Boston Logan International Airport

Boston Logan Airport Noise Study

Final Report

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with participation from
Logan Airport Community Advisory Committee and Massachusetts Port Authority

BACKGROUND IS FOR GRAPHIC REPRESENTATION AND ARE NOT ACTUAL CORRIDORS.

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1. Introduction

1.1 Background

The Boston Logan Airport Noise Study (BLANS)[1] was conducted in fulfillment of the Federal Aviation Administration's (FAA's) Record of Decision (ROD) on the Logan Airside Improvements Planning Project Environmental Impact Statement (EIS) for the Airport, dated August 2, 2002, to identify and implement measures to reduce noise impacts to communities surrounding Boston Logan International Airport (BOS or the Airport). The ROD is included as **Appendix A**. The specific requirements for conducting BLANS are described in Section VIII "Mitigation Measures," of the ROD as Measure Number 6 "Noise Abatement Study and Review of Preferential Runway Advisory System." The measure committed the FAA to work with the Massachusetts Port Authority (Massport) and the Logan Airport Community Advisory Committee (CAC) and states that:

> FAA, Massport, and the CAC (which includes South Shore communities) will work jointly to develop the scope of a noise study that will include enhancing existing or developing new noise abatement measures applicable to aircraft overflights. The study will evaluate proposals on the basis of environmental benefit, operational impact, aviation safety and efficiency, and consistency with applicable legal requirement. Noise abatement proposals that FAA considers safe and efficient and that will not adversely affect other communities will be implemented. These proposals will be implemented to the extent feasible prior to completion of the noise abatement study.

Seven flight procedure measures were recommended as Early Implementation Measures and implemented prior to the completion of the study. Two ground noise measures were also recommended and implemented.

Another requirement of Measure Number 6 is to address the future of the Preferential Runway Advisory System (PRAS) at the Airport. The measure further states that:

> Massport has also committed, as part of its Section 61 Findings, to begin working with the CAC to update the existing PRAS program. FAA supports these efforts and will work with Massport and the CAC to assess the PRAS program with the understanding that the PRAS will remain in place until superseded.

[1] The study was initially named the Boston Overflight Noise Study (BONS). The name was changed to Boston Logan Airport Noise Study when ground noise was added at the beginning of Phase 2 of the study.

As discussed further in Sections 5 and 6, in April of 2012, during the course of BLANS, the CAC voted to abandon PRAS and to pursue the development of a more effective runway use program. The CAC decision was transmitted to Massport via a letter from the CAC President dated June 4, 2012. A copy of the letter is provided in **Appendix B**.

1.2 Report Overview

The *BLANS Final Report* (the Report) provides an overview of the three-phase study process, a description of the phases with greater detail on Phase 3, and a summary of noise abatement measures in place at the Airport. The Report summarizes the various noise abatement and runway use measures that were considered during BLANS, methodologies for analyzing and assessing the measures, the results of those analyses, the measures recommended for implementation, and other commitments made by Massport during the course of the BLANS.

An overall summary of noise abatement measures and programs at the Airport is provided and includes:

- Noise abatement flight and ground procedures recommended through BLANS
- A summary of work completed toward development of a runway use program
- A list of previously existing noise abatement measures implemented at the Airport prior to and separate from BLANS

Pertinent information on specific aspects of the BLANS are provided herein and attached as appendices. More detailed information related to the various phases and analyses completed as part of the BLANS are available on the website that was maintained throughout the course of the study: www.bostonoverflight.com[2]. The information on the website is expected to be transferred to the Massport Community Advisory Committee[3] intact and will continue to be made available to the public.

[2] This URL will be frozen once the final report is posted and will be available to the public until December 31, 2017.

[3] The Massport Community Advisory Committee is a new community organization created by the Massachusetts State Legislature to address community concerns related to Massport facilities, including Boston Logan International Airport. Some community representatives on the Massport Community Advisory Committee served on the Logan Airport Community Advisory Committee during the course of BLANS.

2. Study Process

The study, funded jointly through FAA Airport Improvement Program grants and Massport, was conducted in three phases spanning the period from 2003-2016.

2.1 Project Participants

Consistent with the ROD, the BLANS Project Management Team (PMT) comprised representatives of FAA, Massport, and the CAC. Two Technical Consultants, the Project Consultant (PC) and the Independent Consultant (IC) provided analysis, reporting expertise, and industry knowledge. The PC reported to the PMT under the direction of the FAA. The IC served as a technical resource and reported to the CAC. The roles and responsibilities of the various participants are described in the following paragraphs.

2.1.1 FEDERAL AVIATION ADMINISTRATION

FAA participation in the project was managed by the FAA Air Traffic Organization (ATO) Eastern Service Area, whose representatives provided project oversight and technical guidance, and the FAA Airports Division New England Region, whose representatives followed and monitored the progress of the BLANS and administered the FAA grants. The FAA's responsibility included overall project direction and management of the BLANS to:

(1) ensure the end product was achieved within budget and on schedule,

(2) determine if proposed noise abatement proposals were safe and efficient,

(3) ensure consistency with applicable legal requirements, and

(4) educate other stakeholders on aviation, air traffic and environmental related matters.

2.1.2 MASSPORT

Massport, as the owner and operator of the Airport, was the BLANS's project sponsor. Massport's responsibilities included executing and maintaining contracts for consultant services with the PC and with the CAC for the services of the IC. Other responsibilities were to:

(1) review, approve, and pay invoices to the PC and IC,

(2) represent the interests of the Airport operator,

(3) work jointly with FAA and CAC to develop scopes for each phase of the BLANS, and

(4) provide input related to Airport operational matters.

