BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Baltimore/Washington International Thurgood Marshall Airport Part 150 Update

Prepared under Title 14 of the Code of Federal Regulations Part 150

Documentation of

2014 and 2019 Noise Exposure Maps

Submitted to:
Federal Aviation Administration
Washington Airport District Office
23723 Air Freight Lane
Dulles, VA 20166

Submitted by:
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P.O. Box 8766
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2014 Part 150 Update

June 2016

Baltimore/Washington International Thurgood Marshall Airport

Part 150 Update

2014 and 2019 Noise Exposure Maps

Prepared under Title 14 of the Code of Federal Regulations Part 150

June 2016
Revision of December 2014 Submission

Maryland Aviation Administration

P.O. Box 8766
Baltimore/Washington International Thurgood Marshall Airport, MD 21240

CERTIFICATION

COPY

This is to certify the following:

(1) The revised Noise Exposure Maps, and associated documentation Baltimore/Washington International Thurgood Marshall Airport submitted in this volume to the Federal Aviation Administration under Federal Aviation Regulations Part 150, Subpart B, Section 150.21, are true and complete under penalty of 18 U.S.C. 1001.

(2) Pursuant to Part 150, Subpart B, Section 150.21(b), all interested parties have been afforded adequate opportunity to submit their views, data, and comments concerning the correctness and adequacy of the draft noise exposure map, and of the descriptions of forecast aircraft operations.

(3) The "2014 Existing Condition Noise Exposure Map" (Figure 20 on page 89) accurately represents conditions for calendar year 2014.

(4) The "2019 Five-Year Forecast Condition Noise Exposure Map" (Figure 21 on page 91) accurately represents forecast conditions for calendar year 2019.

Note: This June 2016 volume includes revisions to the December 2014 submission based on comments that the FAA provided to MAA September 29, 2015. The revisions in response to FAA's comments provide clarifications and do not affect the noise contours, land use inventory or population estimates. Unrelated, MAA identified a few properties with different status and has updated the housing inventory.

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Title: Director Real Estate & Noise Abatement, MAA

Date: June 28, 2016

Airport Name: *Baltimore/Washington International Thurgood Marshall Airport*

Airport Owner/Operator: Maryland Aviation Administration

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1 INTRODUCTION

Title 14 of the Code of Federal Regulations (CFR) Part 150 "Airport Noise Compatibility Planning"[1] sets forth standards for airport operators to use in documenting noise exposure in the airport environs and for establishing programs to minimize noise-related land use incompatibilities. While participation in this program by an airport is voluntary, over 250 airports, including Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall), have participated in the program, which assists in standardizing noise analysis at a national level. A formal submission to the Federal Aviation Administration (FAA) under 14 CFR Part 150 includes two principal elements: (1) Noise Exposure Maps (NEMs) and (2) a Noise Compatibility Program (NCP). This document presents an updated NEM submission.

The Maryland Aviation Administration (MAA), the operator of BWI Marshall, completed its first 14 CFR Part 150 Study for BWI Marshall in 1989. The FAA completed its review of the submission, accepted the NEMs on November 30, 1989 and published a "Record of Approval" (ROA) for the NCP on June 21, 1990 (Appendix A). MAA updated the Noise Exposure Map in 1993; FAA accepted the NEMs on February 7, 1995.

The MAA completed the most recent 14 CFR Part 150 study for BWI Marshall in 2007 which included Day Night Average Sound Level (DNL) contours for a 2003 base case and a 2010 forecast. The study culminated in submission of two volumes of documentation to the FAA: (1) NEM documentation[2], and (2) a proposed update to the Noise Compatibility Program (NCP).[3] The FAA found the NEM in compliance with Part 150 requirements on April 3, 2006, and provided a Record of Approval (ROA) for the NCP on February 26, 2008.[4] (Appendix A) The ROA included approval of extending the Residential Property Acquisition and Homeowner Assistance programs to include residences between the 65 dB and 70 dB DNL contours. It also approved a modification of the Runway 15L/33R Noise Rule to use certification noise levels instead of values computed in the Integrated Noise Model (INM) and the addition of an operations and noise monitoring system to the NCP.

This volume presents the updated NEM documentation for Baltimore/Washington International Thurgood Marshall Airport, as required by the specific provisions of 14 CFR Part 150 Subpart B, Section 150.21, and Appendix A. The MAA is updating the NEM only at this time. This document presents noise contours, land use, and related documentation for 2014 existing conditions and 2019 forecast conditions. This volume presents:

- **the 2014 NEM as Figure 20 and**
- **the 2019 NEM as Figure 21.**

This June 2016 volume includes revisions to the December 2014 submission based on comments that the FAA provided to MAA September 2015. The revisions in response to FAA's comments provide clarifications and do not affect the noise contours, land use inventory or population estimates.

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[1] 14 CFR Part 150

[2] Maryland Aviation Administration, Baltimore/Washington International Thurgood Marshall Airport Part 150 Updated Noise Exposure Maps, December 2005.

[3] Maryland Aviation Administration, Baltimore/Washington International Thurgood Marshall Airport Part 150 Update Noise Compatibility Program Update, August 2007.

[4] http://www.faa.gov/airports/environmental/airport_noise/part_150/states/?state=Maryland

Unrelated, MAA identified a few properties with different status and has updated the housing inventory.

This chapter provides the purpose of this update (Section 1.1) a summary of properties eligible for noise mitigation or acquisition (Section 1.2); an introduction to 14 CFR Part 150 (Section 1.3); project roles and responsibilities (Section 1.4); and a completed copy of the FAA NEM review checklist (Section 1.5).

1.1 Purpose

The purpose and goals of this NEM update are to:

- Update the BWI Marshall NEM to reflect current implementation of the Noise Compatibility Program and to reflect current and forecasted aircraft operations at BWI Marshall
- Account for changes in the Airport layout between now and forecast year 2019.
- Collect, analyze and report information regarding current and forecasted operations as it relates to BWI Marshall aircraft noise and land use compatibility
- Continue implementation of the Noise Compatibility Program, in particular, the voluntary residential land acquisition program and sound insulation program
- Share data and information with the public

Chapter 2 of this document provides a reference to noise fundamentals and terminology.

1.2 Summary of Properties Potentially Eligible for Noise Mitigation or Acquisition

With this document, the MAA is providing supplemental information to insure that appropriate noise sensitive land uses are included in a program that will be approved by the FAA to reduce or eliminate conflicts between airport-generated noise and surrounding land uses. As identified by this update of the Noise Exposure Maps for BWI Marshall, there are two areas, as shown in Figure 22, which need consideration for eligibility. Table 1 and Table 2 present a list of the single-family units and multi-family units (respectively) that are potentially eligible for mitigation according to BWI Marshall's existing NCP, which is discussed in Chapter 3 of this document, and as shown on the 2019 NEM (Figure 21).

Note that these tables present the inventory of properties identified during the course of this study. These properties have not yet been examined fully for all eligibility requirements; that process will be done as property owners inquire about participating in the mitigation program. Properties in these lists are considered noise sensitive and incompatible with the 2019 forecast noise levels in the guidelines.

FAA funding guidelines have numerous eligibility requirements in addition to the location of the property with respect to the noise contours. Those requirements include, but are not limited:

- the date the structure was built (for example, many properties built after October 1998 would not be eligible);
- the use of particular rooms;
- status of the property title;

- local building code; and
- the existing acoustic properties of the building (for example, if a structure already sufficiently achieves an interior noise levels below 45 dB DNL, the building may not be eligible for further acoustic treatment/sound insulation).

These requirements are described in other FAA documents and are briefly discussed in Section 3.12 and Section 3.13. The details on the parameters for the eligibility requirements, and how those requirements will be applied around BWI Marshall, will be finalized in future documents (in particular, a sound insulation program plan) prepared by Maryland Aviation Administration and subject to FAA review and approval.

If additional noise sensitive properties are discovered within the noise contours at a later date, they would still be considered a candidate for mitigation.

Table 1 identifies 220 individual single family properties. Of the 220 properties, 23 are to the west of the Airport and are considered potentially eligible for acquisition.[5] To the southeast of the Airport, 27 properties are potentially eligible for acquisition and 170 are potentially eligible for sound insulation.[6] Figure 22 depicts these properties relative to the 2019 NEM contour.[7]

Table 2 identifies 488 units located in five multi-family complexes. All are to the southeast of the Airport and are potentially eligible for sound insulation. Figure 23 depicts these complexes relative to the 2019 NEM contour.

Additional residential properties, in addition to those listed in Table 1 and Table 2 and that are slightly outside the 65 dB DNL contours, could also be considered eligible for mitigation for the purposes of block rounding and neighborhood equity. Determination of eligibility in such cases is subject to the local FAA Airports Division Office approval.[8]

Table 3 identifies two public use facilities that MAA would like to discuss with the respective owners/operators and FAA for sound insulation mitigation evaluation. In this context, "Public Use" facility is the term used in 14 CFR Part 150 Table 1 (reproduced in this document as Table 5), to describe public assembly or gathering places. Properties in this category can be privately owned. Additional discussion regarding these two facilities is presented in Section 5.1 and 6.1.3. Figure 22 depicts these properties relative to the 2019 NEM contour.

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[5] Figure 22, Area 1.
[6] Figure 22, Area 2.
[7] Compared to the September 2014 Draft of this document, five properties have been reclassified.
Two properties have been added to the property inventory presented in Table 1
1258 STONEY RUN ROAD, HANOVER (added December 2014) and
7982 NOLCREST ROAD, GLEN BURNIE (added December 2014)
Three properties have been (reclassified from "Potentially Eligible for Mitigation" to "Previously Mitigated" in December 2015)
608 ELIZABETH ROAD, GLEN BURNIE
366 FLEAGLE ROAD, GLEN BURNIE
394 PHIRNE ROAD W, GLEN BURNIE

[8] FAA's current guidance, policy and procedures are documented in FAA Order 5100.38D, effective September 30, 2014. In particular, see sections C-5, R-9 and R-10.
http://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D.pdf

Table 1 Single-Family Units Potentially Eligible for Mitigation

Source HMMH, June 2016

Figure 22 Inset	Eligible Units	Location	Zoning[9]	Eligibility (subject to property and guideline verification)
1	**Hanover**			
	23	7200 BENTWOODS ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7201 BENTWOODS ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7205 LINDA AVE, HANOVER	Industrial Park District (W1)	Acquisition
		7210 LINDA AVE, HANOVER	Industrial Park District (W1)	Acquisition
		RACE ROAD, HANOVER Unnumbered – Anne Arundel County Tax Map 8, Grid 2, Parcel 06	Industrial Park District (W1)	Acquisition
		RACE ROAD, HANOVER Unnumbered – Anne Arundel County Tax Map 8, Grid 2, Parcel 76	Industrial Park District (W1)	Acquisition
		7292 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7294 RACE ROAD, HANOVER	Open Space District (OS)	Acquisition
		7296 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7298 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7311 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7320 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7321 RACE ROAD, HANOVER	Industrial Park District (W1B)	Acquisition
		7325 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7326 RACE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7215 RIDGE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7221 RIDGE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7234 RIDGE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		7346 RIDGE ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		1250 STONEY RUN ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		1258 STONEY RUN ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		1330 WEEPING WILLOW ROAD, HANOVER	Industrial Park District (W1)	Acquisition
		1339 WEEPING WILLOW ROAD, HANOVER	Industrial Park District (W1)	Acquisition
2	**Glen Burnie**			
	174	511 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		519 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		523 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		525 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		529 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		538 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		541 ARUNDEL AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		300 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		301 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		302 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		303 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		304 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		306 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation

[9] Zoning Use Key Definition from: http://www.aacounty.org/PlanZone/Zoning/ZoningClassifications.cfm#.VAYECvldWpc Accessed September 2014

Figure 22 Inset	Eligible Units	Location	Zoning[9]	Eligibility (subject to property and guideline verification)
		313 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		508 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		510 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		521 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		601 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		617 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		632 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		634 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		703 BAYLOR ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		422 BOUSCH PL, GLEN BURNIE	Residential (R5)	Sound Insulation
		506 BURTON ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		508 BURTON ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7892 CRAIN HWY S, GLEN BURNIE	Residential (R5)	Sound Insulation
		522 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		524 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		526 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		527 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		528 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		529 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		530 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		532 CRESTPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		363 DUBYA CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		530 ELIZABETH ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		617 ELIZABETH ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		613 EVERETT ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		360 FLEAGLE ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		370 FLEAGLE ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		375 FLEAGLE ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		377 FLEAGLE ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		385 JAYBEA CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		504 JOY CIR, GLEN BURNIE	Residential (R5)	Sound Insulation
		302 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		305 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		307 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		311 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		401 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		407 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		508 LUTHER ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		504 MARION ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		510 MARION ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		513 MARION ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		514 MARION ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		606 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		608 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		612 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		614 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		615 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		701 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		708 MARLBORO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation

Figure 22 Inset	Eligible Units	Location	Zoning[9]	Eligibility (subject to property and guideline verification)
		610 MARSHALL ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		614 MARSHALL ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		618 MARSHALL ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		706 MAYO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		708 MAYO ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		501 MCPHERSON AVE, GLEN BURNIE	Industrial Park District (W1)	Acquisition
		612 MINNERVA ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		613 MINNERVA ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		460 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		474 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		475 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		476 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		478 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		480 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7970 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7971 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7972 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7973 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7974 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7975 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7976 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7977 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7978 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7979 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7980 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7981 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7982 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7983 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7984 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7985 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7986 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7987 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7988 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7989 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7990 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7991 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7992 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7993 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7995 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7997 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		7998 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		8000 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		8005 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		8007 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		8009 NOLCREST ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		542 NOLFIELD DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		543 NOLFIELD DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		544 NOLFIELD DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		546 NOLFIELD DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		480 NOLPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		482 NOLPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation

Figure 22 Inset	Eligible Units	Location	Zoning[9]	Eligibility (subject to property and guideline verification)
		484 NOLPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		487 NOLPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		501 NOLPARK DR, GLEN BURNIE	Residential (R5)	Sound Insulation
		522 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		524 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		525 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		526 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		527 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		529 NOLWOOD CT, GLEN BURNIE	Residential (R5)	Sound Insulation
		358 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		381 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		385 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		391 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		393 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		397 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		401 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		407 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		410 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		417 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		419 PHIRNE ROAD W, GLEN BURNIE	Residential (R5)	Sound Insulation
		7961 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7963 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7965 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7967 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7969 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7971 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7973 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7975 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7977 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7979 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7981 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7983 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7985 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7990 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7992 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7994 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7996 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		7998 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8000 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8001 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8002 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8003 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8004 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8005 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8006 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8007 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8008 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8010 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8012 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8049 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8051 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation

Figure 22 Inset	Eligible Units	Location	Zoning[9]	Eligibility (subject to property and guideline verification)
		8053 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8055 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8057 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8058 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8059 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		8060 PHIRNE ROAD E, GLEN BURNIE	Residential (R5)	Sound Insulation
		216 RIDGELY ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		302 RIDGELY ROAD, GLEN BURNIE	Residential (R5)	Sound Insulation
		1226 WILSON ROAD, GLEN BURNIE	Industrial Park District (W1)	Acquisition
2	**Severn**			
	24	399 GAITHER ROAD, SEVERN	General Commercial Districts (C3)	Acquisition
		JONES RD, SEVERN* Unnumbered – Anne Arundel County Tax Map 15, Grid 3, Parcel 749	Industrial Park District (W1)	Acquisition
		507 JONES ROAD, SEVERN	Industrial Park District (W1)	Sound Insulation
		508 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		528 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		538 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		548 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		550 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		564 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		576 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		582 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		586 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		601 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		610 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		612 JONES ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		613 JONES ROAD, SEVERN	Residential (R2)	Sound Insulation
		617 JONES ROAD, SEVERN	Residential (R2)	Sound Insulation
		631 JONES ROAD, SEVERN	Residential (R2)	Sound Insulation
		442 QUEENSTOWN ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		482 QUEENSTOWN ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		504 QUEENSTOWN ROAD, SEVERN	Residential (R2)	Sound Insulation
		510 QUEENSTOWN ROAD, SEVERN	Residential (R2)	Sound Insulation
		534 QUEENSTOWN ROAD, SEVERN	Industrial Park District (W1)	Acquisition
		536 QUEENSTOWN ROAD, SEVERN	Industrial Park District (W1)	Acquisition

Table 2 Multi-Family Units Potentially Eligible for Mitigation

Source HMMH, September 2014

Figure 23 Inset #	Total Units in Complex	Estimated Units Within DNL 65 Contour[1]	Complex Name	Location	Eligibility (subject to property and guideline verification)
3	60	60	Severn Square Apartments[2]	Quarterfield Rd. Glen Burnie	Sound Insulation
1	519	32	Woodside Condos[3]	West Ct, Glen Burnie	Sound Insulation
2	192	84	Glen Mar Apartments[4]	469 Glen Mar Rd, Glen Burnie	Sound Insulation
2	204	204	Glenview Garden Apartments[5]	7987 Nolpark Ct, Glen Burnie	Sound Insulation
2	325	108	Village Square Apartments[6]	8096 Crainmont Dr., Glen Burnie	Sound Insulation

Notes and various websites assisted with the analysis

1 Estimates of multi-family units within the 2019 DNL 65 dB contour were made depending on the data available. Identification of individual buildings and number of units is presented in Figure 23.

2 http://aandgmanagement.com/apartments-for-rent/anne-arundel-county-md/severn-square/4/

3 Eight buildings of this complex, along West Ct., are in the 2019 DNL 65 dB contour.

4 http://morgan-properties.com/morganlocations/PropertyDetail.asp?propertyName=glenmar Includes buildings on both sides of Phirne Rd.

5 http://www.edgewoodmgmt.com/Property-Search.aspx

6 http://www.homeproperties.com/apartments/MD/Glen-Burnie/Village-Square/tabid/90/cid/201/maid/72/Default.aspx

Table 3 Public Use Facilities for Mitigation Evaluation

Source HMMH, September 2014

Figure 22 Inset #	Facility Name	Location	Eligibility (subject to property and guideline verification)
1	Open Door Baptist Church and Open Door Baptist School[1]	7300 Ridge Road Hanover, MD	Sound Insulation
2	Rippling Woods Elementary School[2]	530 Nolfield Drive Glen Burnie, MD	Sound Insulation

Notes

Various websites assisted with the analysis

1 http://opendoorchristianschool.us

Only the portions of this property used for educational uses could be eligible in accordance with BWI Marshall's existing NCP and FAA guidelines.

2 http://www.aacps.org/html/schol/elementary/rippwdes.asp

FAA notified MAA in September 2015 that an NCP update maybe required to mitigate these properties. Any potential mitigation would require further detailed evaluation of the property and would be subject to FAA guidelines.

1.3 14 CFR Part 150 Overview

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

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

1.3.1 Noise Exposure Map

The NEM documentation describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs and the resulting noise/land use compatibility situation. The aircraft noise exposure is expressed in decibels (dB) in terms of the Day-Night Average Sound Level (DNL). Contours of equal DNL values, similar to topographic contours of equal elevation, form the basis for evaluating the noise exposure to the community. The NEM must address two time frames: (1) data representing the year of submission (the "existing conditions") and (2) the fifth calendar year or later following the year of submission (the "forecast conditions"). The NEM also addresses how the forecast operations will affect the compatibility of the land uses depicted.

The primary objective is to describe the current and forecast conditions at the airport and the noise effects of the aircraft activity on the surrounding communities. 14 CFR Part 150 requires more than a simple "map" to provide all the necessary information. The information required to provide the graphics and background for analysis include such tasks as:

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

In addition to the graphics, an extensive effort is made to document, through tabulated information and text discussions, the noise environment due to aircraft activity at the airport now and in the future. Therefore, the NEM documentation describes the data collection and analysis undertaken in development and graphic depiction of existing and future noise exposure resulting from aircraft operations and the land uses in the airport environs. During the process, the airport initiates and maintains contact with the local airport community to get the various perspectives on the modeling inputs. After considering all stakeholder and public comments, the airport sponsor submits the NEM

document to the FAA, and, subsequent to a thorough review, the FAA makes a determination of compliance with the 14 CFR Part 150 standards.

The year of submission for this update is 2014. Therefore, the existing conditions noise contours are for 2014 and the five-year forecast case contours are for 2019.

1.3.2 Noise Compatibility Program

The NCP is essentially a list of the actions the airport proprietor proposes to undertake to minimize existing and future noise/land use incompatibilities. 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.

Official FAA acceptance of the Part 150 submission and approval of the NCP does not eliminate requirements for formal environmental assessment of any proposed actions pursuant to requirements of the National Environmental Policy Act (NEPA). However, acceptance of the submission is a prerequisite to application for funding of implementation actions.

This Part 150 NEM Update includes a review of the status of the approved elements of the existing NCP at BWI Marshall in Chapter 3. No changes to the NCP are proposed in this document.

1.4 Project Roles and Responsibilities

Several groups were involved in the development of the NEM update, including the MAA, the Part 150 Update Community Advisory Committee, and the FAA.

1.4.1 Maryland Aviation Administration (MAA)

As the "airport operator", the MAA has authority over all Part 150 related actions at BWI Marshall. The MAA is responsible for preparation of the NEM. The MAA retained a team of consultants to conduct the technical work required to fulfill the NEM analysis and documentation requirements and to assist in public outreach and consultation.

This NEM update is one element of a contract between the MAA and the consulting firm of Harris Miller Miller & Hanson Inc. (HMMH). HMMH has overall project management responsibility for the NEM update, including all technical aspects of the study and assistance with land-use and public outreach. HMMH has contracted with Straughan Environmental Services as a subcontractor to provide public involvement, land use verification and other assistance on the project.

1.4.2 Part 150 Update Community Advisory Committee

The Community Advisory Committee includes representatives from a broad spectrum of entities with interest in the Part 150 Update process and its products. These entities include government agencies with aviation and land use responsibilities, private sector interests, particularly in the aviation industry, and representatives of the affected communities in the Airport's environs.

The Community Advisory Committee members are responsible for representing their constituents throughout the study process, including commenting on the adequacy and accuracy of collected data, simplifying assumptions, and technical analyses. The Community Advisory Committee also serves

as a forum for the varied interest groups to discuss complex issues and share their differing perspectives on aircraft noise issues.

Comprehensive documentation on the Advisory Committee and all other public participation elements of the Update Study is provided in Chapter 7 of this document.

1.4.3 Federal Aviation Administration

For a NEM update, FAA responsibility includes a review of the submission to determine that the technical work, consultation and documentation comply with Part 150 requirements. Their review encompasses all details of technical documentation. FAA involvement includes participation by staff from several agency offices.

On a regional level, the FAA's **Washington Airports District Office (ADO)** also has a major role. When the MAA submits the NEM to the FAA for review, the **Airports Division** will review the Noise Exposure Maps for compliance with Part 150, notify the MAA of their determinations, publish related notices in the Federal Register, and provide opportunity for public comment.

1.5 FAA Noise Exposure Map Checklist

The FAA has developed checklists for their internal use in reviewing NEM submissions. The FAA prefers that the Noise Exposure Map documentation include copies of the checklists. Table 4 presents a completed copy of the NEM checklist.

Table 4 14 CFR Part 150 Noise Exposure Map Checklist

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

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Baltimore/Washington International Thurgood Marshall Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
I. Submitting and Identifying the NEM:			
A. Submission properly identified:			
1. 14 C.F.R. Part 150 NEM?	Yes		Submittal letter, Chapter 1
2. NEM and NCP together?		No	N/A, Only NEM update
3. Revision to NEMs FAA previously determined to be in compliance with Part 150?	Yes		Section 1.1
B. Airport and Airport Operator's name are identified?	Yes		Certification Section 1.4.1
C. NCP is transmitted by operator's dated cover letter, describing it as a Part 150 submittal and requesting appropriate FAA determination?	Yes		Submittal Letter
II. Consultation: [150.21(b), A150.105(a)]			
A. Is there a narrative description of the consultation accomplished, including opportunities for public review and comment during map development?	Yes		Chapter 7
B. Identification of consulted parties:			
1. Are the consulted parties identified?	Yes		Chapter 7
2. Do they include all those required by 150.21(b) and A150.105 (a)?	Yes		Chapter 7

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Baltimore/Washington International Thurgood Marshall Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
3. Agencies in 2., above, correspond to those indicated on the NEM?	Yes		Chapter 7
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)?	Yes		Certification Chapter 7
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?	Yes		Chapter 7 Appendix G
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)?	Yes		Figure 20 and Figure 21
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?	Yes		Figure 20, Submittal letter
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?	Yes		Figure 21, Submittal letter
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?	N/A		This is only an NEM document. Maps reflect implementation of the previously approved NCP as discussed in Chapter 3.
2. If the forecast year map is based on program implementation:	N/A		
a. Are the specific program measures that are reflected on the map identified?	N/A		
b. Does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	N/A		
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)]			

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Baltimore/Washington International Thurgood Marshall Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
A. Are the maps of sufficient scale to be clear and readable (they must be not be less than 1" to 2,000'), and is the scale indicated on the maps? (Note (1) if the submittal uses separate graphics to depict flight tracks and/or noise monitoring sites, these must be of the same scale, because they are part of the documentation required for NEMs.) (Note (2) supplemental graphics that are not required by the regulation do not need to be at the 1" to 2,000' scale)	Yes		Figure 14, Sheet 1 and 2, Figure 19, Sheet 1 and 2, Figure 20 and Figure 21 are provided at 1" to 2,000' (printing instructions are provided for readers of the electronic version of this document)
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)	Yes		All Figures
C. Depiction of the airport and its environs.	Yes		
1. Is the following graphically depicted to scale on both the existing condition and forecast year maps:			
a. Airport boundaries	Yes		All official figures
b. Runway configurations with runway end numbers	Yes		
2. Does the depiction of the off-airport data include?			
a. A land use base map depicting streets and other identifiable geographic features	Yes		All official figures. Anne Arundel County and Howard County are the land use control authority within, or close to, the DNL 65 dB contours. Note: Maryland land-use enabling statutes grant planning and land use control authority to counties, the independent City of Baltimore, and to certain, incorporated municipalities lying within a county. There are no incorporated towns or cities within Baltimore County or Howard County. The City of Annapolis and the Town of Highland Beach lie within Anne Arundel County; however, neither lie within the 65 dB DNL contour.
b. The area within the DNL 65 dB (or beyond, at local discretion)	Yes		
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)	Yes		
D. 1. Continuous contours for at least DNL 65, 70, and 75 dB?	Yes		All contour figures
2. Has the local land use jurisdiction(s) adopted a lower local standard and, if so, has the sponsor depicted this on the NEMs?	No		MAA uses 14 CFR Part 150 land use compatibility guidelines for the development of the NEM. Section 2.4
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?	Yes		Section 4.2.2
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?	Yes		Section 4.2.5. Figure 14, Sheet 1 and 2 and Figure 19, Sheet 1 and 2 provide a representative sample of the model tracks. All flight tracks are available in Appendix D.
F. Locations of any noise monitoring sites (these may be on supplemental graphics which must use the same land use base map and scale as the official NEMs)	NA		No monitoring data used
G. Noncompatible land use identification:			

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Baltimore/Washington International Thurgood Marshall Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
1. Are noncompatible land uses within at least the DNL 65 dB noise contour depicted on the map graphics?	Yes		Chapter 5, Figure 20, Figure 21
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.)	Yes		
3. Are the noncompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	Yes		
4. Are compatible land uses, which would normally be considered noncompatible, explained in the accompanying narrative?	Yes		Chapter 5
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?	Yes		Section 4.2 presents current and forecast operational data and other modeling inputs.
2. Are the underlying technical data and planning assumptions reasonable?	Yes		Section 4.2 presents current and forecast operational data and other modeling inputs.
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	Yes		Section 4.2
a. Is it FAA approved?	Yes		Section 4.2 INM v7.0d was used for all modeling, the most current INM version at the time of this Part 150 Update was prepared
b. Was the same model used for both maps? (Note: The same model also must be used for NCP submittals associates with NEM determinations already issued by FAA where the NCP is submitted later, unless the airport sponsor submits a combined NEM/NCP submittal as a replacement, in which case the model used must be the most recent version at the time the update was started.)	Yes		
c. Has AEE approval been obtained for use of a model other than those that have previous blanket FAA approval?	N/A		
2. Correct use of noise models:			
a. Does the documentation indicate, or is there evidence, the airport operator (or its consultant) has adjusted or calibrated FAA-approved noise models or substituted one aircraft type for another that was not included on the FAA's pre-approved list of aircraft substitutions?	Yes		No Calibration. Substitutions are documented in Section 4.2.3 and FAA correspondence and approval in Appendix C
b. If so, does this have written approval from AEE, and is that written approval included in the submitted document?	Yes		
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?	N/A		No monitoring data used.

