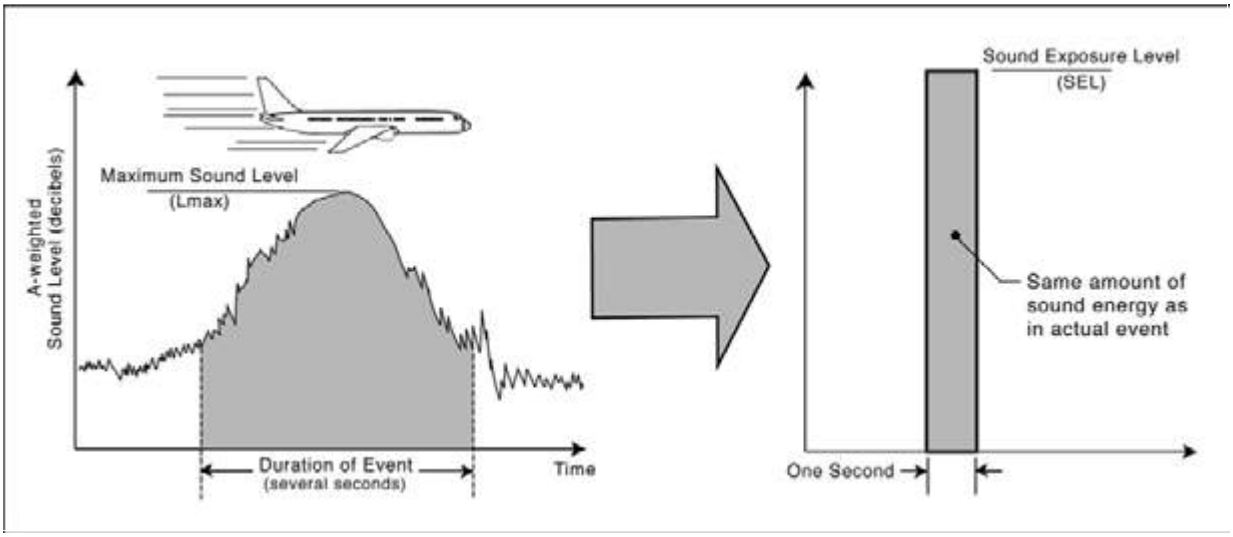
A frequently used metric of noise exposure for a single aircraft flyover is the Sound Exposure Level, or SEL. SEL may be considered an accumulation of the sound energy over the duration of an event. The shaded area in **Figure D-5** illustrates that portion of the sound energy (or "dose") included in an SEL computation. The dose is then normalized (standardized) to a duration of one second. This "revised" dose is the SEL, shown as the shaded rectangular area in Figure D-5. Mathematically, the SEL represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For events that last more than one second, SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event.

Note that, because the SEL is normalized to one second, it will always be larger in magnitude than the maximum A-weighted level for an event that lasts longer than one second. In fact, for most aircraft overflights, the SEL is on the order of 7 to 12 dBA higher than the L_{max}. The fact that it is a cumulative measure means that not only do louder flyovers have higher SELs than quieter ones (of the same duration), but longer flyovers also have greater SELs than shorter ones (of the same L_{max}).

It is the SEL's inclusion of both the intensity and duration of a sound source that makes SEL the metric of choice for comparing the single-event levels of varying duration and maximum sound level. This metric provides a comprehensive basis for modeling a noise event in determining overall noise exposure.

Figure D-5

Relationship Between Single Event Noise Metrics



D.1.5 Equivalent Sound Level (L_{eq})

Maximum A-weighted level and SEL are used to measure the noise associated with individual events. The following metrics apply to longer-term cumulative noise exposure that often includes many events.