2.1.3 LOGAN AIRPORT COMMUNITY ADVISORY COMMITTEE

The CAC, organized in 1978 and incorporated in 2003, represents communities that have authorized representatives and are or may be affected by the operation and potential expansions of the Airport and Airport-related aircraft noise. The CAC considers means to mitigate adverse effects from Airport-related effects. **Exhibit 2-1** depicts the BLANS Study Area (described in Section 2.4) along with the communities surrounding the Airport and identifies those communities that had representation at some point during or over the entire course of the BLANS. As shown on the exhibit, the City of Boston along with 37 communities in the Greater Boston area were represented on the CAC for BLANS. Within the City of Boston, the following 13 neighborhoods were represented:

Beacon Hill	Jamaica Plain
Boston	Roslindale
Charlestown	Roxbury
Chinatown	South Boston
Dorchester	South End
East Boston	West Roxbury
Hyde Park	

The CAC engaged jointly with FAA and Massport to develop the scope of work for BLANS and maintained a contract with the IC to provide technical assistance and peer review of work performed by the PC and others. Other responsibilities of the CAC were to:

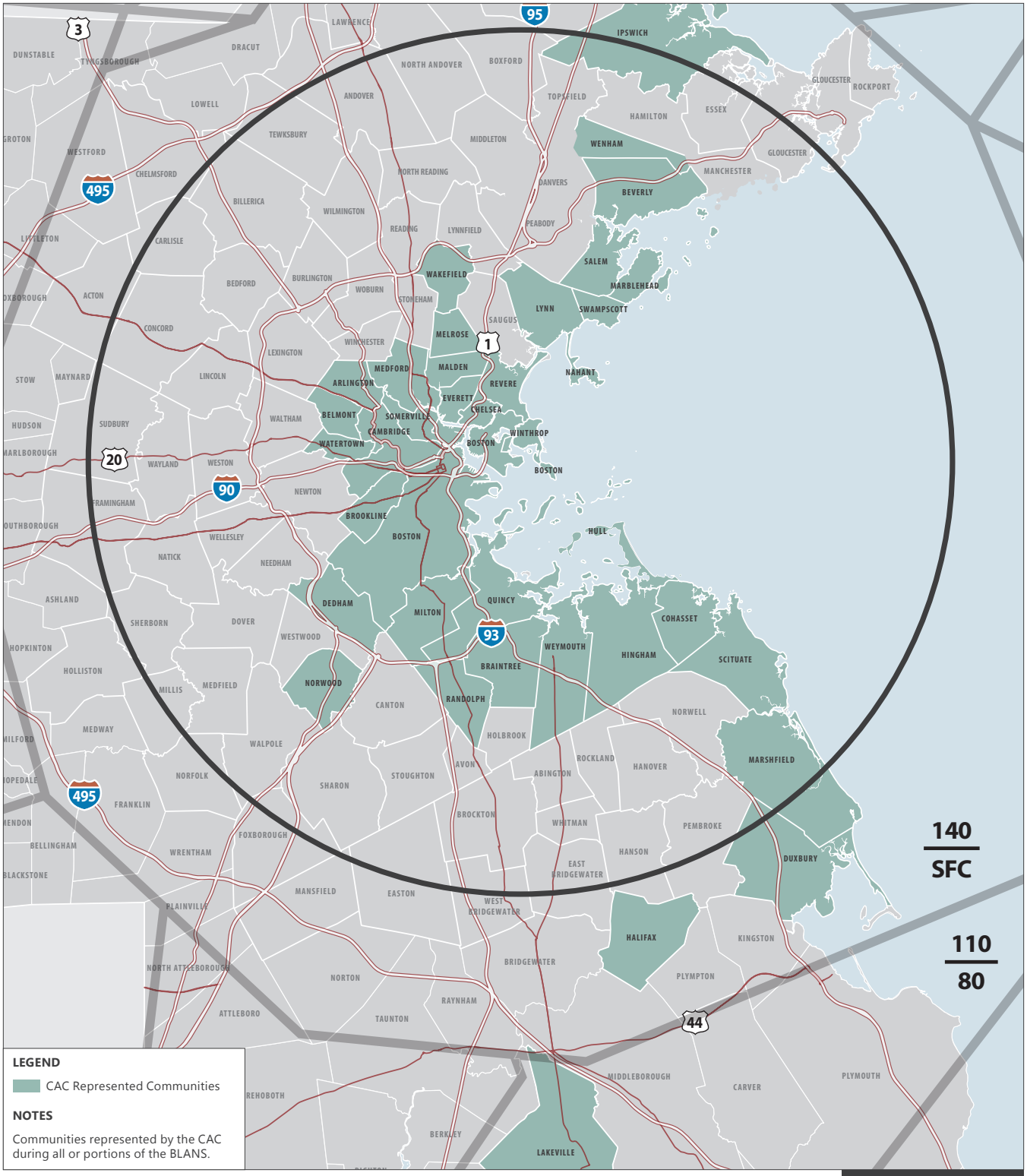
(1) provide the FAA and Massport with input on aircraft noise issues related to the Airport, particularly as they related to the identification of potential noise abatement measures;
(2) provide input on suggested criteria to be used in evaluating and comparing potential measures;
(3) identify measures to recommend for implementation; and
(4) identify potential runway use measures to be in included in a runway use program to replace the PRAS.

2.2 Project Phasing

The study was conducted in three phases; Phase 1, during which the study was referred to as the Boston Overflight Noise Study (BONS),[4] began in 2003 and culminated in October 2007 with FAA issuing a ROD[5] that

[4] For simplicity, the study is referred to as BLANS for the remainder of this document.

[5] Federal Aviation Administration, *Categorical Exclusion Record of Decision, Boston Logan International Airport Phase 1 Procedures/Alternatives Recommended for Implementation from Boston Overflight Noise Study*, October 2007, http://bostonoverflight.com/docs/BONS_Phase1_Catex_ROD_full_document.pdf



SOURCE: Ricondo & Associates Inc., December 2016.
PREPARED BY: Ricondo & Associates, Inc., December 2016.

EXHIBIT 2-1

NORTH 0 Not To Scale

BLANS Study Area

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identified and provided environmental approval for CAC-recommended noise abatement measures/ procedures for FAA implementation that raised aircraft altitudes over communities and maximized the use of over-water flight when conditions permit. See Section 3 for a more detailed summary of BLANS Phase 1.

Early Implementation Measures implemented following the conclusion of Phase 1 included actions that would not cause an impact requiring disclosure and consideration in an environmental assessment (EA) or environmental impact statement (EIS), and were listed in and met the conditions of FAA Order 1050.1E[6] (the version of the Order current at that time) to be considered as the type of action that would normally be categorically excluded from further processing under the National Environmental Policy Act (NEPA).