14 CFR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Baltimore/Washington International Thurgood Marshall Airport	**REVIEWER:**		
	Yes	**No**	**Supporting Pages/Review Comments**
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?	Yes		Section 5.1, Table 15, Table 16 and Table 17
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	Yes		Section 2.4
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 are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?	Yes		Chapter 5, Section 6.1 and Figure 22
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?	Yes		Chapter 5
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?	Yes		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. Section 1001?	Yes		

2 INTRODUCTION TO NOISE TERMINOLOGY AND EVALUATION

Noise is a complex physical quantity. The properties, measurement, and presentation of noise involve specialized terminology that can be difficult to understand. Throughout the Part 150 Update, we will use graphics and everyday comparisons to communicate noise-related quantities and effects in reasonably simple terms.

To provide a basic reference on these technical issues, this chapter introduces fundamentals of noise terminology (Section 2.1), the effects of noise on human activity (Section 2.2), weather and distance effects (Section 2.3), and Part 150 noise-land use compatibility guidelines (Section 2.4).

2.1 Introduction to Noise Terminology

Part 150 relies largely on a measure of cumulative noise exposure over an entire 12 month period, in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not provide an adequate description of noise for many purposes. A variety of other measures are available to address essentially any issue of concern, including:

- Sound Pressure Level, SPL, and the Decibel, dB
- A-Weighted Decibel, dBA
- Maximum A-Weighted Sound Level, L_{max}
- Sound Exposure Level, SEL
- Equivalent A-Weighted Sound Level, L_{eq}
- Day-Night Average Sound Level, DNL

2.1.1 Sound Pressure Level, SPL, and the Decibel, dB

All sounds come from a sound source – a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source travels through the air in sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. The ear senses these pressure variations and – with much processing in our brain – translates them into "sound."

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we can hear without pain contain about one million times more energy than the quietest sounds we can detect. To allow us to perceive sound over this very wide range, our ear/brain "auditory system" compresses our response in a complex manner, represented by a term called sound pressure level (SPL), which we express in units called decibels (dB).

Mathematically, SPL is a logarithmic quantity based on the ratio of two sound pressures, the numerator being the pressure of the sound source of interest (P_{source}), and the denominator being a reference pressure ($P_{reference}$)[10]

[10] The reference pressure is approximately the quietest sound that a healthy young adult can hear.

$$Sound\ Pressure\ Level\ (SPL) = 20 * Log\left(\frac{P_{source}}{P_{reference}}\right) dB$$

The logarithmic conversion of sound pressure to SPL means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels from about 40 to 100 dB.[11]

Because decibels are logarithmic quantities, we cannot use common arithmetic to combine them. For example, if two sound sources each produce 100 dB operating individually, when they operate simultaneously they produce 103 dB -- not the 200 dB we might expect. Increasing to four equal sources operating simultaneously will add another three decibels of noise, resulting in a total SPL of 106 dB. *For every doubling of the number of equal sources, the SPL goes up another three decibels.*

If one noise source is much louder than another is, the louder source "masks" the quieter one and the two sources together produce virtually the same SPL as the louder source alone. For example, a 100 dB and 80 dB sources produce approximately 100 dB of noise when operating together.

Two useful "rules of thumb" related to SPL are worth noting: (1) humans generally perceive a six to 10 dB increase in SPL to be about a doubling of loudness,[12] and (2) changes in SPL of less than about three decibels are not readily detectable outside of a laboratory environment.

2.1.2 A-Weighted Decibel

An important characteristic of sound is its frequency, or "pitch." This is the per-second oscillation rate of the sound pressure variation at our ear, expressed in units known as Hertz (Hz).

When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to consider the "low," "medium," and "high" frequency components. This breakdown is important for two reasons:

- Our ear is better equipped to hear mid and high frequencies and is least sensitive to lower frequencies. Thus, we find mid- and high-frequency noise more annoying.
- Engineering solutions to noise problems differ with frequency content. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low of about 20 Hz to a high of about 10,000 to 15,000 Hz. Most people respond to sound most readily when the predominant frequency is in the range of normal conversation – typically around 1,000 to 2,000 Hz. The acoustical community has defined several "filters," which approximate this sensitivity of our ear and thus, help us to judge the relative loudness of various sounds made up of many different frequencies.

[11] The logarithmic ratio used in its calculation means that SPL changes relatively quickly at low sound pressures and more slowly at high pressures. This relationship matches human detection of changes in pressure. We are much more sensitive to changes in level when the SPL is low (for example, hearing a baby crying in a distant bedroom), than we are to changes in level when the SPL is high (for example, when listening to highly amplified music).

[12] A "10 dB per doubling" rule of thumb is the most often used approximation.

The so-called "A" filter ("A weighting") generally does the best job of matching human response to most environmental noise sources, including natural sounds and sound from common transportation sources. "A-weighted decibels" are abbreviated "dBA." Because of the correlation with our hearing, the U. S. Environmental Protection Agency (EPA) and nearly every other federal and state agency have adopted A-weighted decibels as the metric for use in describing environmental and transportation noise. Figure 1 depicts A-weighting adjustments to sound from approximately 20 Hz to 10,000 Hz.

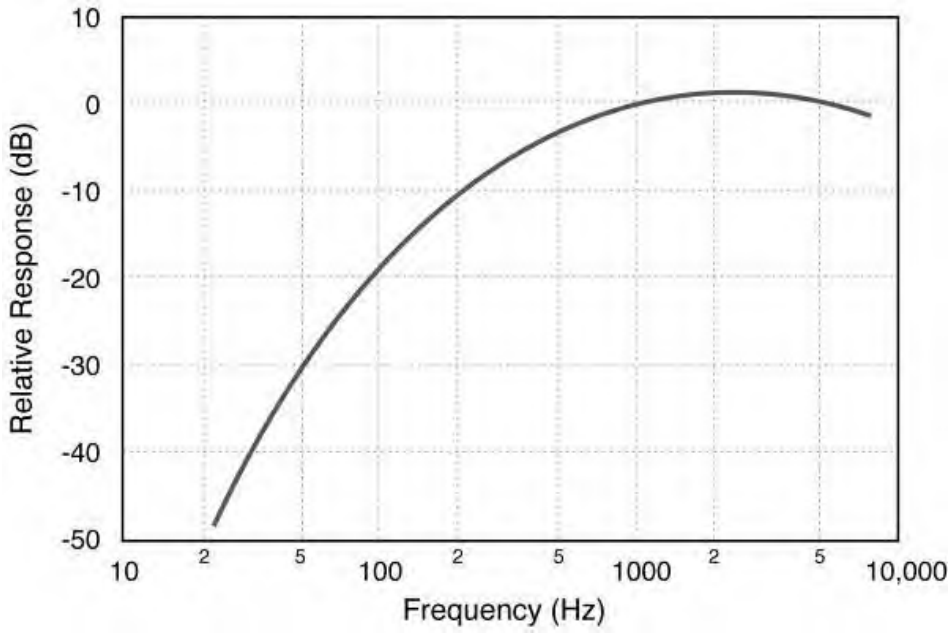


Figure 1 A-Weighting Frequency-Response
Source: Extract from Harris, Cyril M., Editor; "Handbook of Acoustical Measurements and Noise Control," McGraw-Hill, Inc., 1991, pg. 5.13, HMMH

As the figure shows, A-weighting significantly de-emphasizes noise content at lower and higher frequencies where we do not hear as well, and has little effect, or is nearly "flat," in for mid-range frequencies between 1,000 and 5,000 Hz.

All sound pressure levels presented in this document are A-weighted unless otherwise specified.

Figure 2 depicts representative A-weighted sound levels for a variety of common sounds.

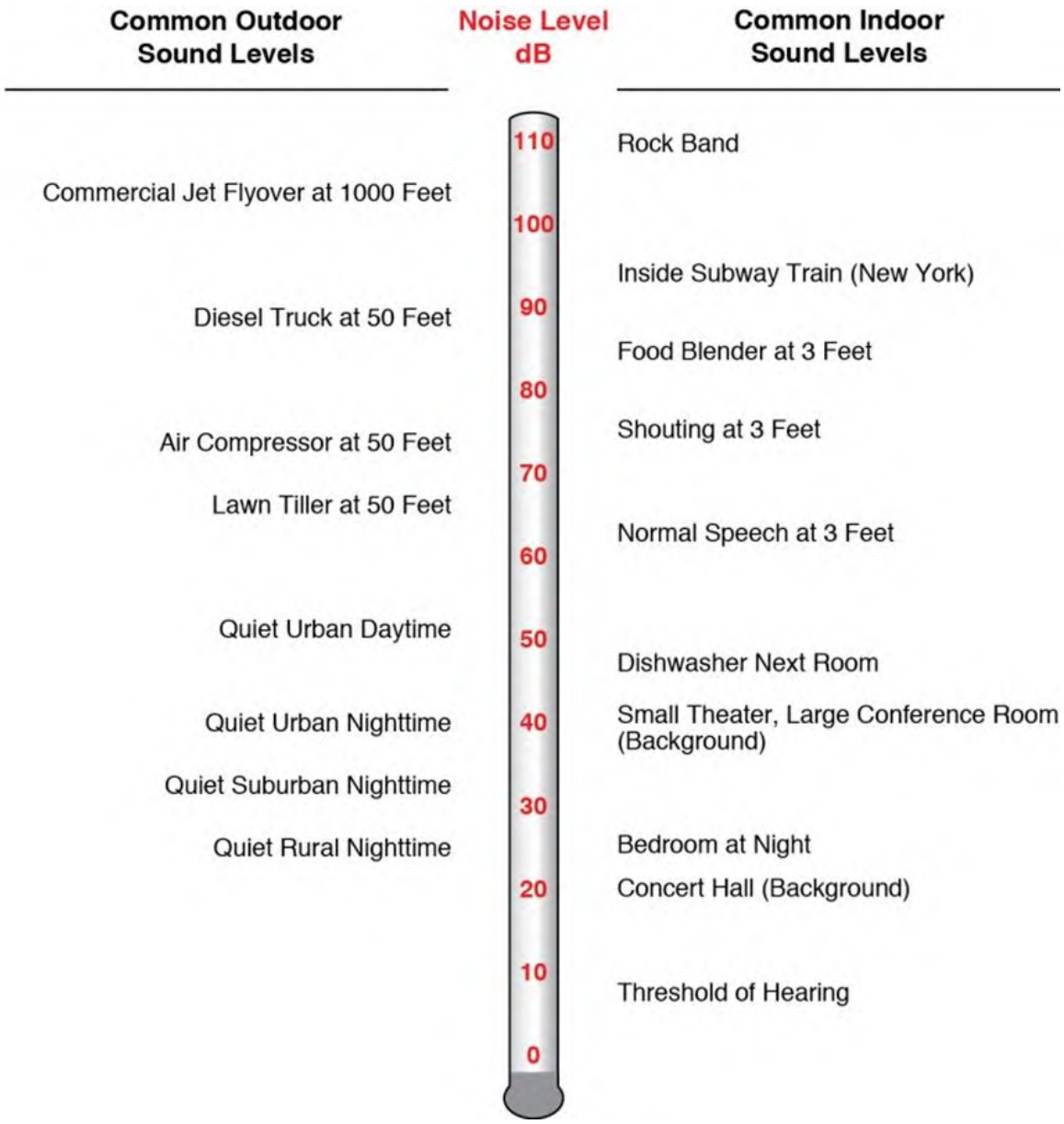


Figure 2 A-Weighted Sound Levels for Common Sounds
Source: HMMH

2.1.3 Maximum A-Weighted Sound Level, L_{max}

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as a car or aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance. The background or "ambient" level continues to vary in the absence of a distinctive source, for example due to birds chirping, insects buzzing, leaves rustling, etc. It is often convenient to describe a particular noise "event" (such as a vehicle passing by, a dog barking, etc.) by its maximum sound level, abbreviated as L_{max}.

Figure 3 depicts this general concept, for a hypothetical noise event with an L_{max} of approximately 102 dB.

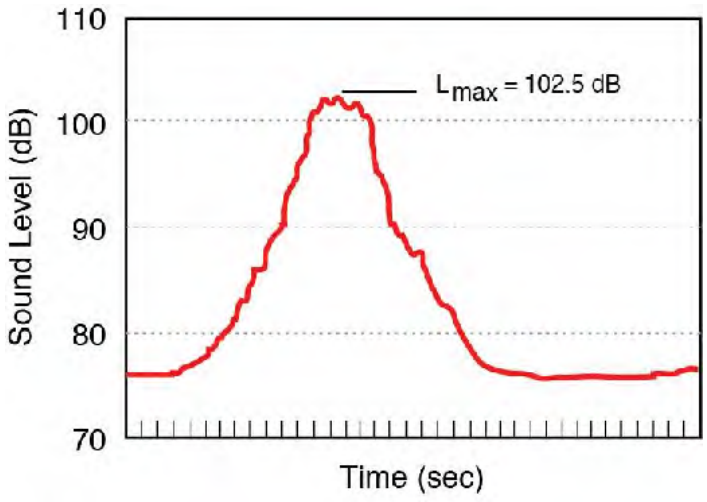


Figure 3 Variation in A-Weighted Sound Level over Time and Maximum Noise Level
Source: HMMH

While the maximum level is easy to understand, it suffers from a serious drawback when used to describe the relative "noisiness" of an event such as an aircraft flyover; i.e., it describes only one dimension of the event and provides no information on the event's overall, or cumulative, noise exposure. In fact, two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next section introduces a measure that accounts for this concept of a noise "dose," or the cumulative exposure associated with an individual "noise event" such as an aircraft flyover.

2.1.4 Sound Exposure Level, SEL

The most commonly used measure of cumulative noise exposure for an individual noise event, such as an aircraft flyover, is the Sound Exposure Level, or SEL. SEL is a summation of the A-weighted sound energy over the entire duration of a noise event. SEL expresses the accumulated energy in terms of the one-second-long steady-state sound level that would contain the same amount of energy as the actual time-varying level.

SEL provides a basis for comparing noise events that generally match our impression of their overall "noisiness," including the effects of both duration and level. The higher the SEL, the more annoying a noise event is likely to be. In simple terms, SEL "compresses" the energy for the noise event into a single second. Figure 4 depicts this compression, for the same hypothetical event shown in Figure 3. Note that the SEL is higher than the L_{max}.

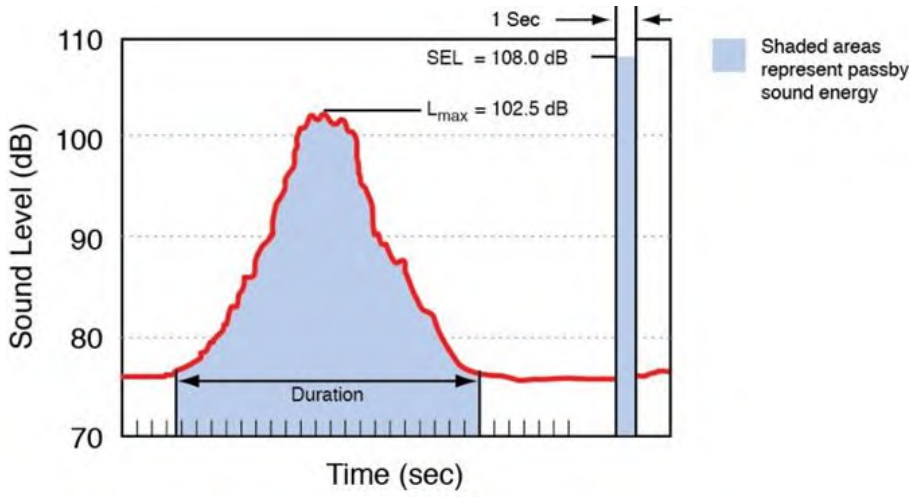


Figure 4 Graphical Depiction of Sound Exposure Level
Source: HMMH

The "compression " of energy into one second means that a given noise event's SEL will almost always will be a higher value than its L_{max}. For most aircraft flyovers, SEL is roughly five to 12 dB higher than L_{max}. Adjustment for duration means that relatively slow and quiet propeller aircraft can have the same or higher SEL than faster, louder jets, which produce shorter duration events.

2.1.5 Equivalent A-Weighted Sound Level, L_{eq}

The Equivalent Sound Level, abbreviated L_{eq}, is a measure of the exposure resulting from the accumulation of sound levels over a particular period of interest; e.g., one hour, an eight-hour school day, nighttime, or a full 24-hour day. L_{eq} plots for consecutive hours can help illustrate how the noise dose rises and falls over a day or how a few loud aircraft significantly affect some hours.

L_{eq} may be thought of as the constant sound level over the period of interest that would contain as much sound energy as the actual varying level. It is a way of assigning a single number to a time-varying sound level. Figure 5 illustrates this concept for a one-hour period. Note that the L_{eq} is lower than either the L_{max} or SEL.

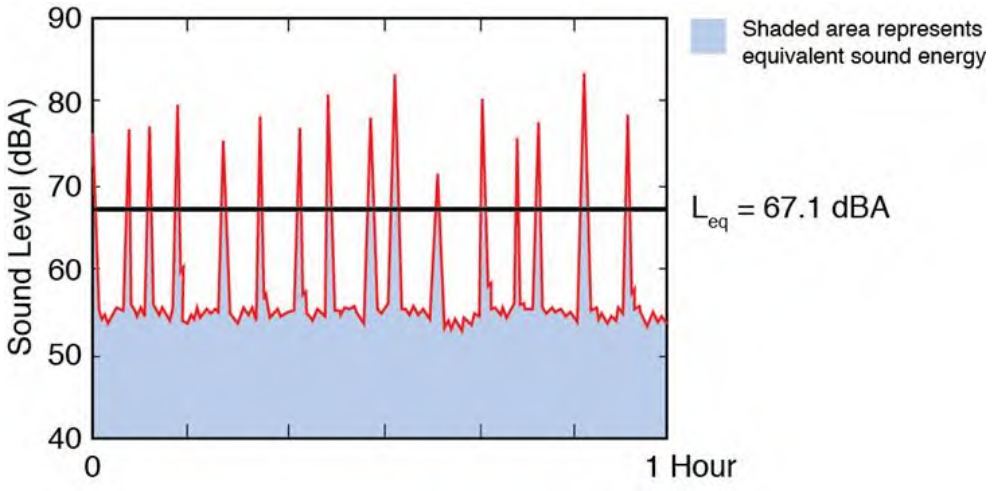


Figure 5 Example of a One Hour Equivalent Sound Level
Source: HMMH

2.1.6 Day-Night Average Sound Level, DNL or L_{dn}

Part 150 requires that airports use a measure of noise exposure that is slightly more complicated than L_{eq} to describe cumulative noise exposure – the Day-Night Average Sound Level, DNL.

The U.S. Environmental Protection Agency identified DNL as the most appropriate means of evaluating airport noise based on the following considerations.[13]

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.
- The measure should correlate well with known effects of the noise environment and on individuals and the public.
- The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
- The required measurement equipment, with standard characteristics, should be commercially available.
- The measure should be closely related to existing methods currently in use.
- The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated; "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

In simple terms, DNL is the 24-hour L_{eq} with one adjustment; all noises occurring at night (defined as 10 p.m. through 7 a.m.) are increased by 10 dB, to reflect the added intrusiveness of nighttime noise events when background noise levels decrease. In calculating aircraft exposure, this 10 dB "penalty" is mathematically identical to counting each nighttime aircraft noise event ten times.

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short periods. Most airport noise studies use computer-generated DNL estimates depicted as equal-exposure noise contours (much as topographic maps have contours of equal elevation). Part 150 *requires* that airports use computer-generated contours, as discussed in Section 4.3.

More specifically, Part 150 requires that Noise Exposure Maps depict the 65, 70, and 75 dB DNL contours for total annual operations for the existing and forecast conditions cases (2014 and 2019 in this study). The annual DNL is mathematically identical to the DNL for the average annual day; i.e., a day on which the number of operations is equal to the annual total divided by 365 (366 in a leap year).

Figure 6 graphically depicts the manner in which the nighttime adjustment applies in calculating DNL. Each bar in the figure is a one-hour L_{eq}. The 10 dB penalty is added for hours between 10

[13] "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974.

p.m. and 7 a.m. Figure 7 presents representative outdoor DNL values measured at various U.S. locations.

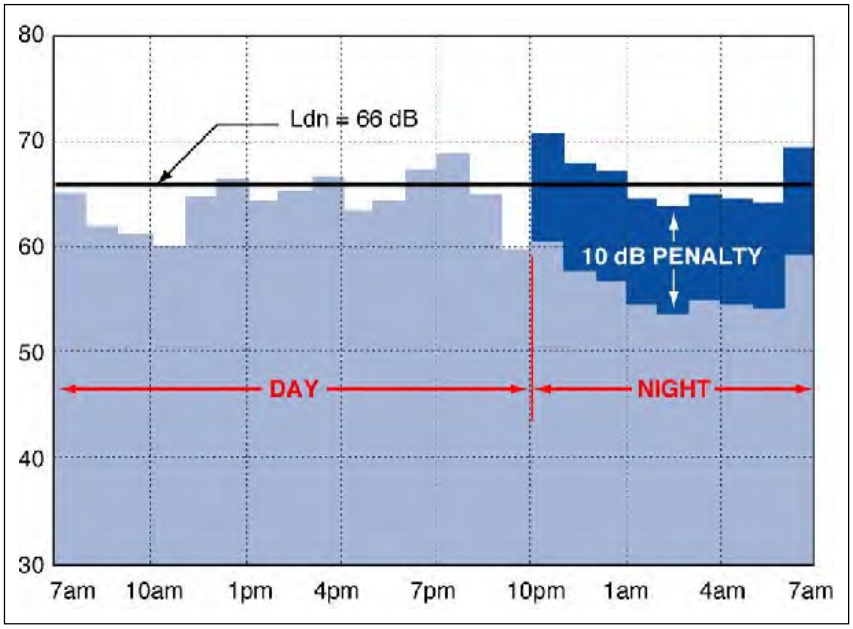


Figure 6 Example of a Day-Night Average Sound Level Calculation
Source: HMMH

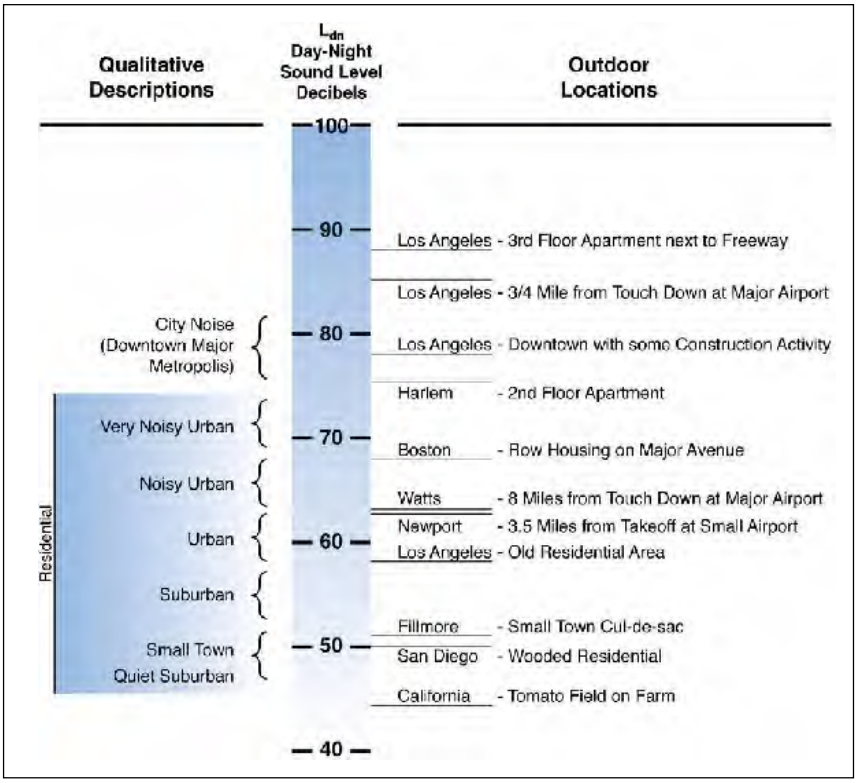


Figure 7 Examples of Measured Day-Night Average Sound Levels, DNL
Source: U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, p. 14.

2.2 Aircraft Noise Effects on Human Activity

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 helps in the understanding of how and why people react to their environment.

2.2.1 Speech Interference

One potential effect of aircraft noise is its tendency to "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech.

Figure 8 presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

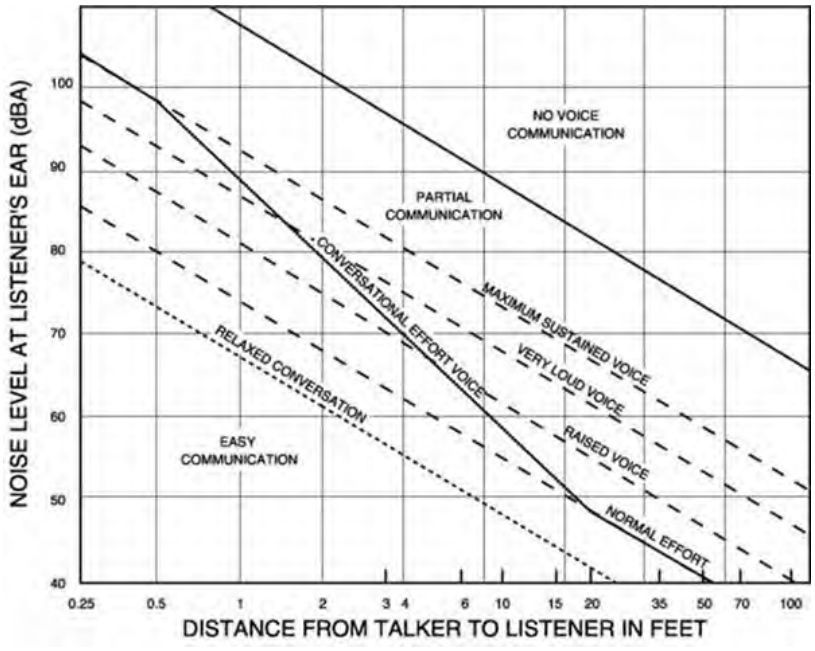


Figure 8 Outdoor Speech Intelligibility
Source: U.S. Environmental Protection Agency, "Public Health and Welfare Criteria for Noise". July, 1973. Pg. 6-5.

Satisfactory conversation does not always require hearing every word; 95% intelligibility is acceptable for many conversations. In relaxed conversation, however, we have higher expectations of hearing speech and generally require closer to 100% intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in the figure (which roughly represents the upper boundary of 100% intelligibility) represents an ideal environment for outdoor speech communication. Indoor communication is generally acceptable in this region as well.

One implication of the relationships in Figure 8 is that for typical communication distances of three or four feet, acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dB. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dB. With windows partly open, housing generally provides about 10 to 15 dB of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dB or less, there a reasonable chance that the resulting indoor sound level will afford acceptable interior conversation. With windows closed, 24 dB of attenuation is typical.

2.2.2 Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, (3) the tendency to awaken increases with age, and other factors. Figure 9 shows a recent summary of findings on the topic.