The first cumulative noise metric, the Equivalent Sound Level (abbreviated L_{eq}), is a measure of the exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an 8-hour school day, nighttime or a full 24-hour day). However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

As for its application to aircraft noise issues, L_{eq} is often presented for consecutive 1-hour periods to illustrate how the hourly noise dose rises and falls throughout a 24-hour period, as well as how certain hours are significantly affected by a few loud aircraft. Since the period of interest for this study is in a full 24-hour day, $L_{eq(24)}$ is the proper nomenclature.

Conceptually, L_{eq} may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level with its normal "peaks" and "valleys," as illustrated in Figure D-3. In the context of noise from typical aircraft flight events and as noted earlier for SEL, L_{eq} does not represent the sound level heard at any particular time, but rather represents the total sound exposure for the period of interest. Also, it should be noted that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged," sound level. Thus, loud events tend to dominate the noise environment described by the L_{eq} metric.

D.1.6 Day-Night Average Sound Level (DNL)

DNL is the same as L_{eq} (an energy-average noise level over a 24-hour period) except that 10 dB is added to those noise events occurring at night (between 10 p.m. and 7 a.m.). This weighting reflects the added intrusiveness of nighttime noise events attributable to the fact that community background noise levels typically decrease by about 10 dB during those nighttime hours. DNL does not represent the sound level heard at any particular time, but rather represents the total (and partially weighted) sound exposure.

Typical DNL values for a variety of noise environments are shown in **Figure D-6** to indicate the range of noise exposure levels usually encountered.

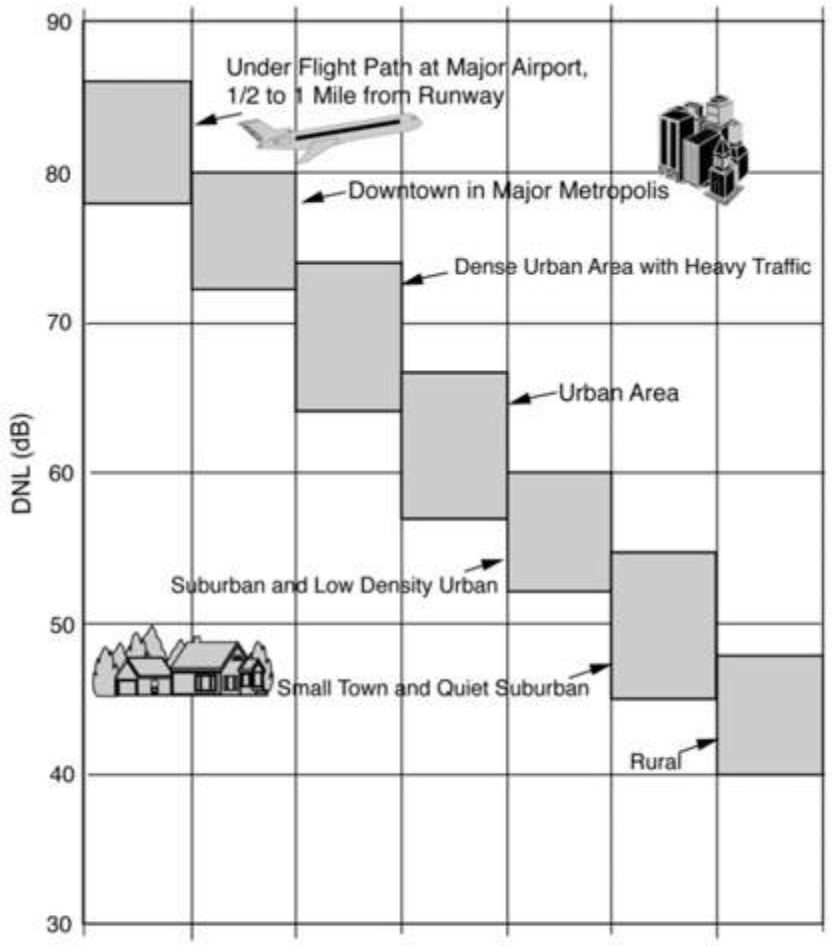
Due to the DNL metric's excellent correlation with the degree of community annoyance from aircraft noise, DNL has been formally adopted by most federal agencies for measuring and evaluating aircraft noise for land use planning and noise impact assessment. Federal interagency committees such as the Federal Interagency Committee on Urban Noise (FICUN) and the Federal Interagency Committee on Noise (FICON) which include the EPA, FAA, Department of Defense, Department of Housing and Urban Development (HUD), and Veterans Administration, found DNL to be the best metric for land use planning. They also found no new cumulative sound descriptors or metrics of sufficient scientific standing to substitute for DNL. Other cumulative