Phase 2[7] began in early 2007 and was completed in December 2012. Phase 2 included an assessment of candidate measures that were not considered Early Implementation Measures, but not eliminated in Phase 1 and new candidate measures identified during Phase 2. The intent was to determine which measures would be recommended for implementation and, if necessary, subject to further environmental analysis. See Section 4 for a more detailed summary of BLANS Phase 2.

Phase 3 began in July 2013 with a kickoff meeting in August 2013 and was concluded in December 2016. Phase 3 included the identification and evaluation of candidate runway use measures to be included in a runway use program to replace the PRAS (CAC voted to abandon the PRAS in April 2012 because the CAC concluded that it had failed to achieve the intended noise abatement) and development of a recommended Runway Use Program. See Section 5 for a more detailed summary of BLANS Phase 3.

2.3 Project Management and Participation

As a requirement of the ROD, the FAA, Massport, and the CAC worked together through the course of the BLANS, aided by the PC and IC. In addition to a Project Management Team (PMT), technical committees were established for the various phases of the BLANS. The following paragraphs briefly describe the makeup and roles of PMT, technical consultants, and the technical committees.

2.3.1 PROJECT MANAGEMENT TEAM

The PMT was formed early in the BLANS process and was responsible for overall scope and budget development for each of the phases, as well as ongoing project management throughout all three phases. The PMT comprised representatives of the FAA, Massport, and the CAC officers. The PMT met over 110 times during the course of the BLANS. Most meetings were held by teleconference, with some held in person. All CAC representatives were invited to participate in PMT meetings as observers, with the potential to comment at the end of the meeting as time permitted.

[6] Federal Aviation Administration, *Order 1050.1E CHG1, Environmental Impacts: Policies and Procedures*, March 20, 2006.

[7] Upon the initiation of Phase 2, the name of the project was changed to the Boston Logan Airport Noise Study (BLANS).

2.3.2 TECHNICAL CONSULTANTS

The PC and IC provided analysis, reporting expertise, and industry knowledge regarding aircraft noise and related concerns. The PC reported to the PMT and prepared overall technical analyses and review and final documentation. The IC reported to the CAC and served as a technical resource, providing peer review of analyses performed by the PC, conducting supplemental analyses requested by the CAC, and providing overall technical guidance and advisory services to the CAC.

2.3.3 BOSTON TECHNICAL ADVISORY COMMITTEE

The Boston Technical Advisory Committee (BOS/TAC) comprised representatives of the FAA, Massport, and the CAC and was formed to review and consider technical aspects of the BLANS and to report to the full PMT and CAC. The BOS/TAC was convened through Phase 1 and Phase 2 of the BLANS, with meetings conducted both in person and via teleconference. Approximately 30 BOS/TAC meetings were held over Phases 1 and 2 of the BLANS.

2.3.4 PHASE 3 TECHNICAL COMMITTEE

The BOS/TAC was not continued into Phase 3. In its place, a smaller Phase 3 Technical Committee was initially formed for Phase 3 that included the CAC officers and representatives of the FAA and Massport. In addition to the FAA members of the PMT, FAA representatives included air traffic control staff from the Boston Airport Traffic Control Tower (ATCT) the Boston Terminal Radar Approach Control (TRACON) facility, regional counsel, and a representative from the FAA New England Regional Administrator's office. After a couple of meetings of the Phase 3 Technical Committee, it was decided to hold technical meetings during which the full CAC membership was invited to participate as available. As work progressed, technical discussions were held as part of PMT meetings, with invitations to FAA air traffic control staff as needed. Two separate Technical Committee meetings were held early in Phase 3, along with four meetings with the CAC President or CAC officers.

2.4 Project Study Area

The Study Area for the BLANS generally included the area within a 20 nautical mile (NM) radius of the Airport, as depicted on Exhibit 2-1[8]. The Study Area incorporated the communities which are or may be affected by Airport-related aircraft noise. To define the Study Area boundary, Integrated Noise Model (INM) data and supporting documentation were obtained from Massport. The flight tracks included in the INM input files were expanded to cover areas within radar coverage that were not accounted for within Massport's Environmental Data Report (EDR) flight tracks.

To ensure accurate noise analysis within the BLANS Study Area, the INM profiles used in the 2003 EDR INM were extended to allow the INM to accurately calculate aircraft noise levels to the Study Area boundary and beyond as necessary. The standard arrival profiles were extended to a maximum altitude of 12,000 feet above

[8] In certain instances, areas outside of the 20-mile radius were included if flight track changes would occur over those areas.

mean sea level (MSL). The standard departure profiles were raised to a maximum altitude of 15,000 feet MSL. The 2003 EDR INM tracks were modified to model the intended effect of each individual procedure type – precision navigation procedures, conventional procedures, visual approaches, raising instrument landing system arrival intercept altitudes, modifications to procedures to reflect precision navigation capabilities, etc., that were considered as part of BLANS.

2.5 Public Coordination/Outreach

Project coordination and outreach through the BLANS included:

- ongoing collaboration between the CAC and the PMT;
- wide-ranging outreach to local, state, and federal elected officials, and the airline industry; and
- development and management of a project website with a comprehensive document library.

2.5.1 COMMUNITY AND WEB-BASED OUTREACH

Outreach to elected officials throughout BLANS included invitations to meetings to discuss project updates, milestones, potential noise abatement measures, and to encourage officials of Study Area communities to participate in the BLANS by joining the CAC if they were not already represented. Elected officials included U.S. House of Representatives, U.S. Senators, State Secretary of Transportation, Massport Director of Aviation, Logan CAC Co-Chairs, and members of the Massachusetts Joint Transportation Committee. Officials within the Study Area included Mayors, Chairmen/Chairwomen, Town Administrators, Town Managers, Selectmen, Town Clerks, and Executive Directors.

Web-based outreach involved the development and continual maintenance of and updates to the project website through the completion of Phase 3. The website maintained a thorough record of the scopes of work for each phase, meeting and outreach information, data, technical reports, and project documentation.