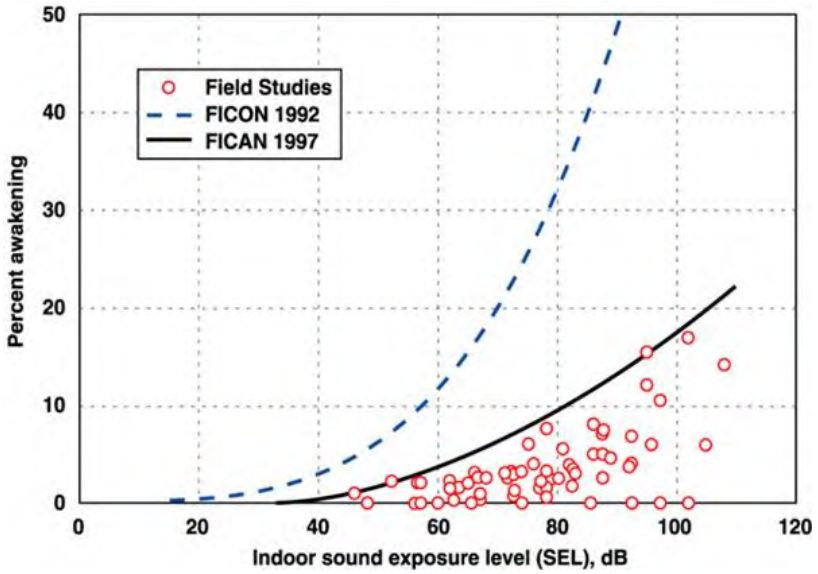


Figure 9 Sleep Interference

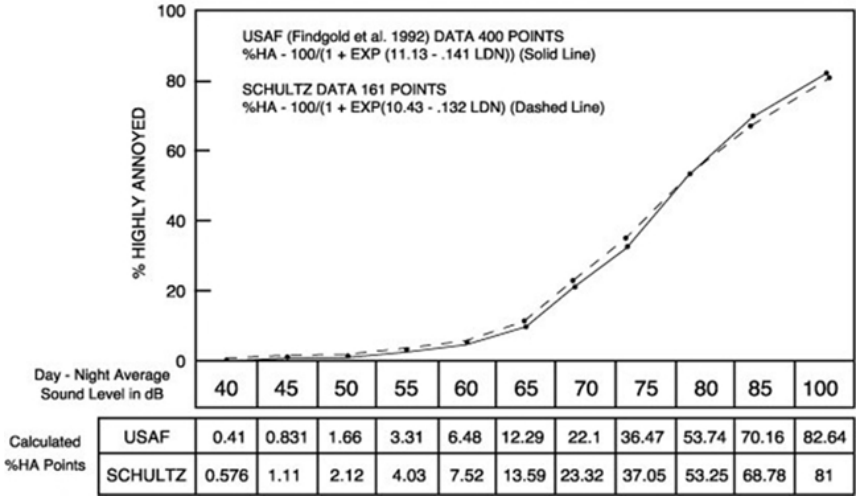
Source: Federal Interagency Committee on Aviation Noise (FICAN), "Effects of Aviation Noise on Awakenings from Sleep", June 1997, page 6.

Figure 9 uses indoor SEL as the measure of noise exposure; current research supports the use of this metric in assessing sleep disruption. An indoor SEL of 80 dBA results in a maximum of 10% awakening. Assuming the typical windows-open interior-to-exterior noise level reduction of approximately 12 dBA and a typical L_{max} value for an aircraft flyover 12 dBA lower than the SEL value, an interior SEL of 80 dBA roughly translates into an exterior L_{max} of the same value.[14]

[14] The awakening data presented in Figure 9 apply only to individual noise events. The American National Standards Institute (ANSI) has published a standard that provides a method for estimating the number of people awakened at least once from a full night of noise events: ANSI/ASA S12.9-2008 / Part 6, "Quantities and Procedures for Description and Measurement of Environmental Sound – Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes." This method can use the information on single events computed by a program such as the FAA's Integrated Noise Model, to compute awakenings.

2.2.3 Community Annoyance

Numerous psychoacoustic surveys provide substantial evidence that individual reactions to noise vary widely with noise exposure level. Since the early 1970s, researchers have determined (and subsequently confirmed) that aggregate community response is generally predictable and relates reasonably well to cumulative noise exposure metrics such as DNL. Figure 10 depicts the widely recognized relationship between environmental noise and the percentage of people "highly annoyed," with annoyance being the key indicator of community response usually cited in this body of research.



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

Figure 10 Percentage of People Highly Annoyed

Source: FICON. "Federal Agency Review of Selected Airport Noise Analysis Issues," September 1992.

Separate work by the EPA has shown that overall community reaction to a noise environment is also dependent on DNL. Figure 11 depicts this relationship.

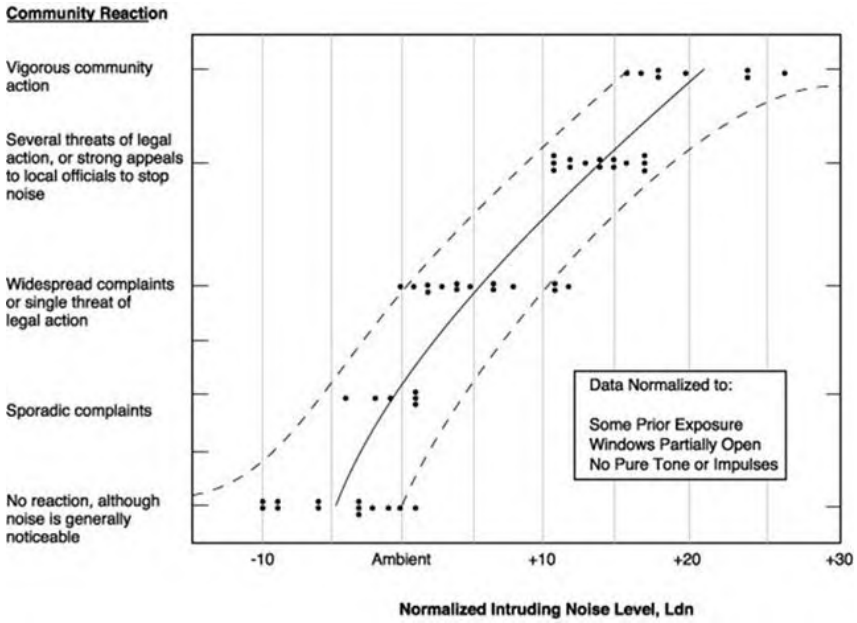


Figure 11 Community Reaction as a Function of Outdoor DNL

Source: Wyle Laboratories, "Community Noise," prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, page 63.

Data summarized in the figure suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when levels exceed the background by 20 dB.

2.3 Effects of Weather and Distance

Participants in airport noise studies often express interest in two sound-propagation issues: (1) weather and (2) source-to-listener distance.

2.3.1 Weather-Related Effects

Weather (or atmospheric) conditions that can influence the propagation of sound include humidity, precipitation, temperature, wind, and turbulence (or gustiness). The effect of wind – turbulence in particular – is generally more important than the effects of other factors. Under calm-wind conditions, the importance of temperature (in particular vertical "gradients") can increase, sometimes to very significant levels. Humidity generally has little significance relative to the other effects.

Influence of Humidity and Precipitation

Humidity and precipitation rarely effect sound propagation in a significant manner. Humidity can reduce propagation of high-frequency noise under calm-wind conditions. In very cold conditions, listeners often observe that aircraft sound "tinny," because the dry air increases the propagation of high-frequency sound. Rain, snow, and fog also have little, if any noticeable effect on sound propagation. A substantial body of empirical data supports these conclusions.[15]

Influence of Temperature

The velocity of sound in the atmosphere is dependent on the air temperature.[16] As a result, if the temperature varies at different heights above the ground, sound will travel in curved paths rather than straight lines. During the day, temperature normally decreases with increasing height. Under such "temperature lapse" conditions, the atmosphere refracts ("bends") sound waves upwards and an acoustical shadow zone may exist at some distance from the noise source.

Under some weather conditions, an upper level of warmer air may trap a lower layer of cool air. Such a "temperature inversion" is most common in the evening, at night, and early in the morning when heat absorbed by the ground during the day radiates into the atmosphere.[17] The effect of an inversion is just the opposite of lapse conditions. It causes sound propagating through the atmosphere to refract downward.

The downward refraction caused by temperature inversions often allows sound rays with originally upward-sloping paths to bypass obstructions and ground effects, increasing noise levels at greater

[15] Ingard, Uno. "A Review of the Influence of Meteorological Conditions on Sound Propagation," Journal of the Acoustical Society of America, Vol. 25, No. 3, May 1953, p. 407.
[16] In dry air, the approximate velocity of sound can be obtained from the relationship:
c = 331 + 0.6Tc (c in meters per second, Tc in degrees Celsius). Pierce, Allan D., Acoustics: An Introduction to its Physical Principles and Applications. McGraw-Hill. 1981. p. 29.
[17] Embleton, T.F.W., G.J. Thiessen, and J.E. Piercy, "Propagation in an inversion and reflections at the ground," Journal of the Acoustical Society of America, Vol. 59, No. 2, February 1976, p. 278.

distances. This type of effect is most prevalent at night, when temperature inversions are most common and when wind levels often are very low, limiting any confounding factors.[18] Under extreme conditions, one study found that noise from ground-borne aircraft might be amplified 15 to 20 dB by a temperature inversion. In a similar study, noise caused by an aircraft on the ground registered a higher level at an observer location 1.8 miles away than at a second observer location only 0.2 miles from the aircraft.[19]

Influence of Wind

Wind has a strong directional component that can lead to significant variation in propagation. In general, receivers that are downwind of a source will experience higher sound levels, and those that are upwind will experience lower sound levels. Wind perpendicular to the source-to-receiver path has no significant effect.

The refraction caused by wind direction and temperature gradients is additive.[20] One study suggests that for frequencies greater than 500 Hz, the combined effects of these two factors tends towards two extreme values: approximately 0 dB in conditions of downward refraction (temperature inversion or downwind propagation) and -20 dB in upward refraction conditions (temperature lapse or upwind propagation). At lower frequencies, the effects of refraction due to wind and temperature gradients are less pronounced.[21]

Wind turbulence (or "gustiness") can also affect sound propagation. Sound levels heard at remote receiver locations will fluctuate with gustiness. In addition, gustiness can cause considerable attenuation of sound due to effects of eddies traveling with the wind. Attenuation due to eddies is essentially the same in all directions, with or against the flow of the wind, and can mask the refractive effects discussed above.[22]

2.3.2 Distance-Related Effects

People often ask how distance from an aircraft to a listener affects sound levels. Changes in distance may be associated with varying terrain, offsets to the side of a flight path, or aircraft altitude. The answer is a bit complex, because distance affects the propagation of sound in several ways.

The principal effect results from the fact that any emitted sound decreases in level as the distance from the source increases. With each doubling of distance, spherical spreading reduces instantaneous or maximum level by approximately six decibels, and SEL by approximately three decibels.

"Atmospheric absorption" is a secondary effect. As an overall example, increasing the aircraft-to-listener distance from 2,000 feet to 3,000 feet could produce reductions of about four to five decibels

[18] Ingard, p. 407.
[19] Dickinson, P.J., "Temperature Inversion Effects on Aircraft Noise Propagation," (Letters to the Editor) Journal of Sound and Vibration. Vol. 47, No. 3, 1976, p. 442.
[20] Piercy and Embleton, p. 1412. Note, in addition, that as a result of the scalar nature of temperature and the vector nature of wind, the following is true: under lapse conditions, the refractive effects of wind and temperature add in the upwind direction and cancel each other in the downwind direction. Under inversion conditions, the opposite is true.
[21] Piercy and Embleton, p. 1413.
[22] Ingard, pp. 409-410.

for instantaneous or maximum levels, and of about two to four decibels for SEL, under average annual weather conditions. This absorption effect drops off relatively rapidly with distance. The Integrated Noise Model (INM) takes these reductions into account.

2.4 Noise / Land Use Compatibility Guidelines

DNL estimates have two principal uses in a Part 150 study:

1. Provide a basis for comparing existing noise conditions to the effects of noise abatement procedures and/or forecast changes in airport activity.

2. Provide a quantitative basis for identifying potential noise impacts.

Both of these functions require the application of objective criteria for evaluating noise impacts. 14 CFR Part 150 Appendix A provides land use compatibility guidelines as a function of DNL values. Table 5 reproduces those guidelines.

These guidelines represent a compilation of the results of extensive scientific research into noise-related activity interference and attitudinal response. However, reviewers should recognize the highly subjective nature of response to noise, and that special circumstances can affect individuals' tolerance. 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 traffic noise. Alternatively, residents of areas with unusually low background levels may find relatively low levels of aircraft noise annoying.

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

The cumulative nature of DNL means that the same level of noise exposure can be achieved in an essentially infinite number of ways. For example, a reduction in a small number of relatively noisy operations may be counterbalanced by a much greater 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.

With these cautions in mind, the Part 150 guidelines can be applied to the DNL contours to identify the potential types, degrees and locations of incompatibility. Measurement of the land areas involved can provide a quantitative measure of impact that allows a comparison of at least the gross effects of existing or forecast operations.

14 CFR Part 150 guidelines indicate that all uses normally are compatible with aircraft noise at exposure levels below 65 DNL. This limit is supported in a formal way by standards adopted by the U. S. Department of Housing and Urban Development (HUD). The HUD standards address whether sites are eligible for Federal funding support. These standards, set forth in Part 51 of the Code of Federal Regulations, define areas with DNL exposure not exceeding 65 dB as acceptable for funding. Areas exposed to noise levels between DNL 65 and 75 are "normally unacceptable," and require special abatement measures and review. Those at 75 and above are "unacceptable" except under very limited circumstances.

14 CFR Part 150 permits airports and local land use control jurisdictions to adopt land use compatibility criteria that differ from the guidelines reproduced in Table 5. MAA uses the FAA

guidelines as set forth in Part 150 for the determination of land use compatibility in BWI Marshall NEM development.[23]

Table 5 14 CFR Part 150 Noise / Land Use Compatibility Guidelines

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

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

Key to Table 5

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.

[23] There are Maryland state law and regulations related to zoning as discussed further in Section 3.11.

Notes for Table 5

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.

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

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

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

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

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

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30

(8) Residential buildings not permitted.

3 EXISTING NOISE COMPATIBILITY PROGRAM

BWI Marshall has an extensive Noise Abatement Plan (NAP) that the Airport and other MAA staff have developed over several decades, through extensive cooperative efforts with citizens and users. The Noise Compatibility Program (NCP) represents the portion of the NAP that has received FAA approval and therefore can be considered for federal grants. While operational measures receive the most public attention, the program is well rounded, and includes complementary compatible land use measures and "continuing program" measures that focus on program implementation, communication, monitoring, and updating. The cooperative Airport, citizen, and user effort has been, and will continue to be, the key to the success of the noise abatement program. Citizens provide critical input related to the identification of needs and program effectiveness. Users provide critical input related to the development, communication, and implementation of practical measures.

Appendix A presents a copy of the FAA's 1990 "Record of Approval" (1990 ROA) on the NCP submission that the MAA made to the FAA in 1989. Appendix A also provides a copy of the FAA's 2008 ROA, dated February 26, 2008, on four revisions to the NCP that were included in the NEM update, dated April 3, 2006. The 1990 ROA summarized the recommended eleven operational elements and four land use elements. Some of these elements were new, some proposed continuation of existing elements, and some proposed revision of existing elements. The FAA 2008 ROA revised one operational element, two land use elements, and added a program element with regard to updating the noise monitoring system. This section summarizes the approved NCP elements and their current implementation status.

MAA does not propose changes to any of the existing measures. Each heading indicates the element item, as defined in the FAA's 1990 ROA and noted with applicable modifications from the 2008 ROA. Only approved and/or implemented NCP elements are discussed here. The only element added by the 2008 ROA is at the end of the list.

3.1 Jet aircraft VFR approaches (1990 ROA Element 1)

As a voluntary measure, all jet aircraft conducting VFR approaches will turn onto final approach a minimum of four miles from the end of the runway, when weather and air traffic permit.

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers are requested to recommend these procedures to pilots.

3.2 Turbojet aircraft visual approaches (1990 ROA Element 3)

All turbojet aircraft conducting visual approaches are expected to maintain 3,000 feet or above until 10 DME from the BWI VOR and, to the maximum extent possible, should remain at or above the Instrument Landing System (ILS) or Visual Approach Slope Indicator (VASI), consistent with safe flight procedures.

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers are requested to recommend these procedures to pilots.

3.3 Departure Procedures (1990 ROA Element 5)

The work of MAA and the FAA after the 1990 NCP created several revised departure paths for various runways. Section 3.3.1 presents the departure paths for those aircraft equipped with Distance Measuring Equipment (DME). The remaining sections apply to aircraft that depart from other runways not mentioned in Section 3.3.1.

3.3.1 Distance measuring equipment jet aircraft departures

Distance Measuring Equipment (DME) departures for jet aircraft will commence departure turns using DME distances from the following runways (unless otherwise directed by the FAA's BWI Tower):

- Runway 15R - two mile DME when turning left and one mile DME when turning right
- Runway 28 - three mile DME for all turns
- Runway 10 - two mile DME for all turns
- Runway 22 - two mile DME for all turns

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers are requested to recommend these procedures to pilots. Runway 4/22 was permanently closed on August 6, 2014.

3.3.2 Runway 33L jet aircraft departures

Jet aircraft departures from Runway 33L will begin turns immediately upon becoming safely airborne, but not below 300 feet above ground during VFR conditions and not below 400 feet during IFR conditions.

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers are requested to recommend these procedures to pilots.

3.3.3 Runway 33R departure heading

All aircraft departing Runway 33R to the north or east will maintain runway heading until one mile from end of runway. Also subject to Noise Rule as discussed in Section 3.5.

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers are requested to recommend these procedures to pilots.

3.3.4 Runway 04 jet aircraft departures

Jets departing Runway 04 will maintain runway heading until one mile from end of runway. Note that there are additional restrictions for Runway 04 and Runway 22, as discussed in Section 3.6.

Implementation Status: Runway 4/22 was permanently closed on August 6, 2014.

3.4 West operations preferred (1990 ROA Element 6)

West operations, which concentrate turbojet departures on Runway 28, are preferred.

Implementation Status: Ultimate authority of the aircraft rests with the pilot. MAA has developed and distributed pilot handouts and other informational packages describing operational procedures. FAA Air Traffic Controllers recommend these procedures to pilots.

3.5 Noise Rule for Runway 15L/33R (2008 ROA Element 1)

The Noise Rule will prohibit any aircraft with an average EPNdB value of 87.0 or greater (that is determined by averaging the take-off and sideline 14 CFR Part 36 certification values). These aircraft that exceed the Noise Rule level are prohibited from using Runway 15L/33R except in emergency conditions. Prohibited aircraft are permitted and encouraged to use the Airport's transport runways, Runways 10/28 and 15R/33L

Implementation Status: The Noise Rule was updated in February 2008 and an updated list of prohibited aircraft was published. One of the anticipated specifications of the noise monitoring system upgrade, discussed later in Section 3.15 and Section 6.1.4, is to provide efficient identification / automated reporting of non-complying operations and provide the address of the operator. The MAA plans to notify via letter any aircraft operator who does not comply with this Noise Rule.

3.6 Restricted use of Runway 04/22 (1990 ROA Element 8)

Runway 04/22 shall be closed to multi-engine aircraft from 2200 to 0700 local time. The above restrictions apply except for unusual weather conditions, emergencies or runway closures that preclude use of other runways.

Implementation Status: Runway 4/22 was permanently closed on August 6, 2014.

3.7 Voluntary Cooperative Airlines/Airport Use Restriction Program (1990 ROA Element 9)

Passenger and cargo airlines voluntarily increase the use of quieter aircraft and decrease the use of louder aircraft with the goal of limiting future noise created by the total commercial jet fleet to a level no higher than that which existed in 1987.

Implementation Status: The retirement of louder noisier aircraft, the introduction of newer and quieter aircraft and the federally required phase out of aircraft over 75,000 lb and certified to 14 CFR Part 36 Stage 2 noise standards has provided additional benefits beyond the voluntary actions of the airlines.

3.8 Tree buffer along east Airport boundary (1990 ROA Element 10)

Although the FAA requested additional information instead of approving this measure in the 1990 ROA, the MAA has planted 622 trees on the eastern boundary of BWI Marshall along Aviation Boulevard (formerly Hammonds Ferry Road). When mature, the buffer will provide some attenuation of ground noise sources as well as a visual barrier between Airport facilities and operations and the adjacent community.

Implementation Status: Complete.

3.9 Powerback restrictions (1990 ROA Element 11)

All aircraft reverse thrust powerback operations at BWI Marshall Airport must be approved in advance by the MAA and the FAA. This procedure will be approved by the MAA for specified gates, and only if the procedure, through demonstration, is in compliance with a maximum noise level test. All powerbacks are prohibited from 2200 to 0700 local time. Authorization to conduct powerback procedures will be terminated by the MAA should any environmental or safety hazards become evident. (Tenant Directive 203.1)

Implementation Status: The airlines no longer perform engine powerbacks at the gate. Several issues, including safety and fuel burn, have caused them to abandon the powerback technique in favor of having a tug push the aircraft out into the taxi lane.

3.10 Engine maintenance runup restrictions (1990 ROA Element 12)

Run-ups are authorized from 0600 to 2200 local time only at approved airfield locations and under procedures prescribed by the MAA. Prior permission must be obtained from the BWI Marshall Airport Operations Center for any runups conducted between 2200 to 0600 local time. Permission during this time period shall be denied unless it can be shown that failure to conduct the runup will delay departure of a scheduled passenger flight. The complete runup restrictions, including approved airfield locations and procedures, are defined in Tenant Directive 501.1.

Implementation Status: A report ("Aircraft Engine Maintenance Run-up Report") must be completed and forwarded to the MAA for all exemptions granted.

3.11 Compatible Land Use Zoning (1990 ROA Element 13)

An Airport Noise Zone (ANZ) is established, per State law, for BWI Marshall to control incompatible development in areas where levels of cumulative aircraft noise exposure are equal to or greater than the limits for cumulative noise exposure established by State regulations. Restrictions placed on land use development allowed within the ANZ are based on established limits for cumulative noise exposure.[24]

The ANZ is determined by a composite of the base year, five year and ten year annual Ldn contours. The three sets of contours are overlaid on each other. In accordance with state regulations, the largest of the three contours in any area around the Airport determines the Airport Noise Zone thereby offering protection within the largest of the existing or future noise exposure contours. This process is performed for each five-decibel increment of noise levels, from 65 Ldn to 75 Ldn.

[24] ANZ maps adopted under Maryland state laws and Code of Maryland Regulations (COMAR) are similar to, but distinct from, NEMs prepared under 14 CFR Part 150. The principal difference between ANZ maps and NEMs pertains to the planning horizon used to develop future noise exposure. For an ANZ map set, a baseline (current), a five-year (future) and a 10-year (future) map is prepared. For NEMs prepared under 14 CFR Part 150, a baseline (current) and a five-year (future) maps are prepared. Copies are available at the offices of MAA, Anne Arundel County, Howard County and the 12 public libraries listed later in Section 7.4. An electronic version is available at MAA's Community Relations website http://www.maacommunityrelations.com/

The most recent ANZ was certified in December 2014.[25] The implementation status is described with the two types of actions described below.

3.11.1 Development Restrictions (including Soundproofing Standards, Avigation Easements, and Exemptions)

Local government approval of development activities prior to construction is prohibited within the ANZ before an airport zoning permit or variance is obtained. Anyone desiring to construct or modify a structure or establish land use within the ANZ is required to first obtain an airport zoning permit from the MAA. According to State law, permits must be denied by the MAA if the proposed land use is incompatible with the established cumulative noise exposure limits. Additions and modifications to an existing residential structure are exempt from the noise zoning permit process, as long as the modification does not increase the number of dwelling units. Permit applications can be obtained from the MAA, the Anne Arundel County Office of Inspections and Permits or the Howard County Office of License and Permits.

In the event an airport zoning permit is denied by the MAA, the applicant may appeal to the Board of Airport Zoning Appeals (BAZA) for a variance from the noise regulations. The Board will consider any facts and circumstances relevant to the request for a variance, including testimony or evidence regarding possible impacts of granting or denying the variance on the surrounding community. In granting a variance to the regulations, the Board will require at a minimum: 1) compliance with all applicable minimum standards of noise attenuation adopted by the MAA; and 2) an avigation easement over the property. The applicable regulations governing control of incompatible land use at BWI Marshall can be found in Sections 11.03.03, 11.03.05 and 11.03.06 of Title 11, Transportation, Code of Maryland Regulations.

Implementation Status: MAA continues to review all applications for BAZA requests. MAA has reviewed 15 BAZA cases between 2004 and 2014. All 15 cases were granted an exemption; where exemptions have been granted, property owners are required to provide sound insulation and to sign aviation easements.

3.11.2 Noise zone notification in real estate transactions

According to the "General Addendum to All Contracts of Sale for Improved Properties Located in the State of Maryland", a buyer may request to review the ANZ if all or a portion of the property lies in the vicinity of an airport.

Implementation Status: Ongoing. The addendums for Anne Arundel County and Howard County can be found in Appendix B.

[25] The most recent ANZ was approved November 19, 2014 and becomes effective December 22, 2014. Maryland Register, Volume 41, Issue 25, Friday December 12, 2014, pg. 1485.
Official copies are available for viewing at MAA's offices, Anne Arundel County and Howard County. Electronic version is available at
http://www.maacommunityrelations.com/content/anznoiseupdate/anz_update_2014.php

3.12 Voluntary Residential Property Acquisition Program (2008 ROA Element 3)

In 1985, the MAA began a program to acquire residential properties with cumulative noise levels of 75 Ldn and greater. Participation in the program is voluntary. The NAP was expanded in 1988 to acquire properties in communities that are exposed to cumulative noise levels of 70-75 Ldn, provided the area has been zoned by local government to transition from residential to a noise compatible use. Large residential properties where the owners have reasonable opportunity for non-residential resale without State or Federal assistance are excluded from the program. Property owners are paid full market value for their property at its highest and best use, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

The 2008 ROA modified the Residential Property Acquisition Program by expanding eligibility to the 65 dB DNL contour as defined by the NEM. The FAA's policy published in the Federal Register on April 3, 1998 (Volume 63, Number 64) states that the FAA will not approve Federal funding to mitigate noise sensitive land uses constructed after October 1, 1998.

Implementation Status: As of August 4, 2014, MAA has acquired 202 properties at a cost of $35.8 million.[26] MAA will continue to seek funding for land acquisition described in this document.

3.13 Homeowners Assistance Program (2008 ROA Element 4)

In 1988, the MAA began the Homeowners Assistance Program to offer financial assistance to homeowners residing in the ANZ, and who are not eligible for the Voluntary Land Acquisition Program.

The 2008 ROA modified the Homeowners Assistance Program by expanding eligibility to the 65 dB DNL contour as defined by the NEM. The FAA's policy published in the Federal Register on April 3, 1998 (Volume 63, Number 64) states that the FAA will not approve Federal funding to mitigate noise sensitive land uses constructed after October 1, 1998. [27]

Implementation Status: As of April 30, 2014, MAA has provided assistance to 782 homeowners (113 homeowners under the resale assurance option and 669 homeowners under the soundproofing option) at a cost of $22 million.

3.13.1 Resale assurance option

Financial assistance is provided to eligible homeowners wishing to move from the 65 dB DNL contour as defined by the NEM. The selected properties are appraised to determine their value as if

[26] "Management of Acquired Noise Land for Baltimore/Washington International Thurgood Marshall Airport Reuse Plan for Acquired Noise Land Parcels" HMMH Report No. 301960.008, September 30, 2010

[27] The FAA's policy published in the Federal Register on April 3, 1998 (Volume 63, Number 64) states that the FAA will not approve Federal funding to mitigate noise sensitive land uses constructed after October 1, 1998. Additional clarification to this policy is provided in FAA Order FAA Order 5100.38D "Airport Improvement Program Handbook" dated September 30, 2014, Table R-6.
http://www.gpo.gov/fdsys/pkg/FR-1998-04-03/pdf/98-8835.pdf
http://www.faa.gov/airports/aip/aip_handbook/

they were located outside the 65 dB DNL contour as defined by the NEM. The homeowner enters into a contract with the MAA, committing the MAA to: 1) pay the difference between the actual selling price of the property and its appraised value if it were outside the 65 dB DNL contour as defined by the NEM; and 2) pay certain closing costs on a replacement house. The homeowner is then required to sign an avigation easement. Prospective purchasers must be advised of the property's location within the 65 dB DNL contour as defined by the NEM and their ineligibility for participation in noise assistance programs.