metrics could be used only to supplement, not replace DNL. Furthermore, FAA Order 1050.1E for environmental documents requires that DNL be used in describing cumulative noise exposure and in identifying aircraft noise/land use compatibility issues.[1 2 3 4 5]

Measurements of DNL are practical only for obtaining values for a relatively limited number of points. Instead, many noise studies, including this document, are based on estimates of DNL using an FAA-approved computer-based noise model.

Figure D-6

Typical Range of Outdoor Community Day-Night Average Sound Levels



Source: U.S. Department of Defense. Departments of the Air Force, the Army, and the Navy, 1978. *Planning in the Noise Environment*. AFM 19-10. TM 5-803-2, and NAVFAC P-970. Washington, D.C.: U.S. DoD.

D.1.7 Time-Above a Specified Level (TA)

The Time-Above a Specified Level (TA) metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." Like DNL, the TA metric is typically associated with a 24-hour annual average day or only for the DNL nighttime period of 10 p.m. to 7 a.m.

When the TA calculation is expressed as a percentage of the day it is referred to as "%TA." Although the threshold chosen for the TA calculation is arbitrary, it is usually the ambient level for the location of interest or 65 dB for comparison to a level of 65 dB DNL.

D.2 The Effects of Aircraft Noise on People

To many people, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, disrupt classroom activities in schools and disrupt sleep. Relating these effects to specific noise metrics aids in the understanding of how and why people react to their environment. This section addresses three ways we are potentially affected by aircraft noise: annoyance, interference of speech and disturbance of sleep.

D.2.1 Community Annoyance

The primary potential effect of aircraft noise on exposed communities is one of annoyance. The U.S. EPA defines noise annoyance as any negative subjective reaction on the part of an individual or group.[1]

Scientific studies [1 2 3 6 7] and a large number of social/attitudinal surveys [8 9] have been conducted to appraise the U.S. and international community of annoyance due to all types of environmental noise, especially aircraft events. These studies and surveys have found the DNL to be the best measure of that annoyance.

This relation between community annoyance and time-average sound level has been confirmed, even for infrequent aircraft noise events.[10] For helicopter overflights occurring at a rate of 1 to 52 per day, the stated reactions of community individuals correlated with the daily time-average sound levels of the helicopter overflights.

The relationship between annoyance and DNL that has been determined by the scientific community and endorsed by many federal agencies, including the FAA, is shown in **Figure D-7.** Two lines in Figure D-7 represent two large sets of social/ attitudinal surveys: one for a curve fit of 161 data points compiled by an individual researcher, Ted Schultz, in 1978[8] and one for a curve fit of 400 data points (which include Schultz's 161 points) compiled in 1992 by the U.S. Air Force.[11] The agreement of these two curves simply means that when one combines the more recent studies with the early landmark surveys in 1978, the results of the early surveys (i.e., the quantified effect of noise on annoyance) are confirmed.