2.5.2 INDUSTY OUTREACH

Industry outreach included communication with airlines and other Airport users through their industry organizations, including the Aircraft Owners and Pilots Association, Airlines for America (previously named the Air Transport Association), International Air Transport Association, National Business Aviation Association, and the Regional Airline Association, to educate them on the Study process and to encourage their participation.

2.5.3 ELECTED REPRESENTATIVES

Outreach to elected representatives occurred at several points throughout the BLANS in the form of group briefings, individual briefings, and periodic correspondence providing updates and briefings on study progress.

Outreach at the beginning of Phase 1 was through a Project Initiation Letter sent to elected representatives. Two follow-up FAA briefings were held near the conclusion of Phase 1:

- May 2, 2007, South Shore Elected Official's Meeting
- May 3, 2007, Legislative Briefing

Outreach during Phase 2 included written correspondence dated August 17, 2007, introducing the kick-off of Phase 2 and inviting participation. Project update letters were issued by the FAA on February 26, 2008; October 30, 2009; and December 20, 2011. On May 30, 2008, the FAA met with federal, state, and local elected representatives at the Volpe Transportation Center in Cambridge to provide an update on the project and to allow elected representatives to comment on proposed noise abatement measures and propose additional measures.

Outreach during Phase 3 included written correspondence on September 26, 2013, informing representatives of the completion of Phase 2, introducing Phase 3, and inviting participation. A briefing to the Massachusetts Legislature and Congressional staff was held on July 18, 2014, and a project update letter was issued by the FAA on October 31, 2014. At the conclusion of Phase 3, an elected official's presentation was developed for use in follow up briefings, if requested.

3. Phase 1

Phase 1 was a collaborative process between the CAC, FAA, and Massport, with support from the PC and IC. The BOS/TAC was established during Phase 1 and comprised representatives of CAC that were able to participate during more technical discussions.

The two primary objectives for Phase 1 were to:

- reach a detailed understanding of existing air traffic procedures and aircraft noise exposure, and
- identify candidate noise abatement measures that would provide noise relief to communities surrounding the Airport and that could receive a Categorical Exclusion under NEPA and therefore be implemented early, prior to the completion of the BLANS

3.1 Inventory of Existing Conditions

Early in Phase 1, an inventory of existing conditions was developed that included a summary of the airfield, airspace and air traffic control conditions and procedures, air traffic demand, and aircraft noise exposure conditions. In 2004, as a starting point for considering options reducing noise impacts from aircraft overflight, the existing air traffic conditions at the Airport were documented within a working paper, prepared by the PC[9]. The baseline report for Phase 1 focused on aircraft overflights. This working paper is provided as **Appendix C** and summarized in the following paragraphs.

Air traffic conditions comprise four major components:

1. Airfield system, including runways, taxiways, and the supporting navigational aids;
2. Air traffic demand, including the types of operations, quantity, and general schedule of activity;
3. Airspace and route structure supporting the Airport; and
4. Air traffic management procedures in use.

The following paragraphs provide a summary of the airfield, air traffic demand, and the air traffic management structure serving the Airport.

[9] Ricondo & Associates, Inc., *Boston Logan International Airport, Overflight Noise Study Air Traffic Base Condition*, December 2004.

3.1.1.1 Airfield

In 2004, the BOS airfield layout included 5 runways ranging from 2,557 feet to 10,083 feet and 27 taxiways, providing access to and from 5 passenger terminals, 2 cargo areas, airline maintenance, and general aviation facilities.

Runway 14-32 was not reflected in the 2004 existing conditions inventory. The 2002 ROD approved new Runway 14-32, for the Airport. The runway subsequently opened in November 2006 and is 5,000 feet long and 100 feet wide. Runway 14-32 is unidirectional with Runway 32 used only for landings (arrivals occur over Boston Harbor to the Runway 32 approach end) and Runway 14 used only for takeoffs (all departures take off from the Runway 14 end and depart over the Boston Harbor). The need to limit Runway 14-32 to unidirectional operations is based on several factors, including:

- the desire to maximize use of over-the-water areas and minimize operational impacts to residential areas,
- the presence of a 174 foot high hotel located 1,300 feet northwest of the runway that penetrates the approach surface thereby precluding arrivals from the west, and
- the absence of taxiway access to the Runway 32 (northwest) end.

The unidirectional use is subject to variances that would allow for overland landings or takeoffs in the case of emergencies. Runway 14-32 use is also limited to conditions when northwest or southeast winds equal or exceed 10 knots.[10]

Table 3-1 lists the Airport runways with the airfield layout illustrated on **Exhibit 3-1**.

Table 3-1: Boston Logan International Airport Runways

RUNWAY	LENGTH (FEET)	WIDTH (FEET)
15R-33L	10,083	150
4R-22L	10,005	150
9-27	7,000	150
4L-22R	7,861	150
14-32[1/]	5,000	100
15L-33R	2,557	100