Implementation Status: As of April 30, 2014, MAA has provided assistance to 113 homeowners in this program.

3.13.2 Soundproofing option

The MAA will assist eligible homeowners in making modifications to their houses, with a goal of reducing interior noise levels to an average of 45 Ldn (or 45 DNL). The type and extent of the improvements are dependent upon the noise reduction capabilities of the existing structure. Fresh air ventilation and air conditioning are installed to allow windows to remain closed and other modifications including replacement of exterior windows and doors, additional insulation, baffles, and other sound attenuation measures are considered. The homeowner enters into a contract with the MAA, committing the MAA to: 1) pay for the agreed upon noise reduction modifications; and 2) monitor the construction and assure its quality. The homeowner is then required to sign an avigation easement.

Additional conditions of the program will follow current FAA guidelines, as documented in MAA's August 2007 NCP submission to FAA (though were not specifically mentioned in FAA's 2008 ROA). [28] The goal of this corrective measure is to alleviate the impact of aircraft noise by providing indoor environments where normal activities can be conducted without interruption by aviation noise. Homes inside the 65 dB DNL contour of the NEM will be eligible, provided that they were constructed and first occupied prior to October 1, 1998, per FAA policy.[29] The measure will reduce interior noise levels and thus improve the compatibility of residential land uses inside the 65 dB DNL contour.

The MAA will assist eligible homeowners in making modifications to their houses, with a goal of reducing interior noise levels by 5 dB to an average of 45 dB Ldn (or 45 dB DNL). The type and extent of the improvements are dependent upon the noise reduction capabilities of the existing structure. Fresh air ventilation and air conditioning are installed to allow windows to remain closed and other modifications including replacement of exterior windows and doors, additional insulation, baffles, and other sound attenuation measures are considered. The homeowner then enters into a contract with the MAA, committing the MAA to: 1) pay for the agreed upon noise reduction modifications; and 2) monitor the construction and assure its quality. The homeowner is then required to sign an avigation easement.

An avigation easement is the right to the use of real property for the purpose of aircraft overflights and related noise, vibrations, and other effects caused by aircraft operations. An avigation easement is a permanent encumbrance on the land. Although the use of navigable airspace by aircraft is a

[28] In particular, Section 5.2.2 from the BWI NCP Update, August 2007. The narrative below is a summary of that section.
[29] See Footnote 27.

federal prerogative, an avigation easement provides an additional mechanism of right-of-way and disclosure. Easements release local jurisdictions, aircraft operators, and the airport owner and operator from the effects of aircraft operations on noise-sensitive properties.

When a resident applies to participate in the program, a property title search is completed to verify ownership and to make sure there are no tax liens, easements or other encumbrances associated with the property which would cause it to be ineligible. Additional conditions of the program will follow current FAA guidelines for AIP.[30] Some of these conditions include the requirement that the building must meet local building codes.

Implementation Status: As of April 30, 2014, MAA has provided assistance to 669 homeowners in this program and intends to continue the sound insulation program.

3.14 School Soundproofing Program (1990 ROA Element 16)

This program provides soundproofing for eligible schools to reduce undesirable interior noise levels. Four schools in the ANZ[31] have received soundproofing through this program at a cost of $9.3 million. These schools are Corkran Middle School, Arthur Slade Regional School, Glen Burnie Park and Oakwood Elementary Schools.

Although not explicitly mentioned in the FAA's 1990 ROA, the 1989 BWI Marshall NCP implicitly refers to the 65 dB DNL (or Ldn) contour as the criterion for a school to be eligible for soundproofing evaluation.[32]

The MAA's 1989 BWI Marshall NCP submission references a fifth school, Rippling Woods Elementary School (ES), within the 65 DNL (or Ldn) contour. A consultant working for MAA at the time concluded "that the interior of Rippling Woods ES is adequately protected from aircraft noise and that school does not require any acoustical modification." This opinion was confirmed by an independent study commissioned by the Anne Arundel County Board of Education.[33]

Implementation Status: Complete for these four schools listed (Corkran Middle School, Arthur Slade Regional School, Glen Burnie Park and Oakwood Elementary Schools). The FAA 1990 ROA and the 1989 BWI Marshall NCP explicitly listed these five schools, presumably to provide the inventory of the time, noting that two of the schools were in the historical 65 dB Ldn and "three more schools projected to be within the 65 dB Ldn Area."[34] The documents to do not state what should happen if additional schools are identified via future NEM updates. MAA may consider additional schools, in discussion with the applicable owner and FAA, in the future, as discussed in Section 6.1.3.

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[30] These guidelines are currently described in FAA Order 5100.38D "Airport Improvement Program Handbook" dated September 30, 2014. The sound insulation guidelines are addressed primarily in Appendix R of the Order.
http://www.faa.gov/airports/aip/aip_handbook/

[31] This statement was written in 1990, using the then current ANZ.

[32] Baltimore/Washington International Airport FAR Part 150 Documentation, Volume III Noise Compatibility Program, January 1989. Section 4.5, pg. 170.

[33] The independent study is referenced in the 1989 BWI NCP (Sec. 4.5 pg. 170), as "Aircraft Noise Impact on Anne Arundel County Public Schools In the Vicinity of BWI Airport."

[34] See Footnote 32.

In comments provided by FAA September 29, 2015 to MAA, the FAA indicated that only the four schools mentioned in the 1990 ROA (Corkran Middle School, Arthur Slade Regional School, Glen Burnie Park and Oakwood Elementary Schools) are included in this NCP measure. FAA stated that an NCP update will be required to include additional schools to this program.

3.15 Noise Monitoring System (2008 ROA Element 4)

The monitoring system is used to help implement the NCP; it is not used to enforce noise abatement procedures. The current noise monitoring system has been a beneficial tool to monitor aircraft operations, noise levels, respond to community inquires. For reasons of aviation safety, the noise monitoring system is not used for enforcement purposes by in-situ measurement of any preset noise thresholds.

Implementation Status: MAA has had a noise monitoring system for nearly 30 years. 14 permanent noise monitors were installed in 1986 and an additional 9 monitors were installed in 1992; monitors are approaching the end of their useful life. MAA would like replace the current monitoring system with a modern system.

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4 EXISTING AND FORECAST NOISE CONTOURS WITH EXISTING NOISE COMPATIBILITY PROGRAM

The fundamental noise elements of a NEM are DNL contours for existing and five-year forecast conditions: i.e., 2014 and 2019 in this update. Figure 12 compares the 2014 and 2019 contours, prepared for this NEM submission, with the 2010 NEM contours as the FAA found in compliance with Part 150 requirements on April 3, 2006. Figure 12 is not the official Noise Exposure Map. The official 2014 and 2019 Noise Exposure Maps are presented and discussed in Chapter 5. This figure is presented to provide the same noise contours on a simpler base map. Section 4.2 discusses the development of these contours.

As presented in Figure 12, the shape of the 2010, 2014 and 2019 noise contours are similar. Comparing the 2014 contours to the 2010 contours, there is a reduction in noise to the west of the Airport. This reduction is primarily attributed to the phase-out of aircraft represented in the 2010 contours and which were louder on departure, compared to aircraft currently operating at BWI in 2014. Part of the reduction in the size of the noise contours to the west of the Airport is also attributed to an overall reduction in aircraft operations compared to what was modeled for the 2010 contour set. To the south-southwest of the Airport, the 2014 and 2010 contours are very similar.

The modeling assumptions used in developing these three sets of contours differ in terms of the level and mix of aircraft activity. The comparison shows that the contours are forecast to grow from 2014 to 2019, due largely to the predicted increase in operations.

4.1 Population within Contours

Table 6 presents the estimated residential population within the 2014 existing conditions and 2019 five-year forecast contours, with the existing NCP, as currently implemented.

Table 6 Estimated Residential Population within 2014 and 2019 Day-Night Average Sound Level (DNL) Contours, with Existing Noise Compatibility Program, as Currently Implemented

Source: HMMH, December 2014

Noise Level, DNL	2014			2019		
	Estimated Population[35]	Estimated Single Family Houses	Estimated Multi-Family Housing Units	Estimated Population	Estimated Single Family Houses	Estimated Multi-Family Housing Units
65-70	1,547	389	226	2,618*	572*	488
70-75	38	14	0	46	17	0
75+	0	0	0	0	0	0
Total	1,585	403	226	2,664*	589*	488

Note:
*Compared to the September 2014 Draft of this document, two properties have been added to the inventory. These properties are discussed further in footnote 7 on page 3.

[35] Population estimates assume 2.7 people per single-family house and 2.2 people per multi-family unit. Both estimates are from analysis of U.S. Census 2010 data.

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BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Existing (2014) and Forecast (2019) DNL Contour Compared to 2010 NEM Contour
Figure 12

- Existing 2014 DNL Contour
- Forecast 2019 DNL Contour
- Forecast 2010 DNL Contour (Found in compliance by FAA on April 3, 2006)
- BWI Airport Property
- Existing Airport Runways
- (H) Existing Helicopter Pad (2014)
- (H) Future Helicopter Pad (2019)

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Note: All previously mitigated homes are considered compatible

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

0 2,000 4,000 8,000 Feet

N

hmmh

June 2016

Path: G:\Projects\305XXX\305160_MAA_On-Call_Services\Task011_BWI_NEM_Update\GIS\305160_011_BWI_NEM_Figure12_2014_2019_NEM_2010_NEM_Crts_MAA.mxd

4.2 Development of Noise Contours

The DNL contours for this study were prepared using the most recent release of the FAA's Integrated Noise Model (INM), Version 7.0d.

The INM requires inputs in the following categories:

- Physical description of the airport layout
- Number and mix of aircraft operations
- Day-night split of operations (by aircraft type)
- Runway utilization rates
- Representative flight track descriptions and flight track utilization rates
- Meteorological conditions
- Terrain
- Aircraft maintenance engine run-ups

Contour input was developed using RealContours™, a proprietary program that enables modeling of all radar track data for a given period.

4.2.1 Airport physical parameters

BWI Marshall has three runways which are designated 10/28, 15R/33L, and 15L/33R. Each pair of numbers corresponds to the name of each runway end.[36] Aircraft can land and takeoff in either direction on a given runway therefore, each runway end has a unique name. The numbers are a shorthand notation that indicates the runway's geographical orientation: the compass heading of the runway, rounded to the nearest ten degrees, with the trailing zero dropped. For example, the magnetic heading of Runway 28 is approximately 284 degrees. The number is rounded to 280, and finally to 28 with the zero dropped; hence, Runway 28. Simple geometry requires that the difference between the designation of each end equals 18 (that is, 180 degrees); hence, Runway 10 is in the opposite direction from Runway 28. There are two runways that are oriented in the same direction, thus both having the 15/33 designation. In order to differentiate one from the other, when facing 150 degrees from the North, the runway to the right is called 15R (for right)/33L, and the other is called 15L (for left)/33R. In this case, 15R/33L is the western-most of the two parallel runways.

Table 7 presents the Existing Runway layouts for the 2014 contours. In addition to the runways, there is a helicopter landing spot on the east side of the Airport, just east of Runway 15L/33R.

Table 8 presents the future Airport layout proposed for the 2019 contours. The five year conditions (2019) include changes proposed on the current Airport Layout Plan, specifically the decommissioning of Runway 4/22, along with changes to certain existing runways to meet the latest federal government design standards. Coordinates, elevations and thresholds that change from the existing layout, as presented in Table 7, are highlighted in italics. Additional details regarding the current and the future runway layout are presented in the following sections.

[36] Runway 4/22 was permanently closed on August 6, 2014 and is not included in the 2014 NEM. Some discussion of Runway 4/22 is included for reference purposes.

4.2.1.1 Runway Lengths and Elevations

Runway 10/28 is 10,502 feet long and 150 feet wide.[37] Runway 10 has an elevation of 139.0 feet and Runway 28 has an elevation of 126.2 feet.

Runway 15L/33R is 5,000 feet long and 100 feet wide. Runway 15L has an elevation of 141.5 feet and Runway 33R has an elevation of 114.1 feet.

Runway 15R/33L is 9,501 feet long and 150 feet wide. Runway 15R has an elevation of 138.6 feet and Runway 33L has an elevation of 129.2 feet.

Runway 4/22 was 6,000 feet long and 150 feet wide. Runway 4/22 was permanently closed on August 6, 2014 and is not included in the 2014 NEM.

4.2.1.2 Existing Runway Displaced Thresholds

A displaced threshold is a runway threshold located at a point other than the physical beginning or end of a runway. Under normal operating conditions, aircraft begin a takeoff roll at the physical end of a runway. For landings, however, they typically will cross over the end of a runway in flight, touching down some distance beyond the threshold. The altitude at which aircraft cross over the threshold when landing is the "threshold crossing height".

Runway 10/28 has displaced arrival thresholds that meet FAA Design Standards. The Runway 10 arrival threshold is displaced 550 feet. The arrival threshold for Runway 28 is displaced 500 feet. All aircraft arriving on Runway 10 or Runway 28 use the displaced arrival thresholds for those runways. Aircraft departing on all runways, except Runway 28, begin their takeoff roll at the physical end of the runway. Most aircraft departing on Runway 28 begin their takeoff roll at the intersection with Taxiway C, approximately 500 feet west of the physical end of the runway. Aircraft which have a need (based on weight, length of flight, or other conditions) for a full 10,502 feet of runway may begin their takeoff roll at the physical end of Runway 28.

4.2.1.3 Future Airport Layout

The most recently approved Airport Layout Plan (ALP) for BWI Marshall proposes several changes to the runway layout/geometry which are scheduled for completion by 2019 are included in the development of the 2019 contours. These alterations are depicted on Sheets 3 and 5 of the ALP approved in August 2012 and summarized in Table 2. These changes are briefly described below:

- Runway 4/22: The runway was permanently closed on August 6, 2014 and is not included in the 2014 or 2019 NEM.
- Runway 10/28: The Runway 28 displaced arrival threshold is expected to increase from 500 feet to 700 feet.
- Runway 15L/33R: No physical changes to this runway are proposed.
- Runway 15R/33L: The runway would shift 3 feet to the southwest. In addition, the arrival threshold for Runway 15R would be displaced 300 feet and the arrival threshold for Runway 33L would be displaced 500 feet.

[37] The width of Runway 10/28 was previously 200 ft. The revised width of 150 feet was published by FAA effective June 27, 2013. The change in runway width does not affect noise calculations.

- Helicopter pad: The helicopter pad would move approximately 645 feet to the southeast.

4.2.1.4 Runway End Coordinates and Dimensions

Table 7 and Table 8 present the runway end coordinates, runway lengths and other geometric data which would be used for modeling predicted noise exposure in 2014 and 2019, respectively, as part of the NEM. Changes in 2019 data, compared to 2014 data, are in *italics*. Figure 13 presents the existing BWI Marshall Airport layout.

Table 7 Existing Runway Layout Data (2014)

Sources: BWI Marshall 2012 Airport Layout Plan, Sheet 5

Threshold Crossing Height from FAA Form 5010 effective August 22, 2013
Helicopter pad information estimated from BWI Marshall 2012 Airport Layout Plan, Sheet 3

Runway	**4**	**22**
Latitude (deg)	39.166878	39.180662
Longitude (deg)	-76.671368	-76.659780
Elevation (ft)	146.0	137.7
Length (ft)	6,000	6,000
Takeoff Threshold (ft)	0	0
Approach Threshold (ft)	0	0
Threshold Crossing Height (ft)	37	47
Runway 4/22 was permanently closed on August 6, 2014 and is not included in the 2014 NEM. Data are presented above for reference purposes only.		
Runway	**10**	**28**
Latitude (deg)	39.174747	39.172632
Longitude (deg)	-76.689618	-76.652676
Elevation (ft)	139.0	126.2
Length (ft)	10,502	10,502
Takeoff Threshold (ft)	0	500 (typical)
Approach Threshold (ft)	550	500
Threshold Crossing Height (ft)	50	55
Runway	**15L**	**33R**
Latitude (deg)	39.187373	39.176236
Longitude (deg)	-76.663540	-76.653231
Elevation (ft)	141.5	114.1
Length (ft)	5,000	5,000
Takeoff Threshold (ft)	0	0
Approach Threshold (ft)	0	0
Threshold Crossing Height (ft)	47	47
Runway	**15R**	**33L**
Latitude (deg)	39.185366	39.164208
Longitude (deg)	-76.681984	-76.662387
Elevation (ft)	138.6	129.2
Length (ft)	9,501	9,501
Takeoff Threshold (ft)	0	0
Approach Threshold (ft)	0	0
Threshold Crossing Height (ft)	50	55
Helicopter Pad		
Latitude (deg)	39.186529	
Longitude (deg)	-76.660582	
Elevation (ft)	132	

Table 8 Forecast Runway Layout Data (2019)

Sources: BWI Marshall 2012 Airport Layout Plan, Sheet 5

Threshold Crossing Height from FAA Form 5010 effective August 22, 2013, unless otherwise noted as "(anticipated)"

Helicopter pad information estimated from BWI Marshall 2012 Airport Layout Plan, Sheet 3

Runway	**4**	**22**
	Permanently closed / decommissioned as a runway effective August 6, 2014	
Runway	**10**	**28**
Latitude (deg)	39.174747	39.172632
Longitude (deg)	-76.689618	-76.652676
Elevation (ft)	139.0	126.2
Length (ft)	10,502	10,502
Takeoff Threshold (ft)	0	500 (typical)
Approach Threshold (ft)	550	*700*
Threshold Crossing Height (ft)	50	*50 (anticipated)*
Runway	**15L**	**33R**
Latitude (deg)	39.187373	39.176236
Longitude (deg)	-76.663540	-76.653231
Elevation (ft)	141.5	114.1
Length (ft)	5,000	5,000
Takeoff Threshold (ft)	0	0
Approach Threshold (ft)	0	0
Threshold Crossing Height (ft)	47	47
Runway	**15R**	**33L**
Latitude (deg)	*39.185361*	*39.164203*
Longitude (deg)	*-76.681993*	*-76.662393*
Elevation (ft)	138.6	129.2
Length (ft)	9,501	9,501
Takeoff Threshold (ft)	0	0
Approach Threshold (ft)	*300*	*500*
Threshold Crossing Height (ft)	50	*50 (anticipated)*
Helicopter Pad		
Latitude (deg)	*39.185181*	
Longitude (deg)	*-76.659115*	
Elevation (ft)	*129*	

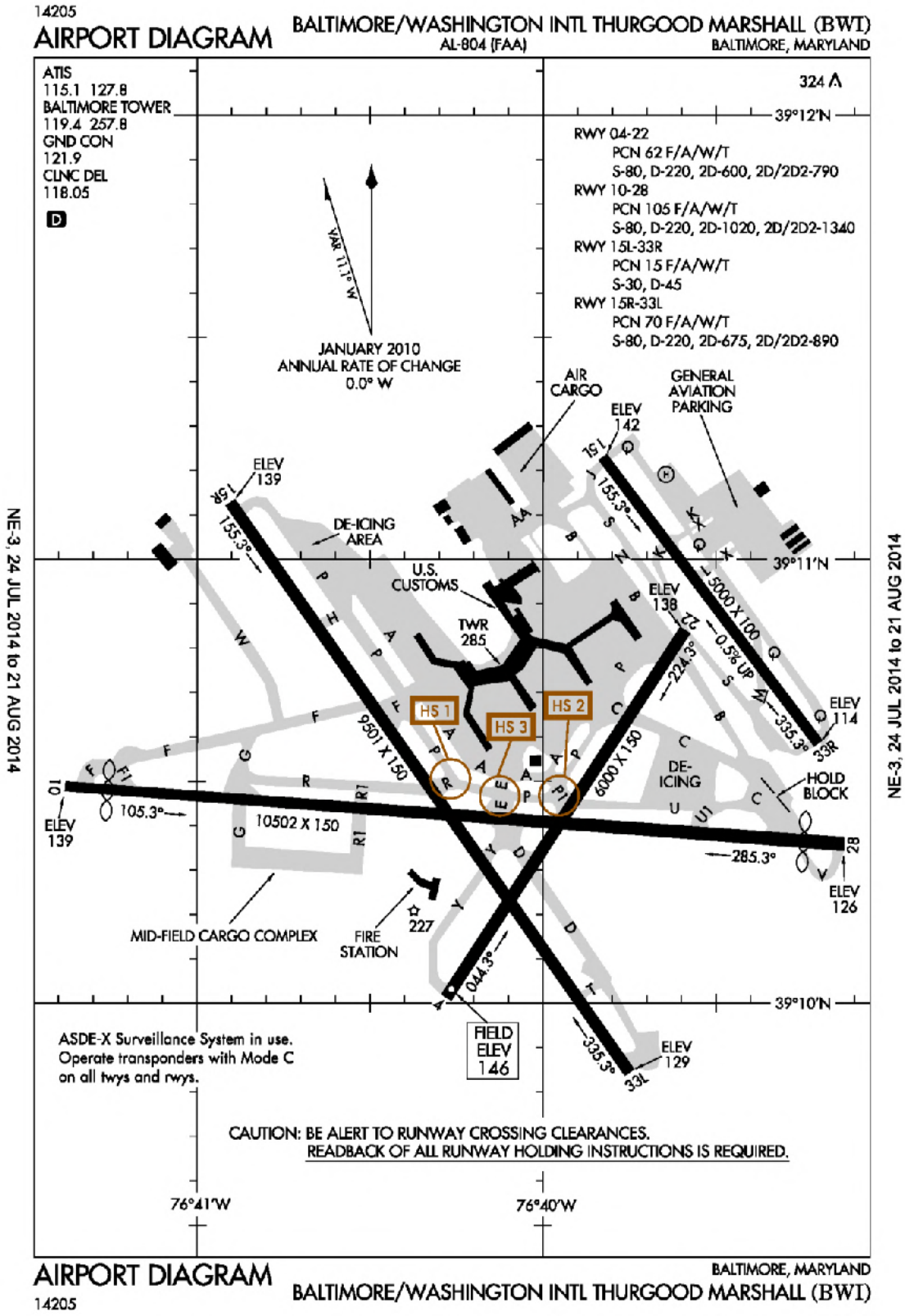


Figure 13 Existing BWI Marshall Airport Layout
Source: FAA, July 2014
Note: Runway 4/22 was permanently closed on August 6, 2014.

4.2.2 Aircraft operations

MAA used the January 2013 issue of the FAA's Terminal Area Forecast (TAF) for aircraft operational activity levels. The TAF reports aircraft operational activity levels in one of four categories listed below.[38]

- Air Carrier – Operations by aircraft capable of holding 60 seats or more and are flying using a three letter company designator.
- Air Taxi - Operations by aircraft less than 60 seats and are flying using a three letter company designator or the prefix "Tango".
- Military – all classes of military operations.
- General Aviation – Civil (non-military) aircraft operations not otherwise classified under air carrier or air taxi.

Table 9 presents the modeled 2014 and 2019 operations by TAF category along with the modeled aircraft operations. For the 2014 NEM, 263,530 annual operations were represented with 722.0 average annual day operations. For the 2019 NEM, 292,253 annual operations were represented with 800.7 average annual day operations.

Table 9 Summary of FAA Terminal Area Forecast (TAF) Operations Activity Levels at BWI Marshall and Modeled Operations for the 2014 and 2019 Noise Exposure Map

Sources: FAA TAF 2013, HMMH December 2013

FAA Operational Category[1]	2014 NEM Operations		2019 NEM Operations	
	2014 Forecast – Issued January 2013	2014 Average Annual Day Modeled Operations	2019 Forecast – Issued January 2013	2019 Average Annual Day Modeled Operations
Air Carrier	208,969	572.5	240,831	659.8
Air Taxi and Commuter	38,329	105.0	34,359	94.1
GA (Itinerant + Local)[2]	15,272	41.8	16,103	44.1
Military	960	2.6	960	2.6
Total[3]	**263,530**	**722.0**	**292,253**	**800.7**

Notes:
1 Operational Categories used in the TAF are those defined in FAA Order 7210.3Y at Chapter 9, Section 9-1-2 (April 2, 2014). http://www.faa.gov/air_traffic/publications/atpubs/FAC/Index.htm
2 General Aviation activity levels presented in "Itinerant" operations include Civil "Local" operations. The TAF forecasts 268 civilian local operations for both 2014 and 2019.
3 Totals may not match exactly due to rounding.

Radar data for April 2012 through March 2013 (inclusive) were scaled to the 2014 and 2019 annual operation totals presented in Table 9. The scaling process considered recent and on-going aircraft fleet changes at several airlines and expected aircraft retirements to represent 2014 and 2019 operations.[39] The forecast for 2019 relies on several assumptions concerning changes to the fleet within the BWI NEM Update time frame. The forecast assumptions were based on publicly available information. Information regarding planned aircraft retirements and aircraft purchases was

[38] FAA Joint Order JO 7210.3Y, Section 9-1-2. Categories of Operations, Published 4/3/2014. Latest version is available at http://www.faa.gov/air_traffic/publications/atpubs/FAC/Index.htm.
[39] 238 days of this 12 month period were used. The remaining days were affected by maintenance runway closures and were not considered "typical" conditions for the purpose of developing noise contours for the NEM.

specifically researched for each of the top ten airlines operating at BWI during calendar year 2012. For example, certain airlines have published plans to retire older aircraft types, such as Boeing 717-200s, 737-300, 737-500, and replace and grow operations with aircraft types on order, such as Boeing 737-700 and 737-800. Collectively, the top ten airlines represented approximately eighty-four percent of calendar year 2012 operations. The remaining sixteen percent of operations were modeled with broader, though publicly supported, assumptions. MAA provided the forecast assumptions, including documentation of changes at various airlines, to the FAA via a HMMH memorandum dated December 12, 2013 and FAA concurred with these assumptions in February 2014. Appendix C provides copies of both documents.

Table 10 and Table 11 present the detailed modeled average daily aircraft operations for each aircraft type included in the study years 2014 and 2019, respectively. Any discrepancies between the total number of operations and the number of operations presented in Table 9 are due to rounding. The "Day" time operations are between 7 AM to 10 PM and "Night" time operations are between 10 PM to 7 AM. The "Day" and "Night" periods correspond to the DNL noise metric (Section 2.1.6).

4.2.3 Aircraft noise and performance characteristics

Specific noise and performance data must be entered for each aircraft type operating at the airport. Noise data is included in the form of sound exposure level (SEL – see Section 2.1.4) at a range of distances (from 200 feet to 25,000 feet) from a particular aircraft with engines at a specific thrust level. Performance data includes thrust, speed and altitude profiles for takeoff and landing operations. The INM database contains standard noise and performance data for over one hundred different fixed wing aircraft types, most of which are civilian aircraft. The program automatically accesses the applicable noise and performance data for departure and arrival operations by those aircraft.

This study included many different aircraft types. While many aircraft could be modeled by direct assignments from the standard INM database, many were not in the INM database. For those aircraft types not in the INM standard database, FAA-approved substitutions were used to model the aircraft with a similar type that was in the database. If no sufficiently similar aircraft could be found, a user-defined aircraft was created for that specific aircraft type. FAA approved substitutions came from the following two sources:

- INM Version 7.0d which includes the current list of standard FAA substitutions;
- A BWI Marshall Part 150 specific request to the FAA for non-standard substitutions and user-defined aircraft. The September 11, 2013 request and FAA's October 1, 2013 approval are documented in Appendix C.