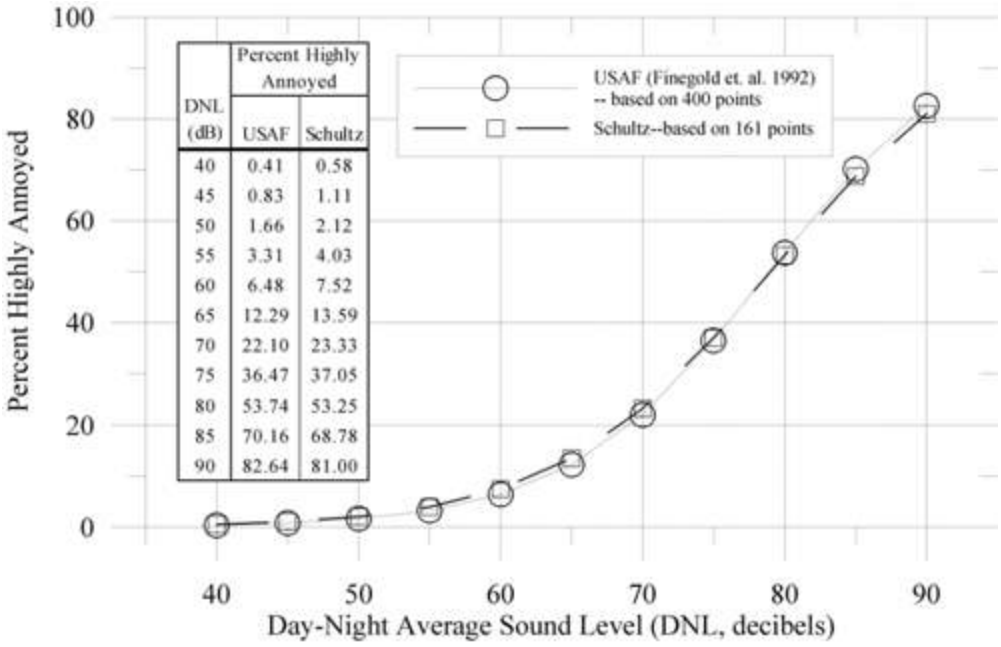
Figure D-7 shows the percentage of people "highly annoyed" by a given DNL. For example, the two curves in the figure yield a value of about 13% for the percentage of people that would be highly annoyed by a DNL exposure of 65 dB. The figure also shows that at very low values of DNL, such as 45 dB or less, 1% or less of the exposed

population would be highly annoyed. Furthermore, at very high values of DNL, such as 90 dB, more than 80% of the exposed population would be highly annoyed.

Recently, the use of DNL has been criticized as not accurately representing community annoyance and land-use compatibility with aircraft noise. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to "meaningless" time-average sound levels. In fact, a time-average noise metric, such as DNL, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

Figure D-7

Relationship Between Annoyance and Day-Night Average Sound Level



DNL (dB)	Percent Highly Annoyed	
	USAF	Schultz
40	0.41	0.58
45	0.83	1.11
50	1.66	2.12
55	3.31	4.03
60	6.48	7.52
65	12.29	13.59
70	22.10	23.33
75	36.47	37.05
80	53.74	53.25
85	70.16	68.78
90	82.64	81.00

Source: Federal Interagency Committee on Noise (FICON), "*Federal Agency Review of Selected Airport Noise Analysis Issues*", August 1992, p. 3-6, Figure 3.1

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime hours during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours 59 minutes and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.5 dB. As a second example, assume that 10 such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-average sound metric, and, specifically, the DNL.

It is often suggested that a lower DNL, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for FAA environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a DNL of 65 dB:

- Provides a valid basis for comparing and assessing community noise effects.
- Represents a noise exposure level that is normally dominated by aircraft noise and not other community or nearby highway noise sources.
- Reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.
- HUD also established a DNL standard of 65 dB for eligibility for federally guaranteed home loans.

D.2.2 Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation.