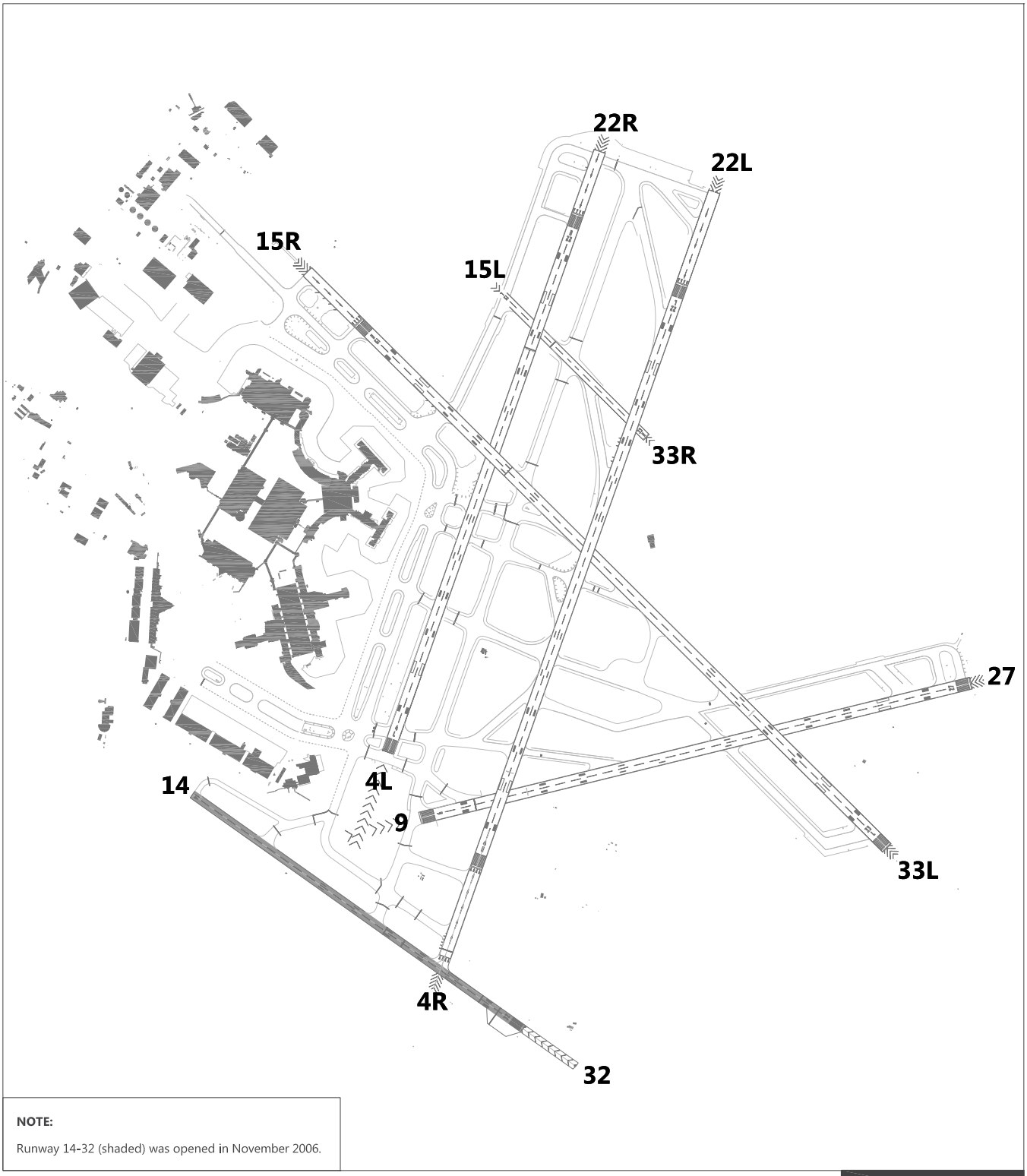
NOTE:

1/ Runway 14-32 was opened in November 2006.

SOURCE: Ricondo & Associates, Boston Logan International Airport, Overflight Noise Study, Air Traffic Base Condition, December 2004, Section 2.1.1., updated to include Runway 14-32, December 2016.

PREPARED BY: Ricondo & Associates, Inc., December 2016.

[10] Federal Aviation Administration, New England Division, Record of Decision, Airside Improvements Planning Project, Logan International Airport, Boston, Massachusetts, August 2, 2002.



NOTE:

Runway 14-32 (shaded) was opened in November 2006.

SOURCE: Massport, *Boston Logan International Airport, Airport Layout Plan*, 2009.
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 3-1

NORTH 0 1,800 ft.

2009 Boston Logan Airfield Layout

Drawing: C:\Projects\BOS\BLANS_ 2015_ Baseline\CAD\BOS_Noise_3-1_BOS Layout_20170120.dwg Layout: Layout2 Plotted: Mar 7, 2017, 03:42PM

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3.1.1.2 Air Traffic Demand

Air traffic demand in 2003, as reported by Massport, included a total of 373,304 flight operations, 22,791,169 passengers, and 372,419 tons of processed mail and cargo. From calendar year 2003 to mid-July 2004, flight operations increased by 7.2 percent, passengers served by 16.1 percent, and mail and cargo tonnage by 3.1 percent.

Baseline daily operational demand was estimated by dividing the sum of all operations over the 12-month period ending August 2004 by 365. The resulting baseline average daily operations level was 1,111 operations, with the following percentage breakdown by operator category:

- Air carrier: 51.3 percent
- Air taxi: 42.0 percent
- General Aviation: 6.5 percent
- Military: 0.2 percent

The peak departure period was between 7 a.m. and 8 a.m. and the peak arrival period was between 4 p.m. and 6 p.m. Nighttime operations, occurring during the period between 10 p.m. and 7 a.m., represented 10.4 percent of the average daily operations.[11]

3.1.1.3 Air Traffic Control

Two primary FAA facilities provide Air Traffic Control (ATC) services to aircraft arriving and departing the Airport and operating within the Study Area:

- Boston Consolidated Terminal RADAR Approach Control (TRACON) Facility (A90) - located in Merrimack, New Hampshire provides RADAR service to aircraft arriving and departing the Airport and 12 additional civil airports in the Boston area. The Boston TRACON airspace within an approximate 30 NM radius of the Airport, or approximately 3,744 square miles, at altitudes of 14,000 feet Mean Sea Level (MSL) and below.
- Boston Airport Traffic Control Tower (BOS ATCT) - a limited RADAR facility located on the airfield provides ATC services to aircraft operating on the airfield and within proximity of the Airport. The ATCT authorizes aircraft to land or takeoff at the Airport or to transition through its delegated airspace. The BOS ATCT airspace lies within an approximate 8 NM radius of the Airport, generally from the ground up to 2,000 feet MSL.

3.1.2 2003 EXISTING CONDITIONS NOISE

Noise conditions at the Airport in 2003 were documented in Chapter 6 of the *Logan International Airport Environmental Data Report* (2003 EDR). The 2003 EDR reported that no people were exposed to noise levels

[11] Ricondo & Associates, *Boston Logan International Airport, Overflight Noise Study Air Traffic Base Condition*, December 2004, Section III.

greater than day-night average sound level (DNL) 75 dBA[12] and higher, 503 people were exposed to noise levels between DNL 70 and 75 dBA, and 7,183 people were exposed to noise levels between DNL 65 and 70 dBA.[13]

3.2 Identification of Phase 1 Measures

The project team began identifying potential noise abatement measures with an initial list of over 50 concepts that were developed in a BOS/TAC brainstorming session held in November 2003. The concepts ranged from arrival and departure flight track changes to changes to cockpit procedures. The only parameters for developing noise abatement alternatives considered in Phase 1 were that they should not include Airport use restrictions, runway use actions, changes in the airspace structure, or procedures intended to address noise generated by aircraft taxiing. Taxi-related ground noise and runway use were to be addressed either in Phase 2 or Phase 3 of the study.