Table 10 2014 Modeled Average Daily Aircraft Operations

Source HMMH, August 2014

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
Air Carrier	*DC86	0.2	<0.1	0.2	<0.1	0.5
	717200	28.3	2.3	28.7	1.9	61.3
	727EM2	<0.1	0.0	<0.1	0.0	<0.1
	737300	39.7	3.7	39.7	3.6	86.6
	7373B2	2.6	0.2	2.5	0.3	5.6
	737400	3.2	0.1	3.3	<0.1	6.7
	737500	5.8	0.6	5.7	0.7	12.8
	737700	119.8	12.1	119.4	12.4	263.7
	737800	11.0	3.8	12.4	2.5	29.8
	737N17	<0.1	0.0	<0.1	0.0	<0.1
	74720A	<0.1	0.0	<0.1	0.0	<0.1
	74720B	<0.1	<0.1	<0.1	<0.1	<0.1
	747400	0.2	<0.1	0.2	<0.1	0.5
	757300	<0.1	0.0	<0.1	0.0	<0.1
	757PW	2.6	1.4	3.2	0.8	8.0
	757RR	1.4	1.3	2.3	0.4	5.4
	767300	1.5	0.8	1.4	1.0	4.6
	767400	<0.1	0.0	<0.1	0.0	<0.1
	767CF6	0.1	0.7	<0.1	0.7	1.5
	767JT9	<0.1	0.0	0.0	<0.1	<0.1
	777200	0.1	<0.1	<0.1	<0.1	0.2
	A300-622R	0.2	1.2	0.7	0.7	2.7
	A310-304	<0.1	0.0	0.0	<0.1	<0.1
	A319-131	5.0	1.7	5.0	1.8	13.5
	A320-211	2.8	1.5	4.0	0.3	8.6
	A320-232	4.2	1.8	5.1	0.8	11.9
	A321-232	0.6	0.4	1.0	<0.1	2.1
	A330-301	<0.1	<0.1	<0.1	<0.1	<0.1
	CRJ9-ER	1.2	<0.1	1.2	<0.1	2.6
	CRJ9-LR	0.3	0.0	0.3	<0.1	0.5
	DC1010	0.5	0.1	0.1	0.5	1.3
	DC1030	0.1	<0.1	<0.1	0.1	0.3
	DC93LW	<0.1	0.0	0.0	<0.1	<0.1
	DC95HW	0.6	<0.1	0.6	<0.1	1.2
	EMB170	<0.1	0.0	<0.1	<0.1	0.1
	EMB175	<0.1	0.0	<0.1	<0.1	0.2
	EMB190	4.3	0.5	3.9	0.9	9.6
	F10062	<0.1	0.0	<0.1	<0.1	0.1
	MD11GE	<0.1	<0.1	0.1	<0.1	0.3
	MD11PW	0.3	0.1	0.3	0.1	0.9
	MD81	<0.1	0.0	<0.1	0.0	<0.1
	MD82	2.6	0.7	3.3	<0.1	6.6
	MD83	7.8	1.3	8.5	0.6	18.3
	MD9025	1.3	<0.1	1.3	<0.1	2.7
	MD9028	0.7	<0.1	0.7	<0.1	1.5

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
Air Carrier Subtotal		249.6	36.7	255.5	30.8	572.5
Air Taxi	*BE36	<0.1	0.0	<0.1	0.0	<0.1
	*COL4	<0.1	0.0	<0.1	0.0	<0.1
	*E50P	<0.1	<0.1	<0.1	<0.1	0.2
	*E55P	0.2	<0.1	0.2	<0.1	0.5
	*LJ40	0.2	<0.1	0.2	<0.1	0.5
	*TBM8	0.0	0.0	<0.1	0.0	<0.1
	BEC58P	0.7	1.4	1.3	0.8	4.2
	CIT3	<0.1	0.0	<0.1	0.0	<0.1
	CL600	1.2	0.1	1.3	<0.1	2.6
	CL601	7.8	1.4	7.0	2.3	18.5
	CNA172	<0.1	0.0	<0.1	0.0	<0.1
	CNA182	<0.1	0.0	<0.1	0.0	<0.1
	CNA206	<0.1	0.0	<0.1	0.0	<0.1
	CNA208	4.3	2.3	4.1	2.5	13.2
	CNA441	0.0	0.1	0.0	0.1	0.3
	CNA510	<0.1	0.0	<0.1	0.0	<0.1
	CNA525C	0.2	0.0	0.2	0.0	0.4
	CNA55B	0.2	<0.1	0.1	<0.1	0.3
	CNA560E	0.5	<0.1	0.5	<0.1	1.0
	CNA560XL	2.2	0.1	2.2	0.1	4.6
	CNA680	0.8	<0.1	0.8	<0.1	1.7
	CNA750	0.9	<0.1	0.9	<0.1	1.9
	CVR580	<0.1	0.0	<0.1	0.0	<0.1
	DHC6	0	<0.1	0.0	<0.1	<0.1
	DHC8	5.7	1.2	6.1	0.8	13.8
	DHC830	4.1	0.6	4.1	0.6	9.4
	DO228	<0.1	0.0	<0.1	0.0	<0.1
	ECLIPSE500	<0.1	<0.1	<0.1	0.0	<0.1
	EMB145	3.4	0.5	3.2	0.7	7.8
	EMB14L	7.6	1.2	7.4	1.3	17.4
	GASEPV	0.1	<0.1	0.1	<0.1	0.3
	GIIB	<0.1	0.0	<0.1	0.0	<0.1
	GIV	<0.1	<0.1	0.1	0.0	0.2
	GV	<0.1	0.0	<0.1	0.0	0.1
	IA1125	<0.1	0.0	<0.1	0.0	<0.1
	LEAR35	1.4	0.1	1.4	0.1	3.0
	MU3001	0.6	<0.1	0.6	<0.1	1.3
	SD330	0.7	<0.1	0.7	<0.1	1.4
Air Taxi Sub-total		43.0	9.5	42.8	9.7	105.0
General Aviation	*B350	0.2	<0.1	0.2	<0.1	0.4
	*BE36	0.1	0.0	<0.1	<0.1	0.2
	*COL3	<0.1	0.0	<0.1	0.0	<0.1
	*COL4	<0.1	0.0	<0.1	0.0	<0.1
	*DA40	<0.1	0.0	<0.1	0.0	<0.1
	*E50P	<0.1	<0.1	<0.1	<0.1	<0.1
	*E55P	<0.1	0.0	<0.1	<0.1	0.2
	*FA7X	<0.1	0.0	<0.1	0.0	<0.1

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
	*H25C	<0.1	<0.1	<0.1	0.0	<0.1
	*KODI	<0.1	<0.1	<0.1	0.0	<0.1
	*LJ40	<0.1	0.0	<0.1	<0.1	<0.1
	*P46T	0.4	<0.1	0.4	<0.1	0.7
	*TBM8	<0.1	0.0	<0.1	0.0	0.1
	1900D	<0.1	<0.1	0.1	0.0	0.2
	737700	0.1	<0.1	0.1	<0.1	0.3
	737800	<0.1	0.0	<0.1	0.0	<0.1
	757RR	<0.1	<0.1	<0.1	0.0	<0.1
	767300	0.0	<0.1	<0.1	0.0	<0.1
	767CF6	<0.1	<0.1	<0.1	0.0	<0.1
	A109	<0.1	0.0	<0.1	0.0	<0.1
	B206L	<0.1	0.0	<0.1	0.0	<0.1
	B212	<0.1	0.0	<0.1	0.0	<0.1
	B407	<0.1	<0.1	<0.1	<0.1	0.2
	B429	<0.1	0.0	0.0	<0.1	<0.1
	B430	<0.1	0.0	<0.1	0.0	<0.1
	BEC58P	0.8	<0.1	0.7	<0.1	1.6
	CIT3	0.2	0.0	0.2	<0.1	0.4
	CL600	0.9	<0.1	0.9	<0.1	1.9
	CL601	1.0	<0.1	1.1	<0.1	2.3
	CNA172	1.1	<0.1	1.1	<0.1	2.4
	CNA182	0.4	<0.1	0.4	<0.1	0.8
	CNA206	0.1	<0.1	0.2	0.0	0.3
	CNA208	0.6	<0.1	0.7	<0.1	1.3
	CNA20T	<0.1	0.0	<0.1	0.0	<0.1
	CNA441	0.8	<0.1	0.8	<0.1	1.6
	CNA500	0.2	<0.1	0.2	<0.1	0.3
	CNA510	<0.1	0.0	<0.1	<0.1	<0.1
	CNA525C	0.7	<0.1	0.7	<0.1	1.4
	CNA55B	0.6	<0.1	0.6	<0.1	1.3
	CNA560E	0.5	<0.1	0.5	<0.1	1.1
	CNA560U	<0.1	0.0	<0.1	<0.1	0.2
	CNA560XL	0.6	<0.1	0.6	<0.1	1.2
	CNA680	0.3	<0.1	0.3	<0.1	0.8
	CNA750	0.4	<0.1	0.4	<0.1	0.8
	CRJ9-ER	<0.1	0.0	<0.1	0.0	<0.1
	DHC8	0.4	0.1	0.5	<0.1	1.0
	DO228	0.2	0.0	0.2	<0.1	0.5
	EC130	<0.1	<0.1	<0.1	<0.1	<0.1
	ECLIPSE500	<0.1	0.0	<0.1	0.0	<0.1
	EMB145	<0.1	0.0	<0.1	<0.1	<0.1
	F10062	0.4	<0.1	0.4	<0.1	0.9
	GASEPF	<0.1	0.0	<0.1	<0.1	<0.1
	GASEPV	2.4	<0.1	2.3	<0.1	4.8
	GIIB	<0.1	0.0	<0.1	<0.1	0.1
	GIV	0.6	<0.1	0.6	<0.1	1.3
	GV	0.5	<0.1	0.6	<0.1	1.3

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
	HS748A	<0.1	0.0	<0.1	<0.1	<0.1
	IA1125	0.3	<0.1	0.3	<0.1	0.5
	LEAR25	<0.1	<0.1	<0.1	<0.1	<0.1
	LEAR35	2.1	0.2	2.1	0.2	4.7
	MU3001	0.8	<0.1	0.8	<0.1	1.8
	PA28	0.2	<0.1	0.2	<0.1	0.5
	PA30	<0.1	0.0	<0.1	0.0	<0.1
	PA31	0.2	<0.1	0.2	<0.1	0.3
	PA42	<0.1	<0.1	<0.1	<0.1	<0.1
	R22	<0.1	<0.1	<0.1	0.0	0.2
	R44	<0.1	0.0	<0.1	0.0	<0.1
	S76	0.1	<0.1	0.1	0.0	0.2
	SA330J	<0.1	0.0	<0.1	0.0	<0.1
	SA365N	<0.1	0.0	<0.1	0.0	<0.1
	SD330	<0.1	0.0	<0.1	0.0	<0.1
General Aviation Sub-total		19.5	1.5	19.7	1.2	41.8
Military	737800	<0.1	0.0	<0.1	0.0	<0.1
	C130	0.1	0.0	0.1	0.0	0.2
	CNA441	1.0	0.0	1.0	0.0	2.0
	DHC6	<0.1	0.0	<0.1	0.0	<0.1
	SD330	0.1	<0.1	0.1	<0.1	0.3
Military Subtotal		1.3	<0.1	1.3	<0.1	2.6
Grand Total		313.3	47.7	319.3	41.7	722.0

Notes:
*Non-standard substitution or user defined aircraft. See Section 4.2.3 for additional information, project specific request, and FAA approval.
Totals and subtotals may not match exactly due to rounding.

Table 11 2019 Modeled Average Daily Aircraft Operations

Source HMMH, May 2014

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
Air Carrier	*DC86	0.2	0.1	0.2	<0.1	0.6
	717200	0.6	<0.1	0.6	<0.1	1.2
	727EM2	<0.1	0.0	<0.1	0.0	<0.1
	737300	24.2	2.2	24.2	2.2	52.9
	7373B2	1.6	0.1	1.6	0.2	3.4
	737400	<0.1	0.0	<0.1	<0.1	<0.1
	737500	0.3	0.1	0.3	0.1	0.8
	737700	176.3	18.2	177.1	17.4	389.0
	737800	30.7	9.6	34.7	5.6	80.6
	737N17	<0.1	0.0	<0.1	0.0	<0.1
	74720A	<0.1	0.0	<0.1	0.0	<0.1
	74720B	<0.1	<0.1	<0.1	<0.1	<0.1
	747400	0.3	<0.1	0.2	0.2	0.7
	757300	<0.1	0.0	<0.1	0.0	<0.1
	757PW	<0.1	0.3	0.3	<0.1	0.6
	757RR	1.2	0.9	1.8	0.3	4.2
	767300	3.0	2.0	1.9	3.0	9.8
	767400	<0.1	0.0	<0.1	0.0	<0.1
	767CF6	<0.1	<0.1	<0.1	0.0	<0.1
	767JT9	<0.1	0.0	0.0	<0.1	<0.1
	777200	0.4	<0.1	<0.1	0.3	0.7
	A300-622R	0.2	1.2	0.7	0.7	2.7
	A310-304	<0.1	0.0	0.0	<0.1	<0.1
	A319-131	5.0	1.7	5.0	1.8	13.5
	A320-211	2.8	1.5	4.0	0.3	8.6
	A320-232	4.3	1.8	5.3	0.8	12.3
	A321-232	8.7	1.5	9.3	0.9	20.4
	A330-301	<0.1	<0.1	<0.1	<0.1	<0.1
	CRJ9-ER	1.4	<0.1	1.4	<0.1	3.0
	CRJ9-LR	0.3	0.0	0.3	<0.1	0.6
	DC93LW	<0.1	0.0	0.0	<0.1	<0.1
	EMB170	<0.1	0.0	<0.1	<0.1	0.1
	EMB175	7.6	1.5	7.5	1.5	18.1
	EMB190	4.9	0.6	4.5	1.0	11.1
	F10062	<0.1	0.0	<0.1	<0.1	0.1
	MD11GE	<0.1	<0.1	0.1	<0.1	0.3
	MD11PW	0.3	0.1	0.3	0.1	0.9
	MD81	<0.1	0.0	<0.1	0.0	<0.1
	MD82	1.1	0.3	1.3	<0.1	2.6
	MD83	7.1	1.0	7.5	0.6	16.2
	MD9025	1.3	<0.1	1.3	<0.1	2.7
	MD9028	0.7	<0.1	0.7	<0.1	1.5
Air Carrier Subtotal		284.8	45.1	292.6	37.3	659.8
Air Taxi	*BE36	<0.1	0.0	<0.1	0.0	<0.1

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
	*COL4	<0.1	0.0	<0.1	0.0	<0.1
	*E50P	<0.1	<0.1	<0.1	<0.1	0.2
	*E55P	0.2	<0.1	0.2	<0.1	0.5
	*LJ40	0.2	<0.1	0.2	<0.1	0.5
	*TBM8	0.0	0.0	<0.1	0.0	<0.1
	BEC58P	0.8	1.5	1.4	0.9	4.6
	CIT3	<0.1	0.0	<0.1	0.0	<0.1
	CL600	1.3	0.1	1.4	<0.1	2.9
	CL601	8.6	1.6	7.7	2.5	20.3
	CNA172	<0.1	0.0	<0.1	0.0	<0.1
	CNA182	<0.1	0.0	<0.1	0.0	<0.1
	CNA206	<0.1	0.0	<0.1	0.0	<0.1
	CNA208	4.7	2.5	4.5	2.7	14.4
	CNA441	0.0	0.1	0.0	0.1	0.3
	CNA510	<0.1	0.0	<0.1	0.0	<0.1
	CNA525C	0.2	0.0	0.2	0.0	0.4
	CNA55B	0.2	<0.1	0.1	<0.1	0.3
	CNA560E	0.5	<0.1	0.5	<0.1	1.0
	CNA560XL	2.4	0.1	2.4	0.1	5.0
	CNA680	0.8	<0.1	0.8	<0.1	1.7
	CNA750	1.0	<0.1	1.0	<0.1	2.1
	CVR580	<0.1	0.0	<0.1	0.0	<0.1
	DHC6	0.0	<0.1	0.0	<0.1	<0.1
	DHC8	5.7	1.2	6.1	0.8	13.8
	DHC830	4.1	0.6	4.1	0.6	9.4
	DO228	<0.1	0.0	<0.1	0.0	<0.1
	ECLIPSE500	<0.1	<0.1	<0.1	0.0	<0.1
	EMB145	0.8	<0.1	0.8	0.1	1.8
	EMB14L	3.7	0.4	3.4	0.7	8.1
	GASEPV	0.1	<0.1	0.1	<0.1	0.3
	GIV	0.1	<0.1	0.2	0.0	0.3
	GV	<0.1	0.0	<0.1	0.0	0.1
	IA1125	<0.1	0.0	<0.1	0.0	<0.1
	LEAR35	1.4	0.1	1.4	0.1	3.0
	MU3001	0.6	<0.1	0.6	<0.1	1.3
	SD330	0.7	<0.1	0.8	<0.1	1.5
Air Taxi Subtotal		38.3	8.7	38.1	9.0	94.1
General Aviation	*B350	0.2	<0.1	0.2	<0.1	0.5
	*BE36	0.1	0.0	<0.1	<0.1	0.2
	*COL3	<0.1	0.0	<0.1	0.0	<0.1
	*COL4	<0.1	0.0	<0.1	0.0	0.1
	*DA40	<0.1	0.0	<0.1	0.0	<0.1
	*E50P	<0.1	<0.1	<0.1	<0.1	0.1
	*E55P	<0.1	0.0	<0.1	<0.1	0.2
	*FA7X	<0.1	0.0	<0.1	0.0	<0.1
	*H25C	<0.1	<0.1	<0.1	0.0	<0.1
	*KODI	<0.1	<0.1	<0.1	0.0	<0.1
	*LJ40	<0.1	0.0	<0.1	<0.1	<0.1

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
	*P46T	0.4	<0.1	0.4	<0.1	0.8
	*TBM8	<0.1	0.0	<0.1	0.0	0.1
	1900D	<0.1	<0.1	0.1	0.0	0.2
	737700	0.1	<0.1	0.1	<0.1	0.3
	737800	<0.1	0.0	<0.1	0.0	<0.1
	757RR	<0.1	<0.1	<0.1	0.0	<0.1
	767300	0.0	<0.1	<0.1	0.0	<0.1
	767CF6	<0.1	<0.1	<0.1	0.0	<0.1
	A109	<0.1	0.0	<0.1	0.0	<0.1
	B206L	<0.1	0.0	<0.1	0.0	<0.1
	B212	<0.1	0.0	<0.1	0.0	<0.1
	B407	<0.1	<0.1	<0.1	<0.1	0.2
	B429	<0.1	0.0	0.0	<0.1	<0.1
	B430	<0.1	0.0	<0.1	0.0	<0.1
	BEC58P	0.8	<0.1	0.8	<0.1	1.8
	CIT3	0.2	0.0	0.2	<0.1	0.4
	CL600	1.0	<0.1	1.0	<0.1	2.1
	CL601	1.1	<0.1	1.2	<0.1	2.5
	CNA172	1.2	<0.1	1.2	<0.1	2.6
	CNA182	0.4	<0.1	0.4	<0.1	0.9
	CNA206	0.1	<0.1	0.2	0.0	0.3
	CNA208	0.7	<0.1	0.7	<0.1	1.5
	CNA20T	<0.1	0.0	<0.1	0.0	<0.1
	CNA441	0.8	<0.1	0.8	<0.1	1.6
	CNA500	0.2	<0.1	0.2	<0.1	0.3
	CNA510	<0.1	0.0	<0.1	<0.1	<0.1
	CNA525C	0.7	<0.1	0.7	<0.1	1.5
	CNA55B	0.6	<0.1	0.6	<0.1	1.3
	CNA560E	0.5	<0.1	0.5	<0.1	1.1
	CNA560U	<0.1	0.0	<0.1	<0.1	0.2
	CNA560XL	0.6	<0.1	0.6	<0.1	1.3
	CNA680	0.3	<0.1	0.3	<0.1	0.8
	CNA750	0.4	<0.1	0.4	<0.1	0.9
	CRJ9-ER	<0.1	0.0	<0.1	0.0	<0.1
	DHC8	0.4	0.1	0.5	<0.1	1.0
	DO228	0.3	0.0	0.2	<0.1	0.5
	EC130	<0.1	<0.1	<0.1	<0.1	<0.1
	ECLIPSE500	<0.1	0.0	<0.1	0.0	<0.1
	EMB145	<0.1	0.0	<0.1	<0.1	<0.1
	F10062	0.4	<0.1	0.4	<0.1	0.9
	GASEPF	<0.1	0.0	<0.1	<0.1	<0.1
	GASEPV	2.6	<0.1	2.5	<0.1	5.2
	GIV	0.7	<0.1	0.7	<0.1	1.6
	GV	0.6	0.1	0.7	<0.1	1.4
	HS748A	<0.1	0.0	<0.1	<0.1	<0.1
	IA1125	0.3	<0.1	0.3	<0.1	0.5
	LEAR35	2.1	0.3	2.2	0.2	4.8
	MU3001	0.8	<0.1	0.8	<0.1	1.8

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Total
		Day	Night	Day	Night	
	PA28	0.2	<0.1	0.3	<0.1	0.6
	PA30	<0.1	0.0	<0.1	0.0	<0.1
	PA31	0.2	<0.1	0.2	<0.1	0.3
	PA42	<0.1	<0.1	<0.1	<0.1	<0.1
	R22	<0.1	<0.1	<0.1	0.0	0.2
	R44	<0.1	0.0	<0.1	0.0	<0.1
	S76	0.1	<0.1	0.1	0.0	0.3
	SA330J	<0.1	0.0	<0.1	0.0	<0.1
	SA365N	<0.1	0.0	<0.1	0.0	<0.1
	SD330	<0.1	0.0	<0.1	0.0	<0.1
General Aviation Subtotal		20.5	1.5	20.8	1.2	44.1
Military	737800	<0.1	0.0	<0.1	0.0	<0.1
	C130	0.1	0.0	0.1	0.0	0.2
	CNA441	1.0	0.0	1.0	0.0	2.0
	DHC6	<0.1	0.0	<0.1	0.0	<0.1
	SD330	0.1	<0.1	0.1	<0.1	0.3
Military Subtotal		1.3	<0.1	1.3	<0.1	2.6
Grand Total		344.9	55.4	352.8	47.5	800.7

Notes:
*Non-standard substitution or user defined aircraft. See Section 4.2.3 for additional information, project specific request, and FAA approval.
Totals and subtotals may not match exactly due to rounding.

4.2.4 Runway utilization

The BWI Marshall operations database contains a record of each flight detected by passive radar in the Airport's noise and operations monitoring system. Each record in the database contains the date and time of flight and the runway used. From these records, overall runway usage tables for 2014 and 2019 were compiled by arrival or departure.

Part 150 requires that the NEMs represent average annual conditions at the time of submittal. In recent months, MAA has occasionally closed BWI Marshall's runways for maintenance. For preparation of the NEM, days that did not have runway closures were used to develop a typical runway use. Days that had closure because of runway maintenance periods were excluded from the analysis.[40] The resulting NEM runway use was compared to, and verified against, historical BWI Marshall runway use statistics which are provided in MAA's quarterly reports.[41]

This data sample is the same as that discussed in Section 4.2.2. Table 12 presents the 2014 modeled air carrier, air taxi, general aviation and military runway utilization rates that HMMH developed for this study. Table 13 presents the 2019 modeled air carrier, air taxi, general aviation, and military runway utilization rates.

[40] MAA posts maintenance for the upcoming week at http://www.maacommunityrelations.com/index.php http://www.maacommunityrelations.com/closures.pdf.
[41] MAA's quarterly reports are available at http://www.maacommunityrelations.com/content/anznoiseupdate/quarterlynoisereports.php.

There are no airport layout changes that are expected to cause a change in the average annual runway use. Therefore, the runway use for 2019 is nearly identical to 2014, with the values in Table 13 typically less than one percent compared to the respective value in Table 12. The small changes between the two forecast years are related to the different growth and retirement rates for specific types of aircraft.[42]

[42] The largest change in the runway percent values between 2014 and 2019 is with Air Taxi aircraft particularly with a larger percent of activity on Runway 15L/33R (which is 5,000 ft. long). However overall, Air Taxi operations are forecasted to decrease, as noted in Table 9, Table 10 and Table 11. The Air Taxi aircraft that predominately use Runway 10/28 and Runway 15R/33L are expected to be retired, especially, American Eagle's Embraer135/140/145s, which are represented in Table 10 and Table 11 as EMB145 and EMB14L and discussed specifically in Appendix C.

Table 12 2014 Runway Use

Source HMMH, August 2014

Aircraft Category	Runway*	Arrivals		Departures	
		Day	Night	Day	Night
Air Carrier	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	26.6%	26.4%	< 0.1%	0.4%
	15L	< 0.1%	< 0.1%	< 0.1%	0.0%
	15R	1.1%	3.1%	28.0%	27.7%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.8%	4.2%	70.5%	69.0%
	33L	69.5%	66.3%	1.4%	2.9%
	33R	< 0.1%	0.0%	< 0.1%	< 0.1%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Air Taxi	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	15.4%	9.3%	0.2%	0.4%
	15L	11.5%	19.1%	13.8%	12.7%
	15R	1.0%	2.3%	13.6%	9.5%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.4%	6.2%	38.3%	39.8%
	33L	36.7%	26.7%	0.8%	2.5%
	33R	33.0%	36.3%	33.3%	35.1%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
General Aviation	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	11.1%	13.2%	0.3%	0.0%
	15L	14.8%	12.7%	20.6%	20.2%
	15R	0.8%	2.3%	5.9%	4.1%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	4.7%	2.8%	15.1%	13.6%
	33L	16.5%	24.7%	0.3%	3.4%
	33R	49.6%	39.8%	55.3%	56.6%
	H	2.3%	4.5%	2.5%	2.0%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Military	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	2.6%	0.0%	0.0%	0.0%
	15L	21.1%	0.0%	27.0%	0.0%
	15R	0.0%	0.0%	0.0%	0.0%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.6%	100.0%	13.2%	0.0%
	33L	10.5%	0.0%	0.0%	0.0%
	33R	63.2%	0.0%	59.7%	100.0%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Notes:
*Runway 4/22 was permanently closed on August 6, 2014. This NEM does not include operations on Runway 4/22.
Totals may not match exactly due to rounding.

Table 13 2019 Runway Use

Source HMMH, May 2014

Aircraft Category	Runway	Arrivals		Departures	
		Day	Night	Day	Night
Air Carrier	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	26.9%	26.1%	< 0.1%	0.4%
	15L	< 0.1%	< 0.1%	< 0.1%	0.0%
	15R	1.1%	3.6%	28.2%	27.2%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.8%	4.6%	70.3%	69.5%
	33L	69.1%	65.7%	1.4%	2.9%
	33R	< 0.1%	0.0%	< 0.1%	< 0.1%
	Total	**100.0%**	**100.00%**	**100.0%**	**100.0%**
Air Taxi	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	13.3%	7.0%	0.2%	0.4%
	15L	13.5%	22.0%	16.2%	14.7%
	15R	0.9%	1.8%	10.9%	7.8%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.3%	6.2%	32.7%	33.8%
	33L	31.2%	20.9%	0.7%	2.6%
	33R	38.8%	42.0%	39.2%	40.7%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
General Aviation	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	11.0%	13.1%	0.3%	0.0%
	15L	14.9%	12.6%	20.6%	20.2%
	15R	0.8%	2.3%	5.8%	4.2%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	4.8%	2.9%	14.9%	13.4%
	33L	16.3%	24.7%	0.3%	3.4%
	33R	49.7%	39.7%	55.5%	56.7%
	H	2.4%	4.7%	2.6%	2.1%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Military	*4**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	10	2.6%	0.0%	0.0%	0.0%
	15L	21.1%	0.0%	27.0%	0.0%
	15R	0.0%	0.0%	0.0%	0.0%
	*22**	*0.0%*	*0.0%*	*0.0%*	*0.0%*
	28	2.6%	100.0%	13.2%	0.0%
	33L	10.5%	0.0%	0.0%	0.0%
	33R	63.2%	0.0%	59.7%	100.0%
	Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Notes:
*Runway 4/22 was permanently closed on August 6, 2014. This NEM does not include operations on Runway 4/22.
Totals may not match exactly due to rounding.

4.2.5 Flight track geometry

HMMH has developed a pre-processor named "RealContours™" that converts radar flight tracks to INM tracks, thereby modeling each and every radar flight track as an INM flight track. The operations on individual flight tracks are then weighted to develop annual average noise modeling inputs for each year.

Figure 14, Sheet 1 and Sheet 2 depict a representative sample of the radar developed model tracks for the 2014 NEM.[43] The representative sample is a random sample of approximately one percent of the flights tracks from across the whole year. A total of 150,145 individual model tracks were modeled for the 2014 NEM. The 150,145 individual tracks were scaled to represent the 263,530 annual operations in 2014 (in other words, 722.0 average annual day operations) documented in Section 4.2.2. Figure 14, Sheet 1 presents a representative sample of 1,460 departure model tracks. Figure 14, Sheet 2 presents a similarly representative sample of 1,544 arrival model tracks.