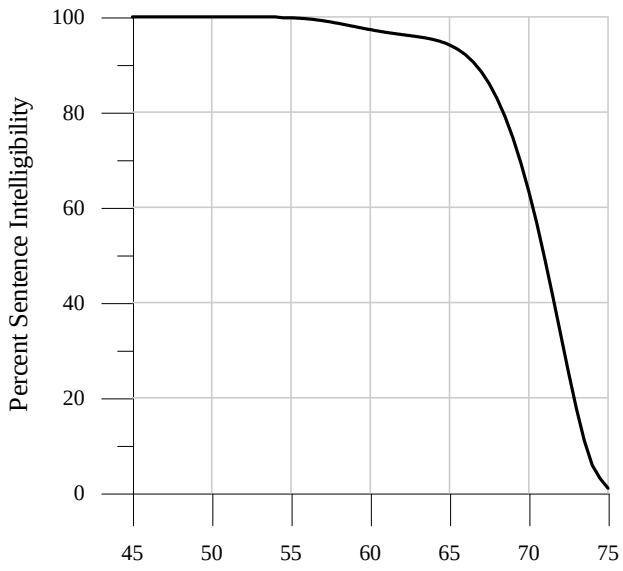
Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities, such as radio or television listening, telephone use or family conversation, causes frustration and aggravation. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication."[1]

Indoor speech interference can be expressed as a percentage of sentence intelligibility among two people speaking in relaxed conversation approximately one meter apart in a typical living room or bedroom.[1] The percentage of sentence intelligibility is a non-linear function of the (steady) indoor background sound level, as shown in **Figure D-8**. This curve was digitized and curve-fitted for the purposes of this document. Such a curve-fit yields 100 percent sentence intelligibility for background levels below 57 dB and yields less than 10 percent intelligibility for background levels above 73 dB. Note that the function is especially sensitive to changes in sound level between 65 dB and 75 dB. As an example of the sensitivity, a 1 dB increase in background sound level from 70 dB to 71 dB yields a 14 percent decrease in sentence intelligibility.

In the same document from which Figure D-8 was taken, the EPA established an indoor criterion of 45 dB DNL as requisite to protect against speech interference indoors.

Figure D-8

Percent Sentence Intelligibility



Source: EPA 1974

D.2.3 Sleep Disturbance

Sleep disturbance is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

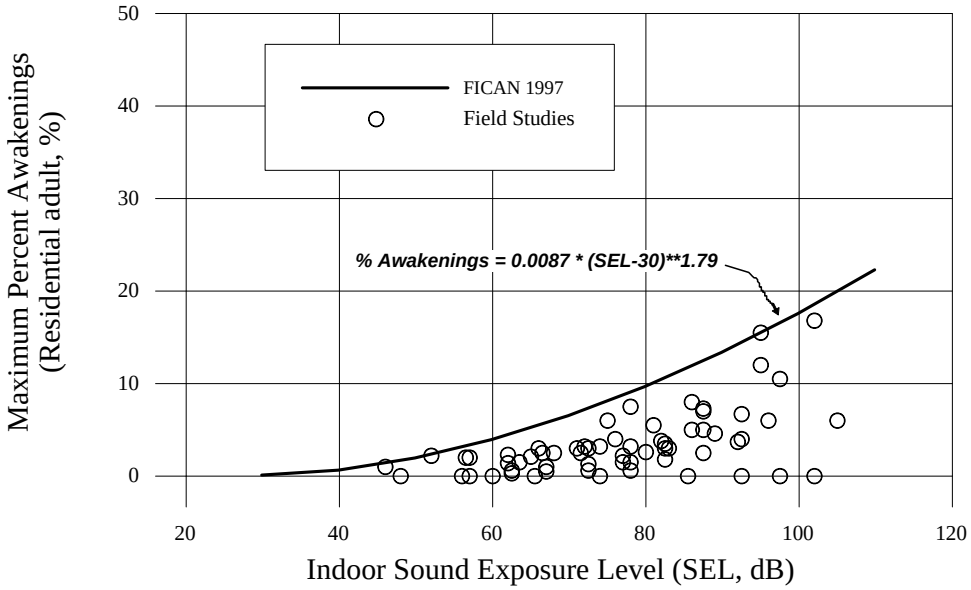
Sleep disturbance can be measured in one of two ways: "Arousal" represents awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without awakening. In general, arousal requires a higher noise level than does a change in sleep stage.