Continuing efforts to identify draft measures and develop a list of actual candidate measures for the BOS/TAC to consider did not commence until after data collection and air traffic baseline work was completed in December 2004 and the Study Area was established.

In January 2005 the consultant teams presented a preliminary list of candidate measures to the BOS/TAC. The measures were then revised and refined and a list of 55 airspace and operational measures that could potentially improve the noise environment around the Airport was presented to the BOS/TAC in June 2005. Section 3.4 provides a summary of the 55 candidate measures developed in Phase 1 and the evaluation/screening process. Detailed information, including graphical representation of each candidate measure is available on the BLANS website and included as **Appendix D**.

3.3 Evaluation of Phase 1 Measures

Each of the 55 candidate measures was subjected to a screening process that evaluated noise benefit, safety, operational feasibility, and identified whether the alternative met the criteria to be included in the list of Early Implementation Measures, or those that could receive a Categorical Exclusion under NEPA and be implemented prior to the completion of the study.

3.3.1 LEVEL 1 SCREENING

Phase 1 Level 1 screening sorted the alternative noise abatement measures into three categories:

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12 dBA = A-weighted decibels. A-weighting is used to represent the frequencies of sound that the human ear detects and is the standard metric for measuring and reporting aircraft noise exposure.

13 Massachusetts Port Authority, *Boston-Logan International Airport, 2003 Environmental Data Report*, June 2004, Chapter 6, Noise Abatement.

1. measures determined to be safe and operationally and technically feasible and could be implemented early in Phase 1 - Early Implementation Measures
2. measures determined to be safe and operationally technically feasible, but had the potential to cause adverse environmental impact if implemented - deferred to Phase 2 for further analysis, and
3. measures determined by the FAA to be either unsafe or technically infeasible and therefore discarded.

Following the preliminary screening in April 2006, the BOS/TAC agreed that there were outstanding issues with many of the alternatives in the first two categories that needed to be addressed before a final determination could be made. Some measures needed further analysis to better define or refine while other measures needed to be evaluated further to determine if they should proceed as final candidate measures. A matrix was prepared summarizing the results of the Phase 1 Level 1 screening. The matrix is available on the BLANS website and is included as **Appendix E**.

3.3.2 LEVEL 2 SCREENING

Phase 1 Level 2 screening focused on two additional criteria for the candidate measures:

1. Operational Issues: Considering the refined definitions of the measures not discarded in Level 1, the FAA Evaluation Team applied the same criteria as in Level 1 to determine whether any measure would compromise safety. In addition, the FAA reviewed the measures for their potential to significantly compromise the efficient movement of air traffic at the Airport, based upon professional experience, historical knowledge, and an expert understanding of air traffic conditions within the Boston area. Those measures that were found to compromise safety or to significantly compromise the efficient movement of air traffic were discarded. The Level 2 screening evaluation also identified other potential operational issues that were not "fatal flaw" issues, but required further consideration.

2. Noise Reduction Potential: Each measure was qualitatively reviewed for the potential to provide a noticeable reduction in aircraft noise levels over communities and other noise-sensitive areas. In addition, the PC and IC reviewed each measure for potential to cause adverse noise exposure impacts to other communities. Those measures that would have the potential to cause adverse noise exposure impacts or that would not provide a noticeable reduction were discarded.

The remaining measures were further examined to determine whether their implementation of the would potentially cause an adverse environmental impact (as defined in FAA Orders 1050.1E and 5050.4B[14]), requiring disclosure and consideration in an Environmental Assessment (EA) or Environmental Impact Statement (EIS). Measures that would not cause an impact requiring disclosure and consideration in an EA or EIS were identified as Early Implementation Measures. As for Level 1, a matrix was prepared summarizing the results of the Phase 1 Level 2 screening. The matrix is available on the BLANS website and is included as **Appendix F**.

[14] Federal Aviation Administration, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 28, 2006.

3.3.3 LEVEL 3 SCREENING

Phase 1 Level 3 screening included further refinement of the candidate measures. In addition, candidate measures were combined if the proposed procedures and intent were identical. Ultimately, 18 measures were discarded, 23 measures were identified as Early Implementation Measures, and 14 were deferred to Phase 2 for further evaluation to determine potential impacts to communities and other noise-sensitive areas. The Phase 1 Level 3 screening results were displayed via a flash presentation on the BLANS website. A hardcopy of the presentation slides is included in **Appendix G**.

3.4 Summary of Phase 1 Evaluations

Table 3-2 provides a summary of the 55 candidate measures that were considered in the Phase 1 screening levels and the outcome for each measure. More detailed information regarding each measure, including graphical representations is provided in Appendix D. The original measure number is depicted in the first column. Candidate measures that were not discarded during Phase 1 were subsequently combined into classifications with common descriptions and given new candidate measure numbers. Table 3-1 is divided into three categories. The first category includes the 23 Phase 1 candidate measures determined to be Early Implementation Measures, which were combined into 13 measures for early implementation. The second category identifies the 14 candidate measures that were deferred for further evaluation in Phase 2. These 14 measures were combined into 12 measures to be carried forward to Phase 2. The third category includes the 18 measures that were discarded in Phase 1.

3.5 Phase 1 Measures Recommended for Early Implementation

As stated in the introduction to Section 3, one of the primary objectives of Phase 1 was to identify noise abatement measures that were appropriate to consider under a NEPA Categorical Exclusion and implemented prior to the completion of the study. **Table 3-3** provides a summary of the 13 Early Implementation Measures that the BOS/TAC recommended to the full CAC on November 8, 2006. Ultimately the CAC recommended 9 of the 13 as Early Implementation Measures. Measures 8, 9, 12, and 13 were not recommended.