Figure 15 through Figure 18 present generalized depictions of all the flight tracks and operations used in the 2014 contours. Rather than presenting every individual track equally, these "flight track density plots" use color gradations to depict the flight track geometry, dispersion, and the relative frequency of overflights in areas of interest. The color ranges are assigned based on the relative density of modeled aircraft operations included in the development of the 2014 contours. In other words, individual tracks represent different numbers of operations in order to represent average annual conditions, and that is taken into account in these density plots. Note that these figures, by themselves, do not indicate noise exposure and they have not been adjusted for aircraft altitudes.

The flight tracks have been organized into four distinct sets:

- Figure 15 presents the 52,320 west flow departures tracks.
- Figure 16 presents the 55,885 west flow arrivals tracks.
- Figure 17 presents the 20,247 east flow departures tracks.
- Figure 18 presents the 21,693 east flow arrivals tracks.

Figure 19, Sheet 1 and Sheet 2 depict a representative sample of the radar developed model tracks for the 2019 NEM.[44] The 2019 NEM set of flight tracks is based on 132,860 individual model tracks from the 2014 NEM. The weighting of each of these tracks was adjusted to reflect the forecast level and types of operations in 2019. The reduction in model tracks from the 2014 NEM to the 2019 NEM is caused by the retirement of some aircraft types, as discussed in Section 4.2.2 and referenced in Appendix C. In other words, only the tracks from the 2014 NEM that are associated with operations not forecasted to be present in 2019 were removed. In summary, the 132,860 individual tracks were scaled to represented the 292,253 annual operations (in other words, 800.7 average annual day operations) documented in Section 4.2.2. Figure 19, Sheet 1 presents a representative sample of 1,281 departure model tracks. Figure 19, Sheet 2 presents a similarly representative sample of 1,373 arrival model tracks.

[43] Figure 14, Sheet 1, Figure 14 Sheet 2, and Figure 19, Sheet 1 and Figure 19, Sheet 2 meet Part 150 requirements when plotted at 1 inch equals 2,000 feet. To meet those requirements, the electronic versions of the figures are to be plotted 300% on 33 inch by 51 inch paper (or larger).
[44] Figure 14, Sheet 1, Figure 14 Sheet 2, and Figure 19, Sheet 1 and Figure 19, Sheet 2 meet Part 150 requirements when plotted at 1 inch equals 2,000 feet. To meet those requirements, the electronic versions of the figures are to be plotted 300% on 33 inch by 51 inch paper (or larger).

Appendix D includes all radar developed model tracks and INM input files from RealContours™ in electronic format.

4.2.6 Aircraft Stage Length

Within the INM database, aircraft takeoff or departure profiles are usually defined by a range of trip distances identified as "stage lengths." A longer trip distance or higher stage length is associated with a heavier aircraft due to the increase in fuel requirements for the flight. For this study, city pair distances were determined for each departure flight track and used in most cases to define the specific stage length using the INM standard definitions.

INM uses stage length as a means to estimate the aircraft weight on departure. Aircraft weight is required to determine the climb performance profile of the aircraft on departure. Stage length is the term used in INM to refer to the length or distance of the complete nonstop flight planned for each departure operation from origin to destination. The flight distance influences the take-off weight of the aircraft as more fuel is required to go greater distances. Aircraft weight is a factor in the aircraft's thrust and performance. The great-circle distance is used to calculate a stage length for each aircraft operation. Great-circle distance is the shortest distance between any two points on the surface of a sphere (earth) measured along the path on the surface of the earth. Nine categories for departure stage length are used in INM.

The stage-length of each individual flight was calculated based on the destination airport on the flight plan.[45] RealContours™ compares each flight's city-pair great-circle distance to the available stage-lengths available in the default INM database and makes an appropriate selection.[46] INM does not have all stage lengths available for all aircraft. In cases where the stage length was not available or exceeded the maximum stage-length profile available for that runway (i.e., the aircraft would not over run the runway on departure), the maximum stage length available without overrunning the runway was selected. If a particular INM aircraft has multiple available default profiles in INM for a given stage-length, RealContours™ compares the flight track's altitude profile to the available default INM profiles, and assigns a default INM profile based on the closest match.[47]

Table 14 presents the nine categories for departure stage length used in INM and the respective number of departures modeled for 2014 and 2019.

[45] EnvironmentalVue is a product of Exelis Inc. The BWI noise and operation system did not provide the destination airport for BWI departures or the originating airport for BWI arrivals. Therefore for this analysis, flightplan data were purchased from FlightAware (http://flightaware.com/). Data from FlightAware were associated with the data provided through EvnvironmentalVue on a flight by flight basis and provided the city-pair information.

[46] The stage-length lookup table is defined in Section 9.6.3 of the INM 7.0 User's Guide.

[47] This process is INM aircraft type specific. The term "default INM profiles" refers to a profile that is included in the INM database (as opposed to user-defined; there are no user-defined profiles in this analysis). INM can include multiple default profiles for commercial aircraft including "STANDARD", "ICAO A" or "ICAO B". Additional discussion regarding the different default profiles is provided in the INM 7.0 Technical Manual, Section 6. Some general aviation aircraft in INM may also include multiple profiles. Aircraft specific documentation is included in the respective INM release notes at the time of introduction of that aircraft or modification of the default profiles between versions of the INM.

Table 14 Stage Length, Trip Length and Modeled Departures for 2014 and 2019

Source FAA INM 7.0 Technical Manual, FlightAware, HMMH, 2014

Stage Length Number	Trip Length (nmi)	2014 Departures		2019 Departures	
		Day	Night	Day	Night
D-1	0 - 500	191.5	27.9	195.7	30.3
D-2	500 - 1,000	83.1	8.7	88.7	10.7
D-3	1,000 - 1,500	27.0	2.2	37.0	2.8
D-4	1,500 - 2,500	16.7	2.6	30.3	3.3
D-5	2,500 - 3,500	0.8	0.3	1.0	0.4
D-6	3,500 - 4,500	0.1	0.1	0.1	0.1
D-7	4,500 - 5,500	0.0	0.0	0.0	0.0
D-8	5,500 - 6,500	<0.1	0.0	<0.1	0.0
D-9	Greater than 6,500	0.0	0.0	0.0	0.0
Total		319.3	41.7	352.8	47.5

Note: Totals may not match exactly due to rounding.

4.2.7 Meteorological Conditions

The INM has several settings that affect aircraft performance profiles and sound propagation based on meteorological data at the Airport. Meteorological settings include average temperature, barometric pressure, relative humidity, and headwind speed. A ten year weather data average spanning calendar years 2003 to 2012 from the National Climatic Data Center (NCDC) Integrated Surface Database (ISD)[48] for BWI Marshall (WBAN number 93721) was collected and reviewed. Based on analysis of the NCDC data, the average conditions used in the INM for BWI Marshall noise modeling include:

- Temperature: 56.6º Fahrenheit
- Sea level pressure: 30.02 inches of Mercury (in-Hg)
- Relative humidity: 66.3 percent.
- Average headwind speed: INM default of 8.0 knots.

4.2.8 Terrain

Terrain data describe the elevation of the ground surrounding the airport and on airport property. The INM uses terrain data to adjust the ground level under the flight paths. The terrain data do not affect the aircraft's performance or emitted noise levels, but do affect the vertical distance between the aircraft and a "receiver" on the ground. This in turn affects the noise levels received at a particular point on the ground. The terrain data were obtained from the United States Geological Survey (USGS) National Map Viewer.[49] Terrain data were not included in the previous 14 CFR Part 150 for BWI Marshall.

[48] http://www.ncdc.noaa.gov/oa/climate/isd/

[49] Data downloaded from http://viewer.nationalmap.gov/viewer/ on 05/31/2013 in 1/3 Arc-second GridFloat format.

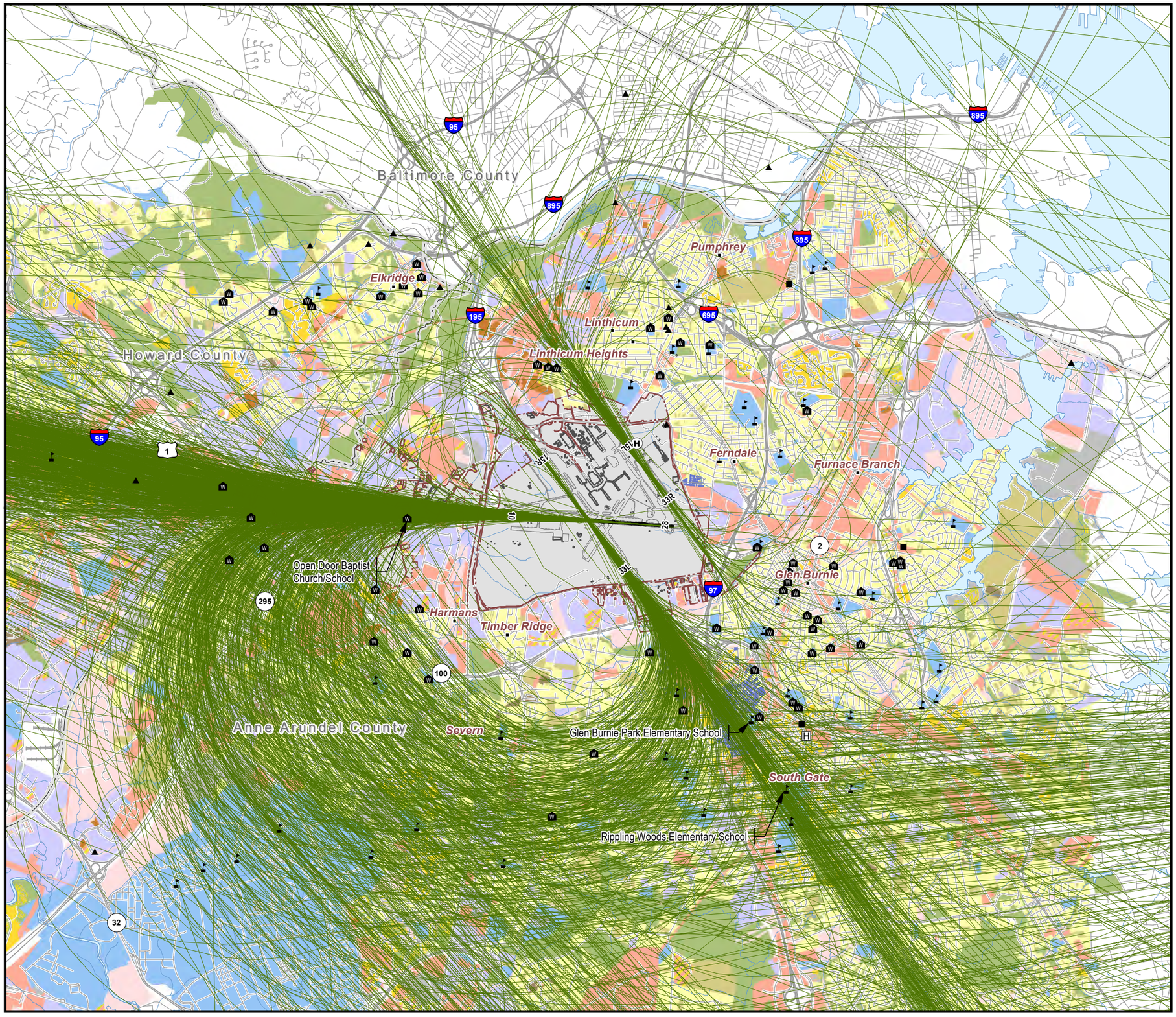
4.2.9 Aircraft Maintenance Engine Run-ups

MAA maintains evening engine run-up logs for aircraft affected by the BWI Marshall Maintenance Engine Run-up Policy. Run-ups are permitted in the holding block of Runway 10, with the nose of the aircraft positioned on a magnetic heading between 190° and 220°, or as an overflow in the holding block of Runway 33L, with the nose of the aircraft positioned on a magnetic heading between 140° and 160°. During the 2016 – 2020 timeframe, the holding block at Runway 10 will be demolished. MAA is considering a new area that will allow run-ups on the same portion of the airfield. Any interruption to service at the existing site would be temporary/brief and occur only as the new site is under construction. For modeling purposes at this time, all future run-ups are modeled at the holding block at Runway 10.[50]

Using the calendar year 2008 through 2012 (inclusive) evening run-up logs as a basis, daily run-up operations were projected for the base year 2014 and forecast year 2019.The five-year average was about 19 run-ups per year.

The sound levels from these operations were then included in the computation of each contour. Run-up operations have minimal effect on the overall contours, only slightly affecting the north-west region of the Airport near the Runway 10 holding block.

[50] Source: Maryland Aviation Administration, Division of Airport Facilities and Planning.



BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

2014 NEM Representative Sample of Model Tracks
Figure 14 - Sheet 1, Departure Tracks

- Model Departure Tracks
- BWI Airport Property
- Existing Airport Runways
- Existing Helicopter Pad

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

N

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hmmh

June 2016

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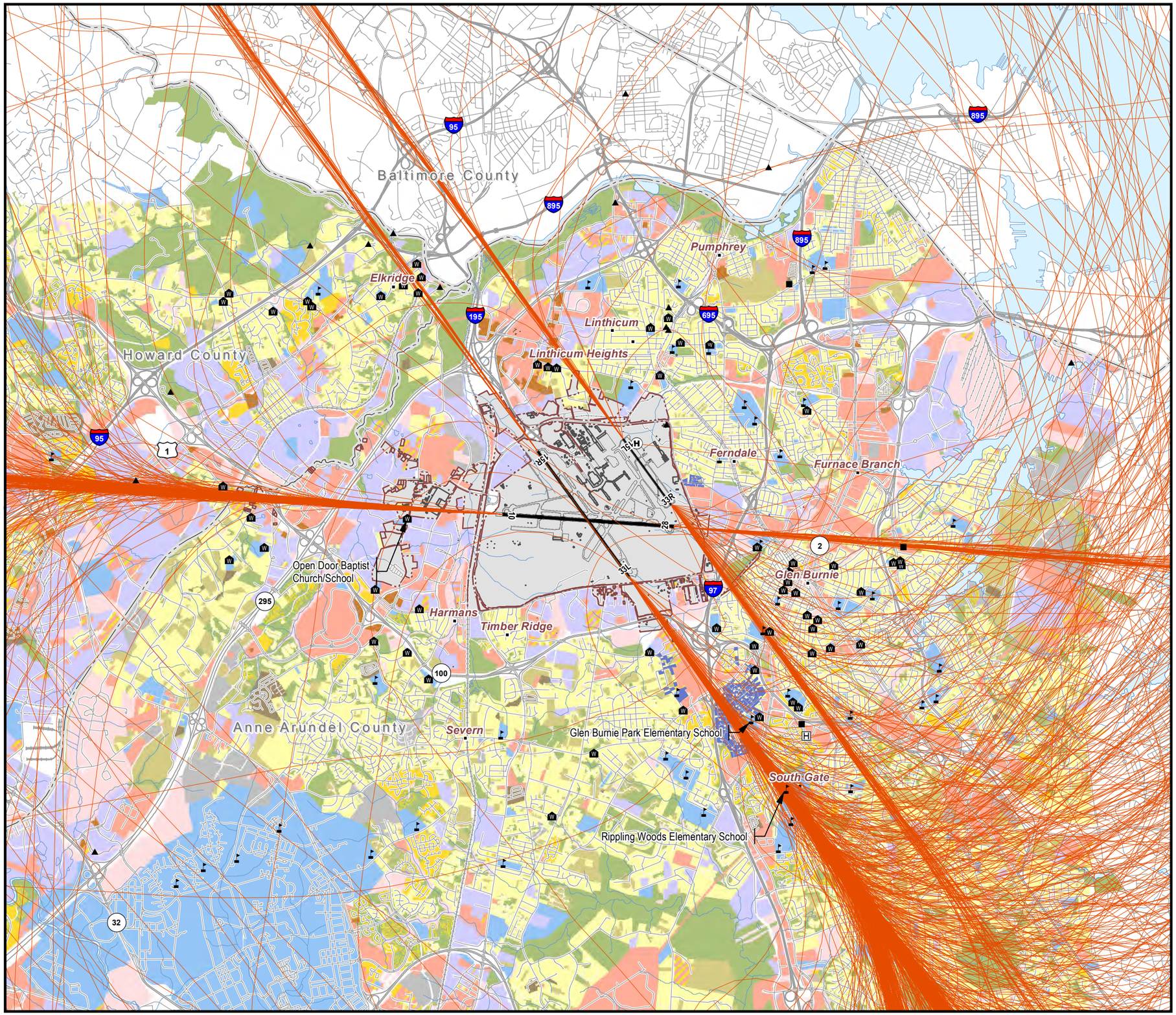

BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

2014 NEM Representative Sample of Model Tracks
Figure 14 - Sheet 2, Arrival Tracks

- Model Arrival Tracks
- BWI Airport Property
- Existing Airport Runways
- Existing Helicopter Pad

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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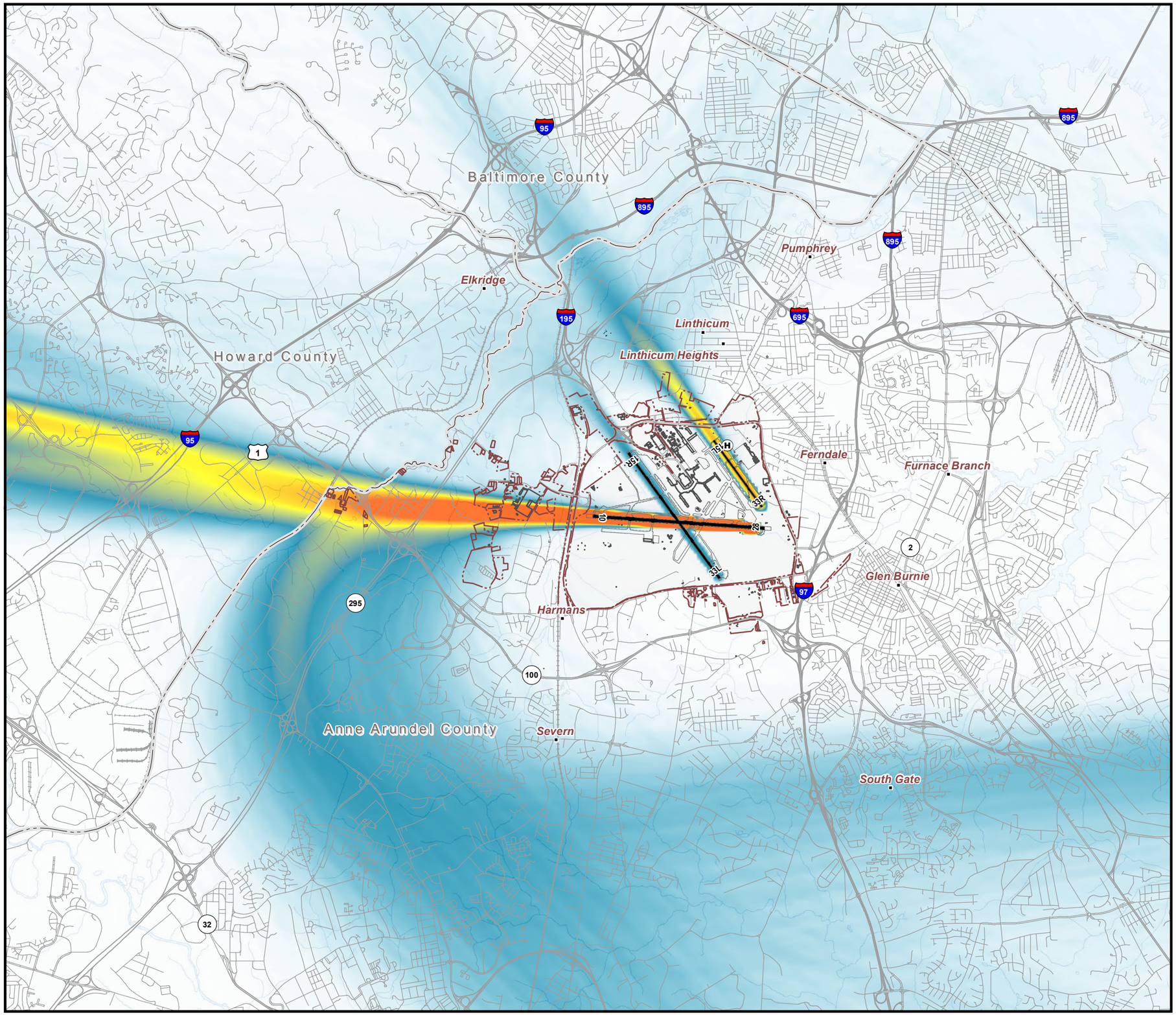

BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Flight Track Density Plot of Modeled Operations
West Flow Departure Tracks
Figure 15

- BWI Airport Property
- Existing Airport Runway Layout (2014)
- Existing Helicopter Pad (2014)
- Roads
- River or Stream
- County Boundary
- Water

Flight Track Density (52,320 Tracks, 95,093 Operations)

Low — Medium — High

Note: This figure depicts 52,320 model tracks weighted to represent 95,093 annual operations. In other words, each of the 52,320 individual tracks represent, on average, 1.8 annual operations

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Flight Track Density Plot of Modeled Operations
West Flow Arrival Tracks
Figure 16

- BWI Airport Property
- Existing Airport Runway Layout (2014)
- Existing Helicopter Pad (2014)
- Roads
- River or Stream
- County Boundary
- Water

Flight Track Density (55,855 Tracks, 94,910 Operations)

Low — Medium — High

Note: This figure depicts 55,855 model tracks weighted to represent 94,910 annual operations. In other words, each of the 55,855 individual tracks represent, on average, 1.7 annual operations

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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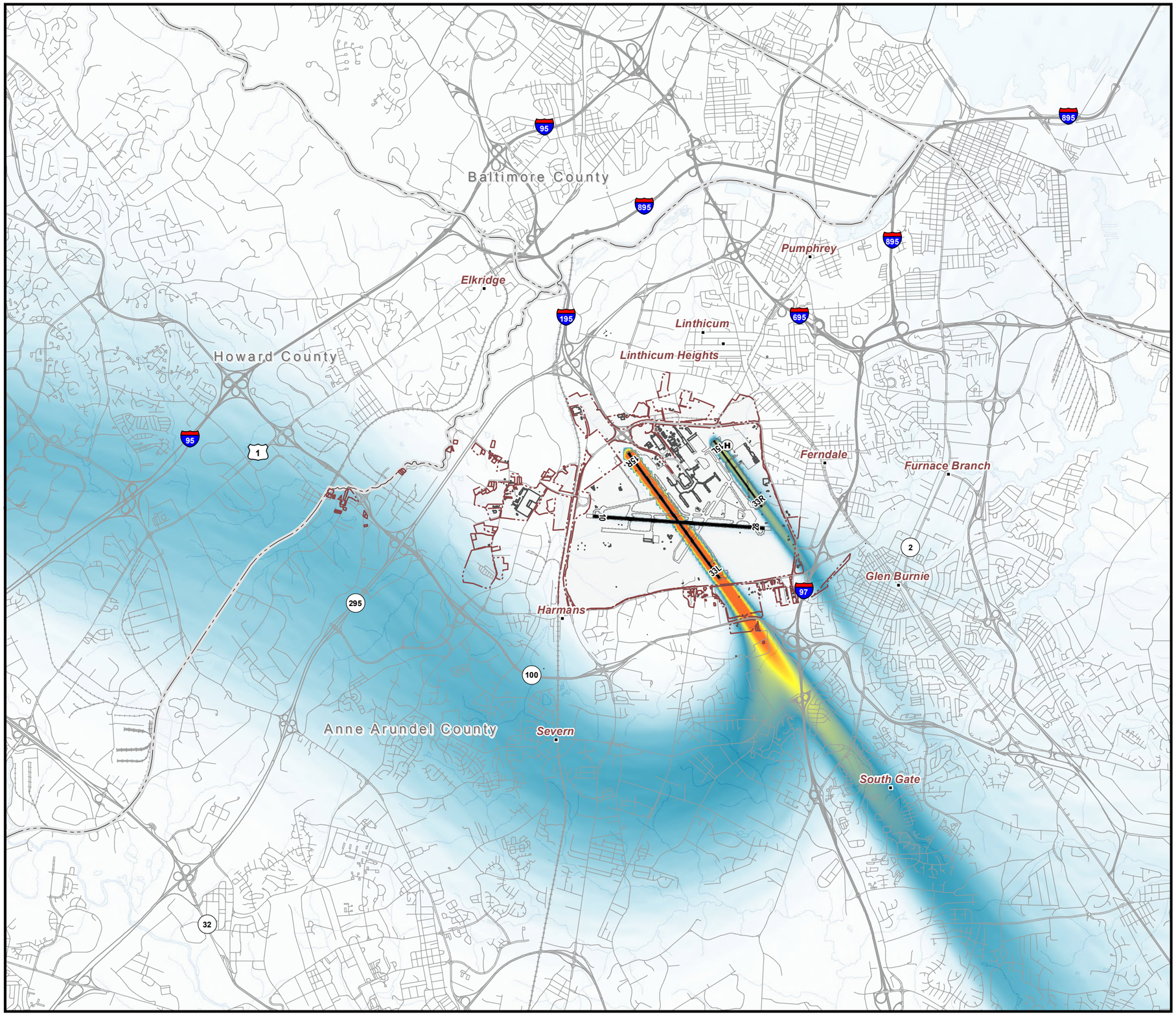
June 2016



BWI Baltimore/Washington International Thurgood Marshall Airport

Flight Track Density Plot of Modeled Operations
East Flow Departure Tracks
Figure 17

- BWI Airport Property
- Existing Airport Runway Layout (2014)
- Existing Helicopter Pad (2014)
- Roads
- River or Stream
- County Boundary
- Water

Flight Track Density (20,247 Tracks, 36,672 Operations)

Low — Medium — High

Note: This figure depicts 20,247 model tracks weighted to represent 36,672 annual operations. In other words, each of the 20,247 individual tracks represent, on average, 1.8 annual operations

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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June 2016

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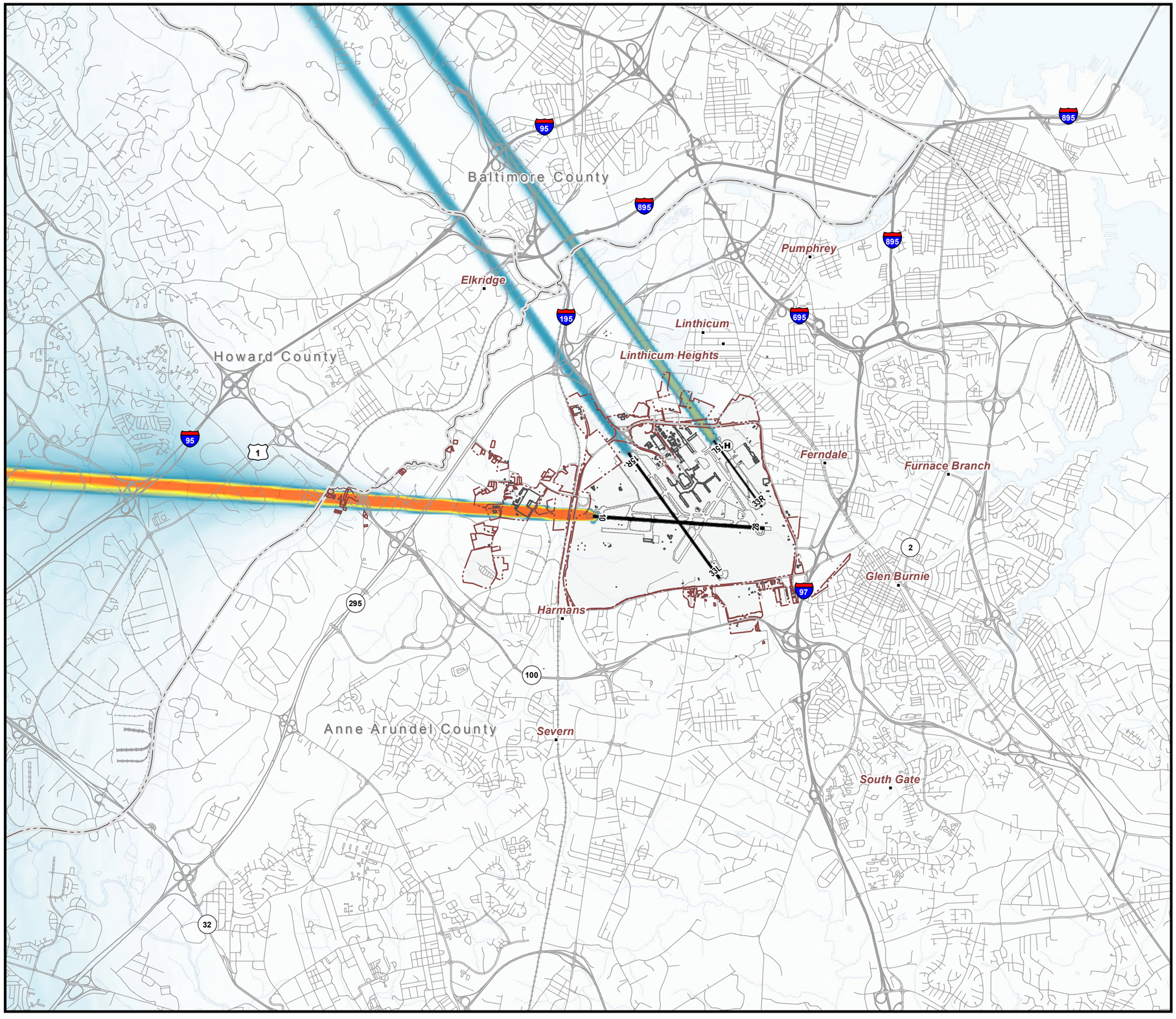