In terms of average daily noise levels, some guidance is available to judge sleep disturbance. The EPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference.[1]

In June 1997, the Federal Interagency Committee on Aviation Noise (FICAN) reviewed the sleep disturbance issue and presented a sleep disturbance dose-response prediction curve.[12] FICAN based their curve on data from field studies[13 14 15 16] and recommends the curve as the tool for analysis of potential sleep disturbance for residential areas. **Figure D-9** shows this curve which, for an indoor SEL of 60 dB, predicts that a maximum of approximately 5 percent of the residential population exposed are expected to be behaviorally awakened. FICAN cautions that this curve should only be applied to long-term adult residents.

Figure D-9

Sleep Disturbance Dose-Response Relationship



Source: FICAN, 1997

Endnotes

[1] U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety," Report 550/9-74-004, March 1974.

[2] "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise (FICUN), June 1980.

[3] "Federal Agency Review of Selected Airport Noise Analysis Issues," Federal Interagency Committee on Noise (FICON), August 1992.

[4] 14 CFR Part 150, Airport Noise Compatibility Planning, Amendment 150-3, Updated April 2012.

[5] FAA Order 1050.1E, Chg 1, Environmental Impacts: Policies and Procedures, Department of Transportation, Federal Aviation Administration, March 20, 2006.

[6] "Sound Level Descriptors for Determination of Compatible Land Use," American National Standards Institute Standard ANSI S3.23-1980.

[7] "Quantities and Procedures for Description and Measurement of Environmental Sound, Part I," American National Standards Institute Standard ANSI S21.9-1988.

[8] Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," *J. Acoust. Soc. Am.,* 64, 377-405, August 1978.

[9] Fidell, S., Barger, D.S., Schultz, T.J., "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise." J. Acoust. Soc. Am., 89, 221-233, January 1991.

[10] "Community Reactions to Helicopter Noise: Results from an Experimental Study," *J. Acoust. Soc. Am.,* 479-492, August 1987.

[11] Finegold, L.S., C.S. Harris, H.E. VonGierke., "Applied Acoustical Report: Criteria for Assessment of Noise Impacts on People." *J. Acoust. Soc. Am.,* June 1992.

[12] Federal Interagency Committee on Aviation Noise (FICAN), "Effects of Aviation Noise on Awakenings from Sleep," June 1997.

[13] Pearson, K.S., Barber, D.S., Tabachnick, B.G., "Analyses of the Predictability of Noise-Induced Sleep Disturbance," USAF Report HSD-TR-89-029, October 1989.

[14] Ollerhead, J.B., Jones, C.J., Cadous, R.E., Woodley, A., Atkinson, B.J., Horne, J.A., Pankhurst, F., Reyner, L, Hume, K.I., Van, F., Watson, A., Diamond, I.D., Egger, P., Holmes, D., McKean, J., "Report of a Field Study of Aircraft Noise and Sleep Disturbance." London Department of Safety, Environment, and Engineering, 1992.

[15] Fidell, S., Pearsons, K., Howe, R., Tabachnick, B., Silvati, L., Barber, D.S. "Noise-Induced Sleep Disturbance in Residential Settings," AL/OH-TR-1994-0131, Wright Patterson AFB, OH, Armstrong Laboratory, Occupational and Environmental Health Division, 1994.

[16] Fidell, S., Howe, R., Tabachnick, B., Pearsons, K., Sneddon, M., "Noise-Induced Sleep Disturbance in Residences Near Two Civil Airports," Langley Research Center, 1995.

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APPENDIX E

Record of Consultation

(will be provided in the Final NEM/NCP Update)

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