3.6 Phase 1 Measures Carried Forward to Phase 2

Table 3-4 provides a summary of the 12 measures that were carried forward for further evaluation to Phase 2 and a brief description of each.

Table 3-2 (1 of 6): Phase 1 Screening Determinations

MEASURE NUMBER						
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT
Phase 1 Candidate Measures Identified for Early Implementation						
1A-2	1	04L/R	D	RNAV/FMS	Develop a Departure Procedure to Fly Over the Nahant Causeway	Avoid/minimize impacts to Nahant and minimize impacts to other communities where aircraft come back on shore
1A-3		04L/R	D	Conventional	Develop a Departure Procedure to Maintain Runway Heading for 5 DME then turn right (north of Nahant)	Minimize impacts to communities where aircraft come back on shore
1B	2	09	D	RNAV/FMS	Develop RNAV/FMS Departure Procedure to Turn at Higher Altitude	Minimize impacts to communities where aircraft come back on shore
2B		09	D	Conventional	Develop Classic Procedure for non-FMS/GPS Equipped Aircraft to Increase Altitudes Over Land	Minimize impacts to communities where aircraft come back on shore
1C	3	15R	D	RNAV/FMS	Develop RNAV/FMS Departure Procedure to Increase Altitudes Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore
2C		15R	D	Conventional	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore. Shoreline crossing component made into a separate alternative - 4/27/05 BOSTAC meeting.
4A	6	22R/L	A	RNAV/FMS	Develop RNAV/FMS Approach Procedure to that Maximizes Flight Over Water	Reduce noise impacts to communities in the vicinity of Braintree, Weymouth and Cohasset from arrivals on downwind to Runway 22.
6A		22	A	Conventional	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures	Reduce noise impacts to communities affected by arrival noise to Runway 22R/L.
4B	7	27	A	RNAV/FMS	Develop RNAV/FMS Approach Procedure to Runway 27 That Maximizes Flight Over Water	Reduce noise impacts to communities in the vicinity of Braintree, Weymouth and Cohasset from arrivals on downwind to Runway 27.
6B		27	A	Conventional	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures	Reduce noise impacts to communities affected by arrival noise to Runway 27.

Table 3-2 (2 of 6): Phase 1 Screening Determinations

MEASURE NUMBER						
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT
Phase 1 Candidate Measures Identified for Early Implementation						
23A	9	04L/R	A	RNAV/FMS	Develop an RNAV/FMS Arrival Procedure for Left Traffic Turbojets to Remain West of the City	Provide more balance of left and right downwind for 4L/R arrivals.
23B		04L/R	A	Conventional	Develop a Classic Arrival Procedure to Mirror RNAV Procedure	Provide more balance of left and right downwind for 4L/R arrivals.
31	15	4L/R, 09,15R, 22L/R	D	Radar Vector	Keep south flow departure traffic east of Minot Light	Reduce south flow departure noise for communities west of Minot Light and cross shoreline at higher altitude.
1D	5	22R/L	D	RNAV/FMS	Develop RNAV/FMS Departure Procedure to Increase Altitude Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore. Shoreline crossing component made into a separate alternative - 4/27/05 BOSTAC meeting.
2D		22R/L	D	Conventional	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore. Shoreline crossing component made into a separate alternative - 4/27/05 BOSTAC meeting.
4C	11	33L	A	RNAV/FMS	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water	Reduce noise impacts to communities affected by arrival noise to Runway 33L.
6C		33L	A	Conventional	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures	Reduce noise impacts to communities affected by arrival noise to Runway 33L.
14		33L	A	RNAV/FMS	Turn onto Final Over Water	Reduce noise impacts to communities affected by arrival noise to Runway 33.
8A	12	4R, 15R, 22L, 33L	A	Conventional	Raise Intercept Altitudes for ILS	Increase altitude to intercept glide slope to 4,000'. Reduce arrival noise for communities impacted by close-in base turns.
30	14	4L/R, 09,15R, 22L/R	D	RNAV/Classic	Increase shoreline crossing altitudes	Increase shoreline crossing altitudes.

Table 3-2 (3 of 6): Phase 1 Screening Determinations

MEASURE NUMBER						
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT
Phase 1 Candidate Measures Identified for Early Implementation						
4E	8	15R	A	RNAV/FMS	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water	Reduce noise impacts to communities affected by arrival noise to Runway 15.
6E		15R	A	Conventional	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures	Reduce noise impacts to communities affected by arrival noise to Runway 15.
24	13	15R, 22L/R	D	N/A	Develop Nighttime Departure Procedures for Props to Follow the Same Nighttime Procedures as Jets	Reduce nighttime propeller noise over communities to the south and west.
Phase 1 Candidate Measures Carried Over to Phase 2						
16	27	4L/R	A	Conventional	Develop Offset Approaches From the East and West	Reduce noise impacts to communities directly under the existing approach area to Runways 4R and L.
1E	4	14	D	RNAV/FMS	Develop RNAV/FMS Departure Procedure to Increase Altitude Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore. Shoreline crossing component made into a separate alternative - 4/27/05 BOSTAC meeting.
2E		14	D	Conventional	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore. Shoreline crossing component made into a separate alternative - 4/27/05 BOSTAC meeting.
4D	16	32	A	RNAV/FMS	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water	Reduce noise impacts to communities affected by arrival noise to Runway 32.
6D		32	A	Conventional	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures	Reduce noise impacts to communities affected by arrival noise to Runway 32.
3	17	27/33L	D	RNAV/FMS	Develop RNAV/FMS and Classic Departure Procedures for Fanning	Minimize departure noise impacts to communities in the departure areas to Runway 27 and 33.
9	18	'04L/R, 09, 27, 33L	D	Conventional	Cockpit Departure Procedures	Reduce departure noise to close-in communities off Runways 4, 9, 27 and 33.
15	19	27	D	Conventional	Discontinue Departures from this Runway	Reduce noise impacts to communities in the departure area to Runway 27.