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BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Flight Track Density Plot of Modeled Operations
East Flow Arrival Tracks
Figure 18

- BWI Airport Property
- Existing Airport Runway Layout (2014)
- Existing Helicopter Pad (2014)
- Roads
- River or Stream
- County Boundary
- Water

Flight Track Density (21,693 Tracks, 36,855 Operations)

Low — Medium — High

Note: This figure depicts 21,693 model tracks weighted to represent 36,855 annual operations. In other words, each of the 21,693 individual tracks represent, on average, 1.7 annual operations

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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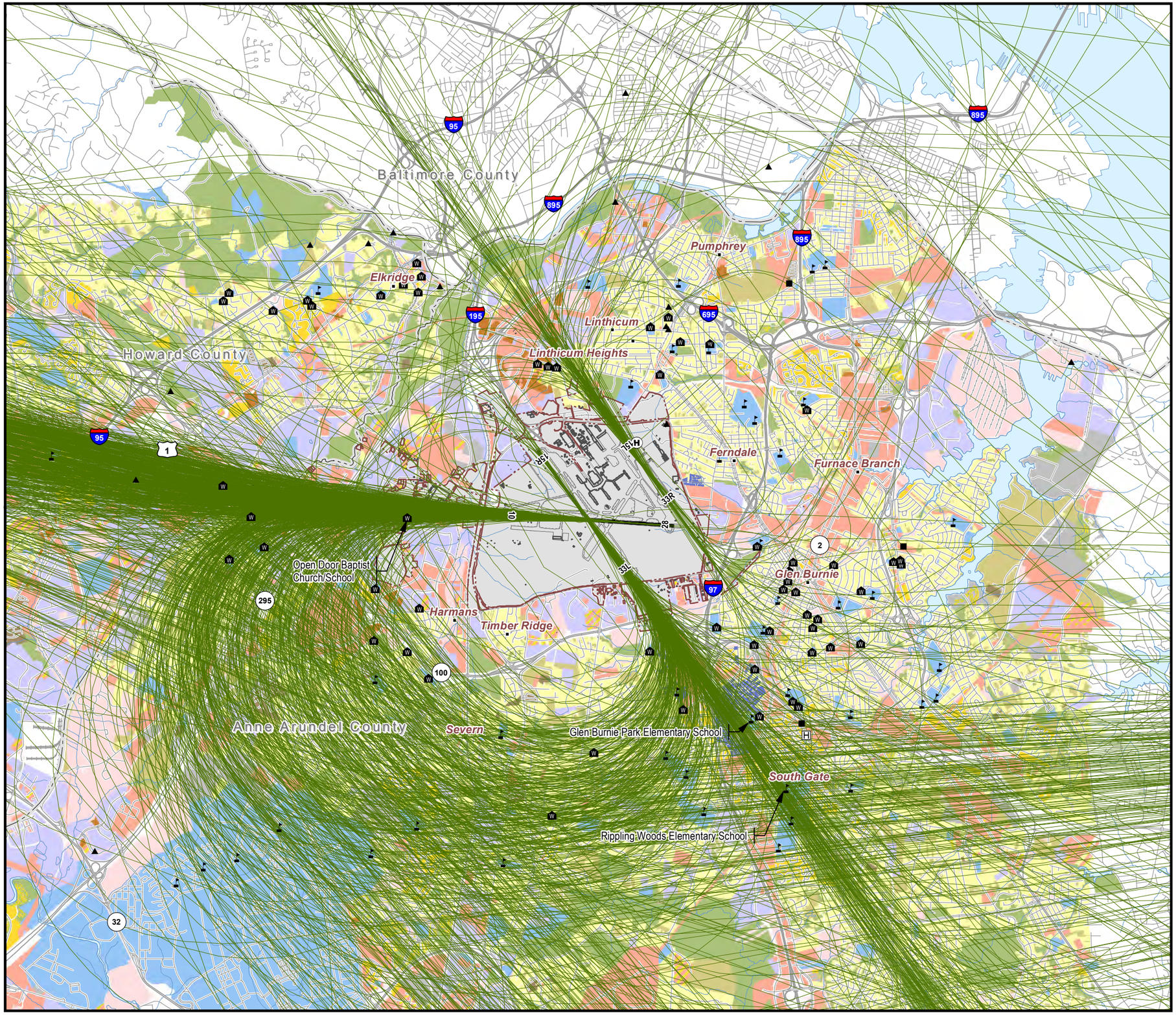
June 2016



BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

2019 NEM Representative Sample of Model Tracks
Figure 19 - Sheet 1, Departure Tracks

- Model Departure Tracks
- BWI Airport Property
- Existing Airport Runways
- Existing Helicopter Pad

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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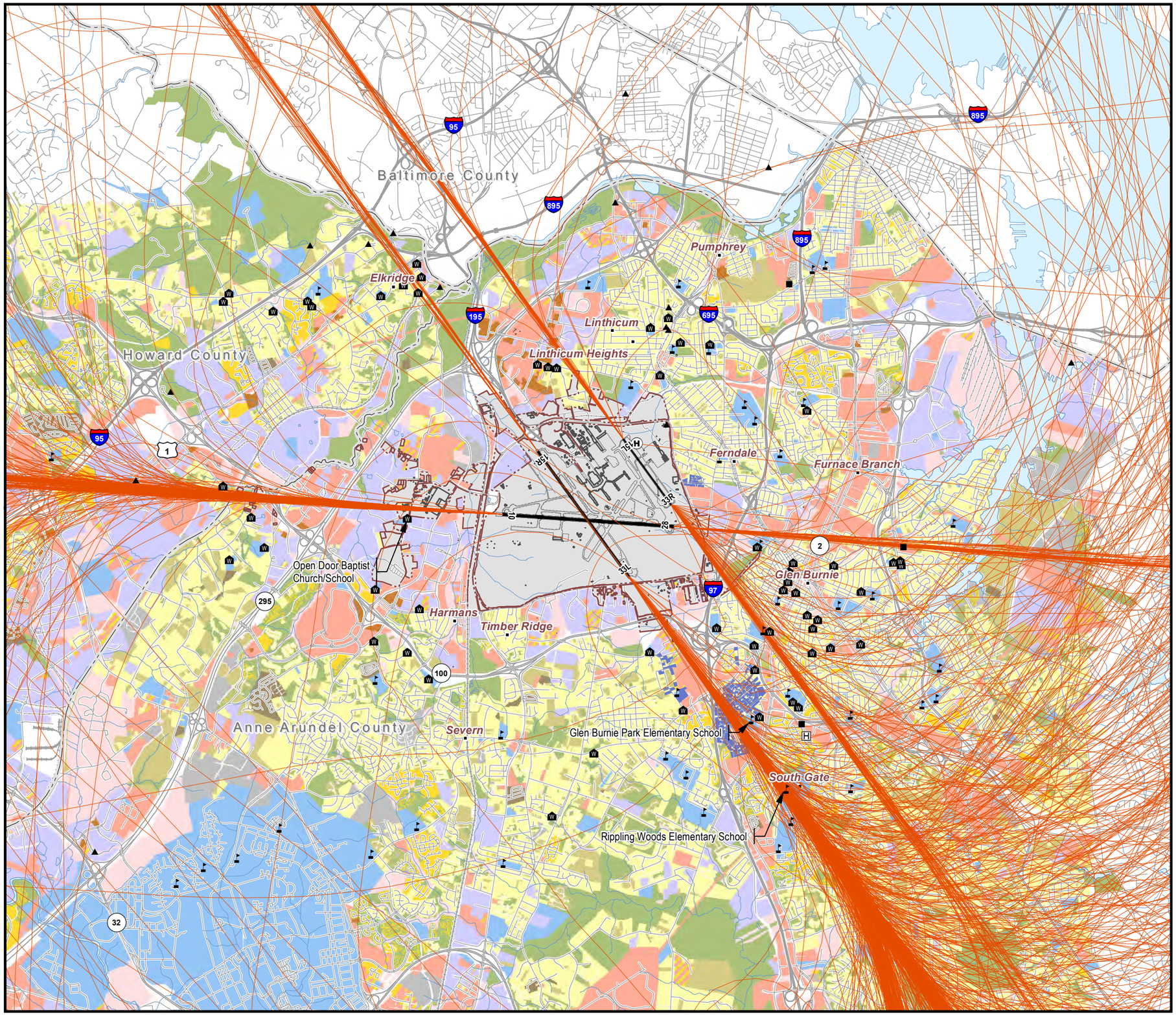

BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

2019 NEM Representative Sample of Model Tracks
Figure 19 - Sheet 2, Arrival Tracks

- Model Arrival Tracks
- BWI Airport Property
- Existing Airport Runways
- Existing Helicopter Pad

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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June 2016

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5 UPDATED NOISE EXPOSURE MAPS

Figure 20 and Figure 21 present NEMs for 2014 and 2019, respectively.[51] The 2014 NEM includes implementation of the existing NCP and the 2019 NEM is based on continued implementation of the existing NCP.

As 14 CFR Part 150 requires, the maps depict the runway layout, airport boundary, the noise contour modeling input documented in Chapter 4, and the jurisdictional boundaries of local land use planning and control organizations. The maps also depict land uses, to use in identifying potentially non-compatible areas, as discussed in Section 5.1. Table 15 presents the estimated residential population within these contours. Population estimates for single-family units were made by counting the number of single-family residential parcels within each contour, assuming that each parcel had a single-family house, and multiplying by an average number of people per house. The population estimates for multi-family units were made by multiplying the number of units by an average number of people per unit.[52]

Table 15 Estimated Residential Population within 2014 and 2019 Day-Night Average Sound Level (DNL) Contours, with Existing Noise Compatibility Program, as Currently Implemented

Source: HMMH, June 2016

Noise Level, DNL	2014			2019		
	Estimated Population	Estimated Single Family Houses	Estimated Multi-Family Housing Units	Estimated Population	Estimated Single Family Houses	Estimated Multi-Family Housing Units
65-70	1,547	389	226	2,618*	572*	488
70-75	38	14	0	46	17	0
75+	0	0	0	0	0	0
Total	1,585	403	226	2,664*	589*	488

Note:
*Compared to the September 2014 Draft of this document, five properties have been reclassified. These properties are specifically noted in footnote 7 on page 3.

5.1 Land Uses within the Updated Noise Exposure Maps

The objective of airport noise compatibility planning is to promote the compatible growth and development of airports with their surrounding communities. As discussed in Section 2.4, the MAA utilizes the FAA's land-use compatibility guidelines, as set forth in 14 CFR Part 150, Appendix A, Table 1, which is reproduced in Table 5 of this document. As the table indicates, the FAA considers all land uses to be compatible with aircraft-related DNL Levels below 65 dB. Between DNL 65 dB and DNL 70 dB, only mobile home parks, outdoor music shells, and amphitheaters are considered outright incompatible. Residences, schools, churches, auditoriums, concert halls, hospitals, and

[51] Figure 20 and Figure 21 meet Part 150 requirements when plotted at 1 inch equals 2,000 ft. To meet those requirements, the electronic versions of the figures are to be plotted 200% on 22 inch by 34 inch paper (or larger).
[52] Population estimates assume 2.7 people per single-family house and 2.2 people per multi-family unit. Both estimates are from analysis of U.S. Census 2010 data.

nursing homes are considered compatible with adequate interior-to-exterior noise-level reduction (NLR).

The NEM base map depicts existing land uses, according to major categories identified in the 14 CFR Part 150 guidelines, including residential, commercial, exempt commercial, industrial, and agriculture/forest. Residential land is subdivided into three categories:

- Residential: This category represents an existing residential use, single family (only one living unit per lot) and has not been previously mitigated for noise.
- Residential Multi-family: This category represents an existing residential use, multi-family (more than one living unit per lot) and has not been previously mitigated for noise.
- Residential - Previously mitigated: This category represents an existing residential use that has received noise mitigation through one of the programs listed in in Chapter 3 and therefore are considered a compatible land use with respect to Part 150. All of these properties are all single family, and received mitigation through the Homeowner's Assistance Program.

The "industrial" classification includes warehouse, light manufacturing, assembly and heavy commercial uses. Where industrial, office and other commercial uses are intermixed, the figure indicates the most common use.

Anne Arundel County controls the local land use within the 2014 and 2019 65 dB DNL NEM contours, as wells as BWI Marshall Airport. Since there is no incorporated land within the contours, Anne Arundel County Office of Planning and Zoning is the sole planning agency over this area. For additional reference, the NEM maps depict the general areas of various neighborhoods (for example, Elkridge to the northeast of the Airport and Harmans and Severn to the south of the Airport). The 2014 and 2019 65 dB DNL NEM contours come close, but do not enter, Howard County.

As mentioned previously, Figure 20 and Figure 21 present NEMs for 2014 and 2019, respectively. The 2014 and 2019 DNL contours are generally the same size and shape. However, the 2019 forecasted increase in operations, changes in aircraft types, changes in airport layout and associated runway use are expected to cause several changes to the contours, including:

- increase west of the Airport near Runway 28 departure and Runway 10 arrivals flight paths due to the increase in Air Carrier operations;
- increase southeast of the Airport near Runway 33L arrivals and Runway 15R departures flight paths due to the increase in Air Carrier operations; and
- decrease northeast of the Airport near Runway 15L and Runway 33R flight paths due to the combined reduction in Air Taxi and General Aviation operations as noted in Table 9.

In 2019, the addition of the displaced arrival thresholds on Runway 15R/33L is overshadowed by the increase in Air Carrier operations resulting in a net increase in the contour to the southeast. These changes will create a net increase in non-compatible land use for the 2019 NEM compared to the 2014 NEM. The 2019 contour is larger in all areas except to the northern end of Runway 15L/33R; however, that area is on Airport property.

As shown in Figure 20 and Figure 21, there are three public use facilities that could be incompatible with the noise exposure associated with BWI Marshall's operations.[53] The three facilities are discussed below. Section 6.1.3 provides supplemental information and maps.

- The Open Door Baptist Church and Open Door Christian School,[54] 7300 Ridge Road Hanover, MD, is west of the Airport and is between the 65 dB DNL and 70 dB DNL contours for both 2014 (Figure 20) and 2019 (Figure 21). The noise level reduction (NLR) properties of this facility are not known.[55]
- Glen Burnie Park Elementary School (southeast of the Airport) is between the 65 dB DNL and 70 dB DNL contours for both 2014 (Figure 20) and 2019 (Figure 21). This school has been mitigated and sound insulated as part of MAA's School Soundproofing Program, as discussed in Section 3.14.
- Rippling Woods Elementary School (southeast of the Airport) is outside the 65 dB DNL contour for 2014 (Figure 20), though it is between the 65 dB DNL and 70 dB DNL contour for 2019 (Figure 21). The 2019 65 dB DNL contour extends south almost to Shetlands Lane. As discussed in Section 3.14, this school was also in the 65 dB DNL contour in the late 1980s. A consultant working for MAA at the time concluded "that the interior of Rippling Woods ES is adequately protected from aircraft noise and that school does not require any acoustical modification." This opinion was confirmed by an independent study commissioned by the Anne Arundel County Board of Education.[56] There are other schools on this same parcel of land, all of which are south of Shetlands Lane and all outside the 65 dB DNL contour for both the 2014 and 2019 conditions.[57]

An analysis of residential land use, including GIS from Anne Arundel County data,[58] MAA records, aerial photography and field verification, was prepared to develop a count of the number of residential parcels potentially eligible for mitigation (subject to property and guideline verification). The analysis considered parcels previously mitigated through any of MAA's existing land use programs (e.g. Voluntary Acquisition Program, Homeowners Assistance Program, and BAZA) within the specified DNL levels on the 2014 and 2019 contours as shown in Figure 20 and Figure 21, respectively. Table 16 presents the results of this analysis. Table 17 presents an estimate of the number of units in multi-family complexes that would be potentially eligible and within the specified DNL contour levels. If additional noise sensitive properties are discovered within the noise contours at a later date, they would still be considered a candidate for mitigation. The eligibility of individual properties are subject to property and guideline verification.

Chapter 6 provides supplemental information and maps regarding individual properties.

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[53] As noted previously, in this context, "Public Use" facility is the term used in 14 CFR Part 150 Table 1 (reproduced in this document as Table 5), to describe assembly or gathering places. However properties in this category can be privately owned.

[54] The school's website is http://opendoorchristianschool.us

[55] As with any potentially Federally funded mitigation activities, eligibility for sound insulation of specific buildings (or rooms) on a site would be determined at such time as a property owner makes application. This determination would be subject to available funding and would be made in accordance with the then-applicable policies and programmatic guidance as currently exists or as may be promulgated by FAA in the future.

[56] The independent study is referenced in the 1989 BWI NCP (Sec. 4.5 pg. 170), has "Aircraft Noise Impact on Anne Arundel County Public Schools In the Vicinity of BWI Airport."

[57] The other schools on this parcel and outside of the 2014 and 2019 65 dB DNL contours are Old Mill Middle School (North and South), Old Mill High School and Ruth Parker Eason School.

[58] Data was made available from the Anne Arundel County Office of Planning and Zoning to MAA.

Table 16 Number of Single-Family Homes Potentially Eligible for Mitigation Based on DNL Level

Source HMMH, June 2016

Noise Level, DNL (dB)	2014			2019		
	Previously Mitigated[1]	Eligible for Mitigation[2]	Total	Previously Mitigated	Eligible for Mitigation[2,3]	Total
65-70	297	92	389	369	203*	572*
70-75	0	14	14	0	17	17
75+	0	0	0	0	0	0
Total	297	106	403	369	220*	589*

Note:
1 Prior to development of this Noise Exposure Map (i.e. 2014). The total number of properties mitigated to date is 952; the numbers presented in this table are those that are still within DNL 65 dB contours.
2 As discussed previously in this document, the eligibility of individual properties are subject to property and guideline verification.
3 These individual properties are listed in Table 1.
*Compared to the September 2014 Draft of this document, five properties have been reclassified. These properties are specifically noted in footnote 7 on page 3.

Table 17 Number of Multi-Family Residential Units Potentially Eligible for Mitigation Based on DNL Level

Source HMMH, September 2014

Noise Level, DNL (dB)	2014			2019		
	Previously Mitigated	Eligible for Mitigation[1]	Total	Previously Mitigated	Eligible for Mitigation[1,2]	Total
65-70	0	226	226	0	488	488
70-75	0	0	0	0	0	0
75+	0	0	0	0	0	0
Total	0	226	226	0	488[2]	488

Note:
1 As discussed previously in this document, the eligibility of individual properties is subject to property and guideline verification.
2 These 488 units are listed in Table 2.

BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Existing Condition (2014) Noise Exposure Map
Figure 20

Existing 2014 DNL Contour

BWI Airport Property

Existing Airport Runway Layout (2014)

Existing Helicopter Pad (2014)

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Note: All previously mitigated homes are considered compatible

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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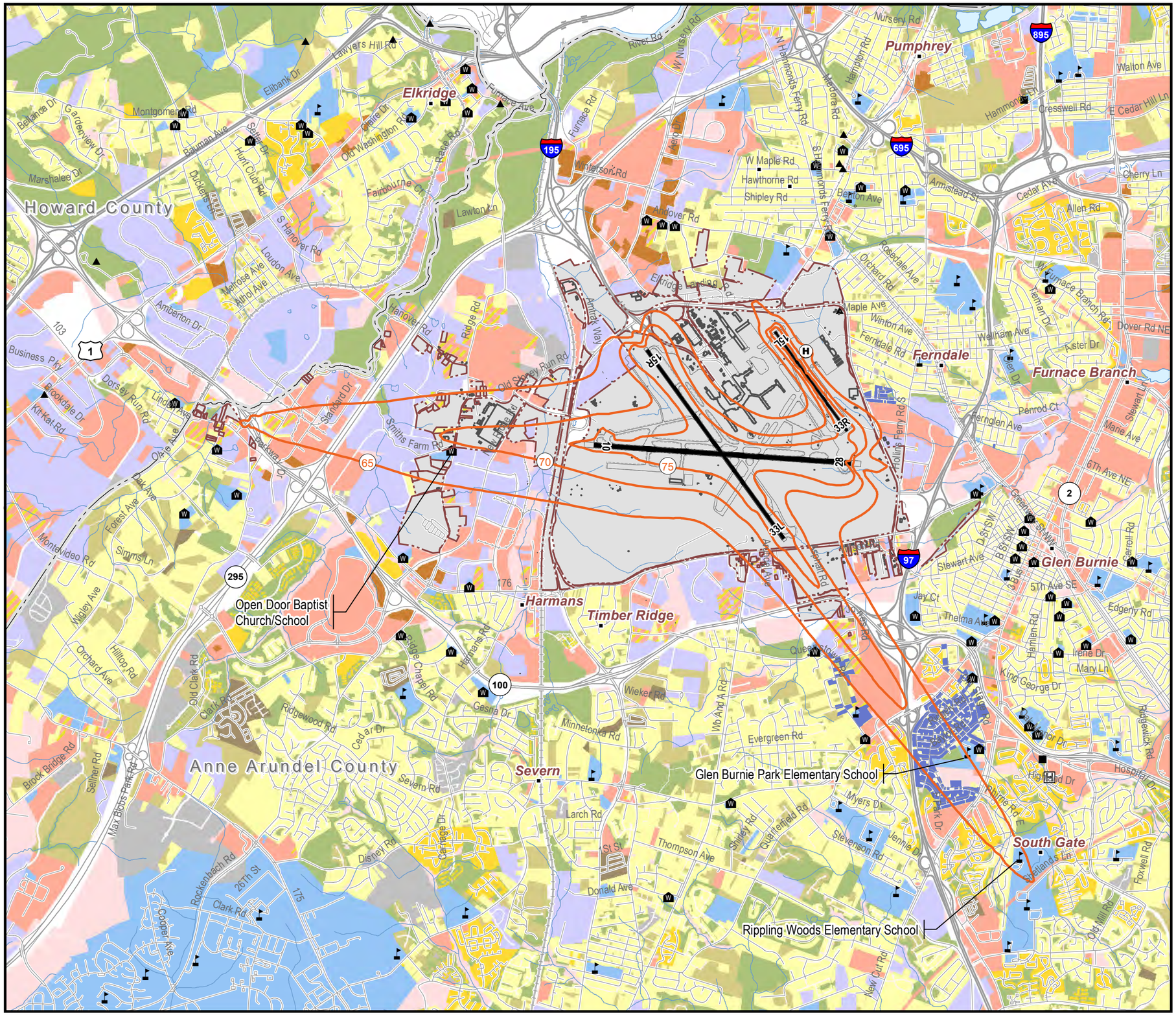
June 2016



BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Forecast Condition (2019) Noise Exposure Map
Figure 21

Note: All previously mitigated homes are considered compatible

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

June 2016

Path: G:\Projects\305XXX\305160_MAA_On-Call_Services\Task011_BWI_NEM_Update\GIS\305160_011_BWI_NEM_Figure21_2019_Forecast_Contour.mxd

6 CONTINUING ACTIVITIES

As discussed in Chapter 3, the BWI Marshall NCP includes a broad range of implementation-related continuing program elements. MAA expects to continue the following activities.

6.1 Activities Within the Noise Compatibility Program

Following FAA acceptance of this NEM update, MAA intends in the near term, to request the use of federal funds, or state funds subject to federal requirements, to continue the following elements of the NCP.[59] Other elements of the NCP would continue as stated in Chapter 3, but do not require the use of federal funds.

6.1.1 Voluntary Residential Property Acquisition Program (2008 ROA Element 3)

The history of this program was discussed in Section 3.12. Following completion of this NEM update, MAA intends to continue this program.

Participation in the program is voluntary. Property owners are paid full market value for their property at its highest and best use, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

As discussed in Section 1.2, 50 single family properties (23 to the west of the Airport and 27 to the southeast of the Airport) have been identified for consideration for this program using the current land use inventory, the 2019 NEM contours and the area has been zoned by local government to transition from residential to a noise compatible use. Individual properties will be reviewed, relative to federal and state guidelines, before being considered eligible. If additional noise sensitive properties are discovered within the noise contours at a later date, they would still be considered a candidate for mitigation.

Figure 22 presents the 2019 NEM contours and the properties that could be reviewed for eligibility following this NEM update.

6.1.2 Homeowners Assistance Program (2008 ROA Element 4)

The Homeowners Assistance Program offers financial assistance to homeowners residing in the 65 dB DNL contour as defined by the NEM, and who are not eligible for the Voluntary Land Acquisition Program. The history of this program was discussed in Section 3.13. Following completion of this NEM update, MAA intends to continue this program, in particular, the soundproofing option.

The MAA will assist eligible homeowners in making modifications to their houses, with a goal of reducing interior noise levels to an average of 45 dB Ldn (or 45 dB DNL). The type and extent of the improvements are dependent upon the noise reduction capabilities of the existing structure.

[59] MAA has an escrow account that is subject to federal grant requirements.

Fresh air ventilation and air conditioning are installed to allow windows to remain closed and other modifications including replacement of exterior windows and doors, additional insulation, baffles, and other sound attenuation measures are considered. The homeowner enters into a contract with the MAA, committing the MAA to: 1) pay for the agreed upon noise reduction modifications; and 2) monitor the construction and assure its quality. The homeowner is then required to sign an avigation easement.

The FAA's policy published in the Federal Register on April 3, 1998 (Volume 63, Number 64) states that the FAA will not approve Federal funding to mitigate noise sensitive land uses constructed after October 1, 1998. Additional conditions of the program will follow current FAA guidelines for AIP. Some of these conditions include the requirement that the building must meet local building codes.[60] Section 3.13 provides additional information.

As discussed in Section 1.2, 170 single family properties and 488 multi-family units (located in five complexes) have been identified for consideration for this program using the current land use inventory, the 2019 NEM contours and consideration of properties not eligible for the Voluntary Residential Property Acquisition Program. Individual properties will be reviewed, relative to federal and state guidelines, before being considered eligible. If additional noise sensitive properties are discovered within the noise contours at a later date, they would still be considered a candidate for mitigation.

Figure 22 presents the 2019 NEM contours and the properties that have been previously mitigated through the Homeowners Assistance Program and those that could be reviewed for eligibility following this NEM update.

Figure 23 presents the 2019 NEM contours and the multi-family five complexes listed in Table 2 that could be reviewed for eligibility following this NEM update. Figure 23 also identifies the location of buildings at are within, or partially with the 2019 NEM 65 dB DNL contour. A label over each building indicates the number of units.

6.1.3 School Soundproofing Program (1990 ROA Element 16)

Of the three schools that were identified in Section 5.1 as potentially incompatible with BWI Marshall noise exposure, the Glen Burnie Park Elementary School has been mitigated and sound insulated as part of MAA's School Soundproofing Program, as discussed in Section 3.14, while the other two have not.

Figure 22 presents the location of all three schools relative to the 2019 NEM contours. The Glen Burnie Park Elementary School parcel is color coded as sound insulated, and the building intersects the 2019 65 dB DNL contour.

Rippling Woods Elementary School was evaluated for sound insulation in the late 1980s as discussed in Section 5.1. The Rippling Woods Elementary parcel is color coded as a public use facility for mitigation evaluation. However, as noted in Section 5.1 there are additional schools on this parcel of land that are outside the 65 dB DNL contour. The building footprint for Rippling

[60] These guidelines are currently described in FAA Order 5100.38D "Airport Improvement Program Handbook" dated September 30, 2014. The sound insulation guidelines are addressed primarily in Appendix R of the Order.

Woods Elementary School is shown on Figure 22 Inset 2. All of the other schools, that are outside of the 65 dB DNL contour, are south of Shetlands Lane and are not shown in Figure 22 Inset 2.

The Open Door Christian School is depicted on Figure 22 Inset 1. MAA has not previously evaluated the Open Door Christian School.

Following the completion and FAA acceptance of this NEM update, MAA will approach respective property owners potentially eligible for noise mitigation to determine their interest in obtaining sound insulation treatment as mitigation for the existing aircraft noise from BWI operations. For properties containing educational facilities (e.g., schools), MAA will evaluate the potential for sound insulation in accordance with the latest FAA guidelines and provide treatment to spaces within buildings used for "educational instruction", e.g., classrooms and libraries.[61]

In comments provided by FAA September 29, 2015 to MAA, the FAA indicated that only the four schools mentioned in the 1990 ROA (Corkran Middle School, Arthur Slade Regional School, Glen Burnie Park and Oakwood Elementary Schools) are included in this NCP measure. FAA stated that an NCP update will be required to include additional schools to this program.

6.1.4 Noise Monitoring System (2008 ROA Element 4)

The history of this program was discussed in Section 3.15. Following completion of this NEM update, MAA would like replace the current noise monitoring system with a modern system. The noise monitoring system, as an element to the NCP, was added to the 2008 NCP ROA. Prior to 2008 NCP, MAA did not apply for federal grants to fund the current monitoring system. Since the 2008 NCP, MAA has not had the opportunity to issue a procurement for a new system, although plans to in the next few years.

The current noise and operations monitoring system at BWI Marshall was installed in the mid-1980s and has become significantly out of date. The system includes the following major components:

- 18 permanent noise monitors in the Airport environs. The system originally had 23 total permanent monitors and five have been decommissioned. Of the remaining 18 monitors, several are operating inconsistently, and due to age, it is difficult to find replacement parts.
- Four portable monitor capable of five days of independent operation, in a manner that mimics a permanent installation.
- Operations monitoring components to collect information on flight tracks, altitudes, runway use, and available data on aircraft type, operator, and other flight identification.
- Central computer hardware and software for data accumulation, storage, analysis, and reporting. The central software includes the capability to correlate flight operations data with data on individual noise "events" and complaints that MAA personnel manually enter into the system.

[61] These guidelines are currently described in FAA Order 5100.38D "Airport Improvement Program Handbook" dated September 30, 2014. General eligibility requirements for noise compatibility projects are addressed primarily in Appendix R of the Order.

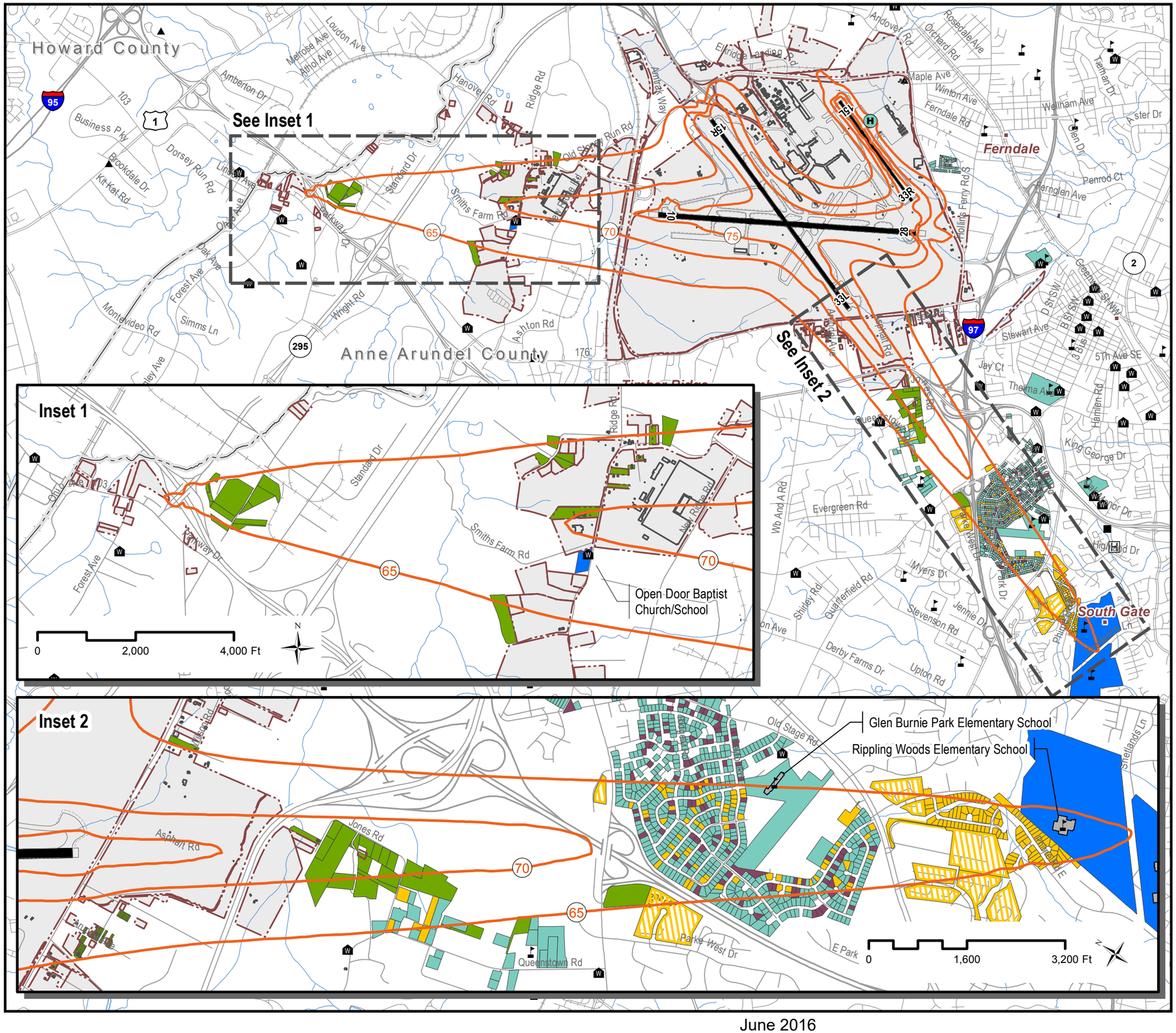
Contemporary noise monitors now have significantly greater flexibility and memory capacity, while modern noise and operations monitoring systems software includes several new features such as Geographic Information System (GIS) and access to contemporary graphical capabilities and a range of reporting capabilities.

In addition to replacing monitoring equipment in the 18 existing monitoring sites, the addition of seven more sites and refurbishment of one defunct site is also suggested to better sample the noise impact in the surrounding community. Figure 24 shows the location of the existing and proposed monitoring sites, while Table 11 lists suggested locations for the proposed new and refurbished monitoring sites along with additional information, if available.

Current replacement monitoring systems cost on the order of $1.2 million to $2 million depending on the number of monitors and complexity of the replacement. The modernized noise monitoring system should be completed approximately two years after the award of a Federal grant. This will allow time for securing property easements then purchasing, installing and accepting the new noise monitoring system.

Only certain portions of the system are eligible for FAA funding.[62] For example, only the placement of fixed noise monitoring equipment is eligible only within the DNL 65 dB noise contour at the time of installation (additional monitors are not eligible for FAA funding).

[62] These guidelines are currently described in FAA Order 5100.38D "Airport Improvement Program Handbook" dated September 30, 2014, Table R-6.



BWI BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

Forecast Condition (2019) DNL Contours with Mitigation Status
Figure 22

- Forecast 2019 DNL Contour
- BWI Airport Property
- Future Airport Runways (2019)
- Future Helicopter Pad (2019)

Mitigation Status - Previously Mitigated

- Soundproofed
- Resale

Mitigation Status - Potentially Eligible

- Homeowners Assistance, Sound Insulation – Single Family
- Homeowners Assistance, Sound Insulation – Multi Family
- Voluntary Residential Property Acquisition
- Public Use Facilities for Mitigation Evaluation – Schools

- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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June 2016

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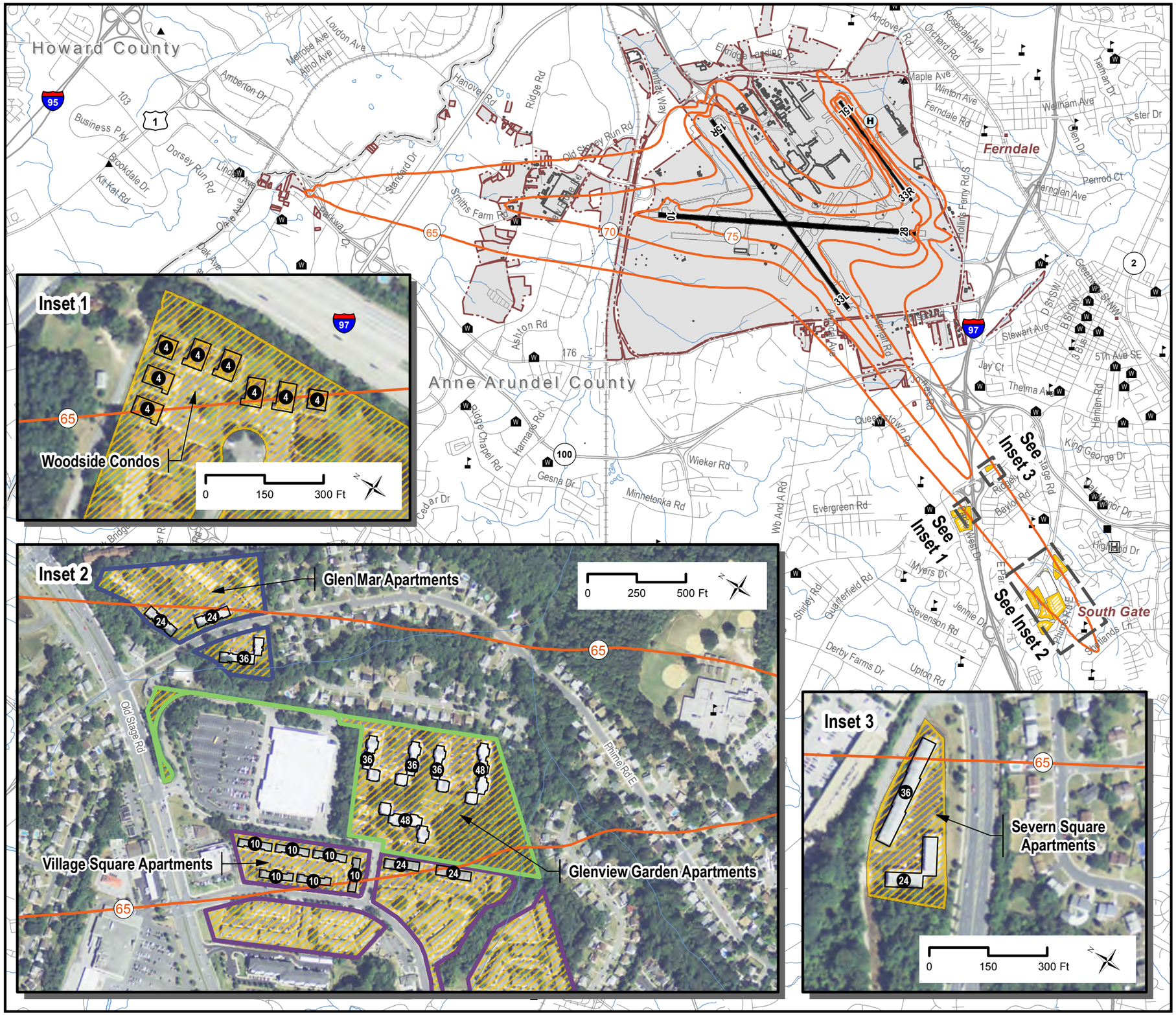

BWI Baltimore/Washington International Thurgood Marshall Airport

Forecast Condition (2019) DNL Contours with Mitigation Status, Multi-Family Properties
Figure 23

- Forecast 2019 DNL Contour
- BWI Airport Property
- Future Airport Runways (2019)
- Future Helicopter Pad (2019)

Mitigation Status - Potentially Eligible

- Homeowners Assistance, Sound Insulation – Multi Family
- Multi-Family Structure with ≥65 dB DNL Exposure, with Estimated Number of Units
- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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6.2 Activities Beyond the Noise Compatibility Program

MAA has expanded some aspects of the NCP outside of the 14 CFR Part 150 process to ensure it is as comprehensive as possible. Additional continuing program elements implemented outside of the 14 CFR Part 150 process include:

- BWI Marshall Neighbors Committee
- Noise Hotline
- Quarterly Reports

The primary intent of these continuing program elements is to maximize the effectiveness of the noise abatement and compatible land use elements of the NCP, and to ensure that the NCP is as sensitive to current airport operations and land use issues as possible.

The following sections discuss the status of each of the activities.

6.3 BWI Marshall Neighbors Committee

The BWI Marshall Neighbor's Committee was established in 1983 by the Maryland Aviation Administration in response to neighbor's concerns about aircraft noise and future airport growth and development. The Committee serves as a liaison between the Airport and the surrounding communities to ensure continuing and timely discussion of mutual Airport and community interests. These interests include:

- Highway access and local traffic
- Long-range plans
- Operational changes
- Noise
- Parking
- Land use

This committee serves as a forum for exchanging information, ideas and suggestions. The Neighbors Committee meets one to two times a year at the MAA offices in Linthicum.

The BWI Marshall Neighbors Committee formed the basis of the Community Advisory Committee for this study as discussed in Chapter 7.

6.3.1 Recommendation

The BWI Marshall Neighbors Committee will continue to meet on a regular basis. Additional meetings can be scheduled as needed.

6.4 Noise Hotline

The Office of Noise, Real Estate and Land Use Compatibility[63] maintains a 24-hour noise "Hotline". Residents may call (410) 859-7021 to identify a noise concern. During normal weekday business

[63] This office of MAA encompasses the duties of the former "Division of Aviation Noise and Abatement."

hours, a staff person will discuss concerns directly with citizens. During non-business hours, an answering machine is programmed to record necessary information concerning a complaint and the calls are reviewed the following workday. A member of the MAA staff investigates complaints and follows up with a response to the caller if necessary.

6.4.1 Recommendation

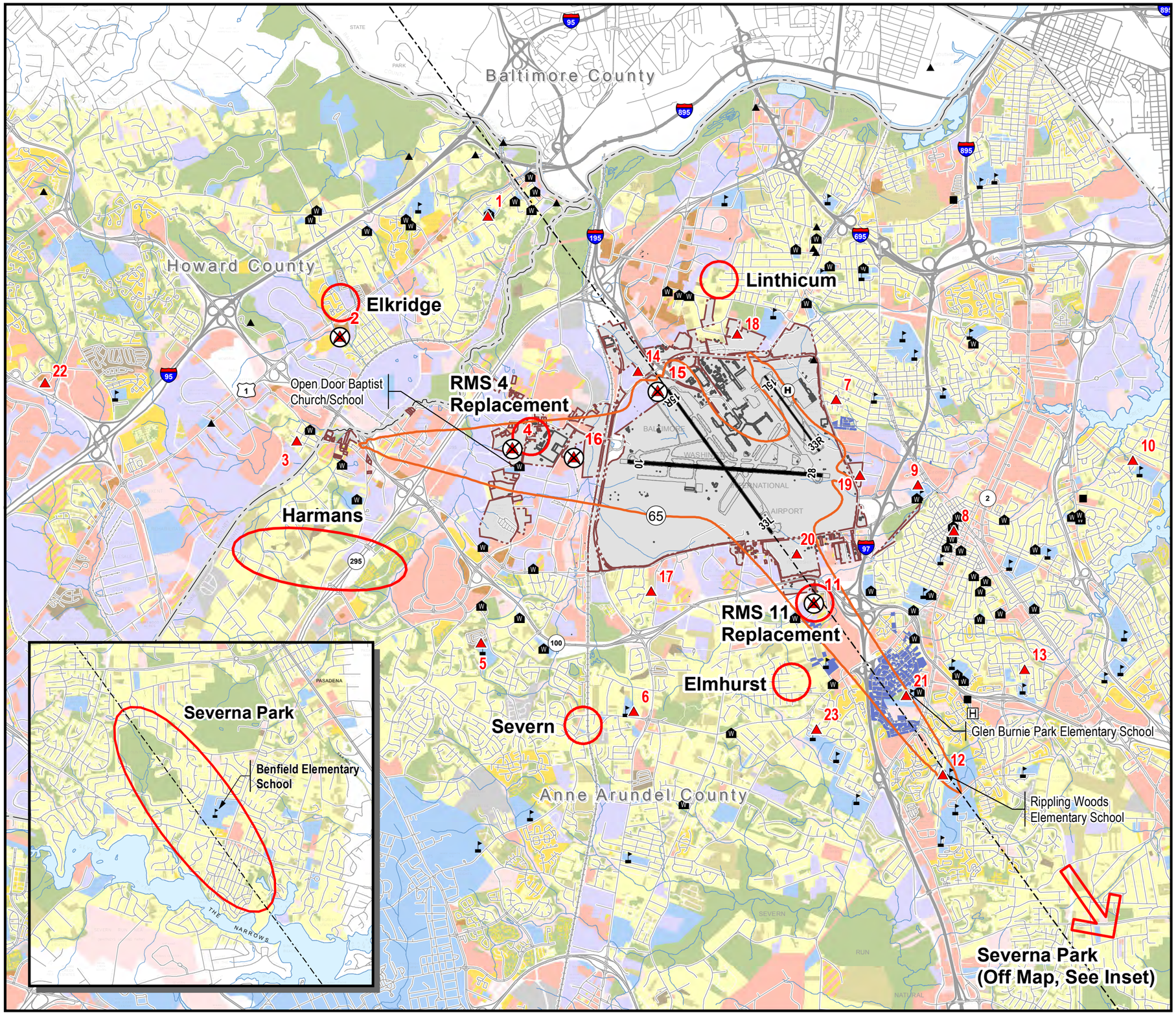
It is recommended that this program measure continue unchanged.

6.5 Quarterly Report

A report is prepared presenting noise related data for each quarter of the year. The report includes monthly noise levels actually recorded by the Airport's 18 remote monitoring sites and contains monthly information regarding noise complaints, BWI Marshall east/west operational modes and statistics related to the use of various flight corridors.

6.5.1 Recommendation

It is recommended that this program measure continue unchanged.



BWI
BALTIMORE/WASHINGTON
INTERNATIONAL
Thurgood Marshall
AIRPORT

Noise Monitor Locations
Figure 24

- RMS# Noise Monitor Location
- RMS# Former Noise Monitor Location; Equipment has been dismantled and will be relocated.
- Proposed Noise Monitor Site Location
- Forecast 2019 DNL Contour
- BWI Airport Property
- Future Airport Runways (2019)
- Future Helicopter Pad (2019)

Land Use

- Residential
- Multi-Family Residential
- Transient Lodging
- Mobile Home
- Mixed Use Residential
- Undeveloped Residential
- Residential, Previously Mitigated
- Public Use
- Commercial
- Exempt Commercial
- Manufacturing and Production
- Recreational Open Space
- Vacant / Undefined
- Roads
- River or Stream
- County Boundary
- Water
- School
- Place of Worship
- Nursing Home
- Historic Site
- Hospital

Note: All previously mitigated homes are considered compatible

Data Sources: Maryland Aviation Administration; Maryland State Highway Administration; Anne Arundel & Howard County; Maryland Department of Planning; Environmental System Research Group, Inc.

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June 2016

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7 PUBLIC CONSULTATION

The MAA conducted this Noise Exposure Map update with extensive consultation with all members of the airport public, including airport users, fixed based operators, pilots, potentially affected residents of the airport environs, and local, state, and federal officials.

The MAA and its consultants used several mechanisms in pursuing these external consultations:

- Two meetings were held with the BWI Marshall Neighbors Committee which were open to the public and agendas were provided in advance.
- One Noise Exposure Map Community Advisory Committee meeting was held and written background material was provided in advance.
- One public workshop was held for the entire community to attend.

These consultations are described in the following sections.

7.1 BWI Marshall Neighbors Committee

MAA staff gave presentations on the status of the Noise Exposure Map at two Neighbors Committee meetings: April 23, 2013 and March 18, 2014. The Office of Noise, Real Estate and Land Use Compatibility Planning sent out meeting notification and an agenda to all Committee members. Copies also go to local elected officials, local county planning representatives, additional community representatives and to individuals from the community who have requested to be on the mailing list. Materials related to these two Neighbors Committee meetings are presented in Appendix E.

The BWI Marshall Neighbors Committee formed the basis of the Community Advisory Committee for this study.

7.2 Community Advisory Committee

The MAA established the Community Advisory Committee, specifically for this NEM update and the concurrent Airport Noise Zone Update, made up of neighborhood representatives, aviation representatives, elected officials, and local, state, and federal officials, to provide input and make recommendations to the staff and consultants. Committee members helped disseminate information on the study to the rest of the community and aviation industry and solicit their input.

Table 18 lists the Community Advisory Committee members. Anne Arundel County Office of Planning and Zoning is the agency with land use jurisdiction for the entire off airport land depicted in the 2014 and 2019 NEM contours. For additional reference, the NEM maps depict the general areas of various neighborhoods (for example, Elkridge to the northeast of the Airport and Harmans and Severn to the south of the Airport). The 2014 and 2019 65 dB DNL NEM contours come close, but do not enter, Howard County.

The Community Advisory Committee met May 14, 2014, during the NEM update. MAA sent backgrounds to the Committee prior to the meeting and requested that the Committee review. The meeting included a presentation followed by a general discussion. The Community Advisory Committee meeting was advertised using mail and follow-up phone calls.

Appendix E lists the Community Advisory Committee membership, summarizes the meeting and topics, and presents copies of background material, minutes, and sign-in sheets for the meeting.

Table 18 Community Advisory Committee Members

Source MAA, HMMH, October 2014

Organization	Representing	Representative
Neighbors Committee Members	The Greater Elkridge Community Association Elmhurst Improvement Association Glen Burnie Improvement Association Harmans Civic Association Linthicum-Shipley Improvement Association Severn Improvement Association Timber Ridge Improvement Association Ferndale-Linthicum Area Community Council	Edward Huber Eric Jordan Nancy Brown (Chairman) Rusty Bristow Ken Glendenning Melvin Kelly (Chairman) Richard Hanna Liz Wagner
Elected Officials	Senate of Maryland	Senator James E. DeGrange, Sr.
Federal Aviation Administration	BWI Tower Potomac Consolidated TRACON Washington Airports District Office	Stephen M. Batchelder* Stephen Smith Marcus Brundage
Aviation Representatives	National Business Aviation Association Aircraft Owners and Pilots Association Southwest Airlines Signature Flight Support BWI Business Partnership	Greg Voos Craig Fuller Bert Seither Jerome Fernandez** Linda Greene
Public Planning Agencies	Howard County Office of Planning and Zoning Anne Arundel County Office of Planning and Zoning	Brian Muldoon Lynn Miller
Maryland Aviation Administration	Director, Office of Noise, Real Estate & Land Use Compatibility Assistant Attorney General Director, Office of Planning and Environmental Services Chief Engineer, Facilities Development and Engineering	Ellen Sample Louisa Goldstein Wayne Schuster Paul Shank

Notes:
*BWI Tower is now represented by Stephen M. Batchelder; the previous representative was Ed Donaldson.
**Signature Flight Support is now represented by Jerome Fernandez; the previous representatives were Dave Fitzgerald and Robert Grant

7.3 Project Newsletters

The study team prepared and distributed one executive summary during the NEM Update process, as part of draft NEM release announcement. Appendix E presents a copy of the executive summary.

7.4 Public Workshop

A public workshop, and public hearing for the concurrent Airport Noise Zone Update, was held October 21, 2014 at Maryland Aviation Administration's Offices in Linthicum. A Public Workshop and Public Hearing Notice were published in four different local area newspapers, MAA's website and were delivered to 12 area public libraries along with the NEM Maps and Executive Summary. The notices also discussed the associated comment period (which is discussed in Section 7.5).

The newspaper publication and respective dates are listed below.

- The Baltimore Sun, Friday October 3, 2014
- The Baltimore Sun, Saturday October 11, 2014
- The Baltimore Sun, Sunday October 19, 2014
- Howard County Times, October 9, 2014
- Howard County Times, October 16, 2014
- The Capital, October 11, 2014
- The Capital, October 19, 2014

- Maryland Gazette, October 8, 2014
- Maryland Gazette, October 18, 2014

The 12 area public libraries are listed below.

- Anne Arundel County
  - Linthicum Branch
  - Severn Community Branch
  - Brooklyn Park Branch
  - Riviera Beach Branch
  - Glen Burnie Regional Branch
  - Severna Park Branch
- Howard County
  - East Columbia Branch
  - Central Branch
  - Elkridge Branch
  - Miller Branch
  - Savage Branch
- Baltimore County
  - Arbutus Branch

In addition, the concurrent ANZ Public Hearing was announced in the Maryland Register October 3, 2014.[64]

The full NEM document and related maps and materials have been made available at the MAA offices at 991 Corporate Boulevard in Linthicum, Maryland and on the MAA Community Relations website.[65]

Prior to the workshop, the Chief Executive Officers, Zoning Boards and Planning Directors of Anne Arundel, Howard and Baltimore Counties were given an opportunity to comment. Additionally, a direct mail notice was sent out to our Advisory Committee, Neighbors Committee, community associations and interested parties on our mailing list.

The public workshop included boards attended by MAA staff and the contractor team. In addition, there was a rolling presentation. Copies of the September 2014 Executive Summary were available as handouts. The complete September 2014 draft of this document and NEM maps were available on display for review. Comment cards were available in the event attendees wanted to provide written comments.

Appendix F provides copies of materials related to the library distribution, notices, letters and the workshop itself.

[64] Maryland Register, October 3, 2013, Volume 41, Issue 20, pg. 1168.
[65] http://www.maacommunityrelations.com/

7.5 Comments

Public comments were accepted from October 3, 2014 until November 3, 2014. The notification for the comment period, and the location of the NEM document, was the same as the notification for the public workshop. That notification process is documented in Section 7.4 and Appendix F. The notification included the locations in which the public could review the September 2014 draft of this document.

Three written comments were received were received by mail. No formal written or oral comments were received at the Public Workshop. MAA responded to each commenter individually with letters dated December 12, 2014.

Comments received and MAA's responses are presented in Appendix G.

Table 19 Public Outreach Schedule

Source HMMH, December 2014

Date	Event
April 23, 2013	**BWI Marshall Neighbors Committee Meeting** Discussion of Noise Exposure Map Update
March 18, 2014	**BWI Marshall Neighbors Committee Meeting** Discussion of Noise Exposure Map Update
May 14, 2014	**Community Advisory Committee Meeting No. 1** Discussion of Noise Exposure Map Update
October 3, 2014	**Start of Public Comment Period**
October 21, 2014	**Public Workshop**
November 3, 2014	**End of Public Comment Period**
Upcoming	
December 2014	**Submittal to Federal Aviation Administration** Once FAA finds the NEM in compliance with Part 150 regulations, FAA will publish notification in the Federal Register and MAA will publish a notice in local papers.