Table 3-2 (4 of 6): Phase 1 Screening Determinations

MEASURE NUMBER							
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT	
Phase 1 Candidate Measures Carried Over to Phase 2							
18	20	4L and 22R	A/D	N/A	Remove Noise Emission Restriction	(none identified)	
19	21	All	D	N/A	Develop Fanning Departure Procedures Based on Route of Flight.	Disperse noise impacts for departures from all runways.	
20	22	4L/R and 22L/R	A/D	N/A	Develop Runway Use Procedure to More Evenly Use Runways 4L/R and 22L/R in Small Tailwind Conditions	(none identified)	
21	23	27/15	A/D	N/A	Arrive on Runway 27 and Depart on Runway 15 During Late Night Hours.	(none identified)	
25	24	27	D	N/A	PATTS Departure Procedure	Reduce the aircraft noise exposure during the nighttime hours (10pm to 7am) for the communities in the departure area of Runway 27.	
28	26	27	D	N/A	Modify the Runway 27 WYL YY Departure Procedure so That Aircraft are Fanned after the Second Gate	Reduce the aircraft noise exposure for the communities in the departure area of Runway 27.	
Phase 1 Candidate Measures Discarded							**Screening Level Discarded**
27	DISCARDED	27	D	N/A	Alter Runway Use to Provide a More Equal Balance in the Number of Departures Between Runway 27 and 33	Reduce the aircraft noise exposure for the communities in the departure area of Runway 27.	Level 2
1A	DISCARDED	4L/R	D	RNAV/FMS	Develop an Early Right Turn RNAV/FMS Procedure	Avoid/minimize impacts to Nahant and minimize impacts to other communities where aircraft come back on shore.	Level 2
1D-2	DISCARDED	22L/R	D	Conventional	Develop RNAV or GPS Departure to Increase Altitude Over Land	Avoid/minimize impacts to Hull and minimize impacts to other communities where aircraft come back on shore.	Level 2

Table 3-2 (5 of 6): Phase 1 Screening Determinations

MEASURE NUMBER							
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT	Screening Level Discarded
Phase 1 Candidate Measures Discarded							
2A	DISCARDED	4L/R	D	Conventional	Develop Classic Early Right Turn Procedure for Non-FMS/GPS-Equipped Aircraft	Avoid/minimize impacts to Nahant and minimize impacts to other communities where aircraft come back on shore.	Level 2
5A	DISCARDED	4L/R	A	RNAV/FMS	Runway 4L/R and 15 – Develop RNAV/FMS Arrival Procedures That Take Advantage of Water or Compatible Land Use	Reduce noise impacts to communities affected by arrival noise to Runways 4L/R and 15.	Level 2
5B	DISCARDED	15R	A	RNAV/FMS	Runway 4L/R and 15 – Develop RNAV/FMS Arrival Procedures That Take Advantage of Water or Compatible Land Use	Reduce noise impacts to communities affected by arrival noise to Runways 4L/R and 15.	Level 1
7	DISCARDED	All	A	RNAV/FMS	Develop Continuous Descent Approach (CDA)	Reduce arrival noise to all runways.	Level 2
8B	DISCARDED	4R, 15R, 22L and 33L	A	Conventional	Raise Glide Slope Angle	Reduce arrival noise to all runways.	Level 2
10	DISCARDED	All	A	Conventional	Cockpit Arrival Procedures	Reduce arrival noise to all runways.	Level 2
11	DISCARDED	All	A/D	RNAV/FMS	Seek Opportunity for Implementation of Procedures in Off-Peak Hours	Increase likelihood of implementing noise abatement procedures.	Level 2
12	DISCARDED	All	A/D	N/A	Seek Voluntary Agreements with Night Operators	Increase likelihood of implementing noise abatement procedures.	Level 2
13	DISCARDED	9, 27, 33	D	Conventional	Develop Cockpit Departure Procedure That Includes Major Power Reduction	Reduce noise impacts to close-in communities in the departure areas of Runways 9, 27 and 33.	Level 2
2F	DISCARDED	27	D	Conventional	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Turn Left Immediately After Take-off to Avoid Over Flying the City.	Avoid/minimize impacts to South Boston and Hull and minimize impacts to other communities where aircraft come back on shore.	Level 2

Table 3-2 (6 of 6): Phase 1 Screening Determinations

MEASURE NUMBER							
ORIGINAL MEASURE[1/] NUMBER	NEW MEASURE[1/] NUMBER	RUNWAY	ARR/DEP	TECHNOLOGY[2/]	MEASURE DESCRIPTION	INTENT	
Phase 1 Candidate Measures Discarded							**Screening Level Discarded**
17	DISCARDED	22L/R and 33L	A	Conventional	Develop Visual Circle to Land Approach Procedure Using Runway 27 ILS	Minimize noise impacts to north shore communities from approaches to Runways 22R/L and 33L.	Level 1
26	DISCARDED	27	D	N/A	Change the Logan 2 departure procedure	Reduce the aircraft noise exposure for the communities in the departure area of Runway 27.	Level 1
29	DISCARDED	27	D	N/A	Modify Runway 27 departure procedure to an initial right turn	Reduce the aircraft noise exposure for the communities in the departure area of Runway 27.	Level 3
22A	DISCARDED	15R	A	RNAV/FMS	Develop an RNAV/FMS Arrival Procedure to Fly West of the City	Provide more balance of left and right downwind for 15R arrivals.	Level 2
22B	DISCARDED	15R	A	Conventional	Develop a Classic Arrival Procedure to Mirror RNAV Arrival Procedures	Provide more balance of left and right downwind for 15R arrivals.	Level 2

NOTES:

1/ The original measure number is depicted in the first column. Measures that were identified as Early Implementation Measures or passed forward to Phase 2 were combined into classifications of common description and given a new candidate measure number.

2/ Technology refers to the type of navigation technology with the applicable candidate measure:

- Conventional: Ground based navigation aid, primarily involving air traffic control issued heading or use of existing navigational aids.
- RNAV (Area Navigation): A method of navigation that uses onboard equipment to calculate and follow a direct path between two points and allows the aircraft to choose from multiple courses within a network of station-referenced navigation signals.
- FMS (Flight Management System): A multi-sensor RNAV system that uses navigation, atmospheric and fuel flow data from several sensors to provide a centralized system for flight management.

SOURCE: BLANS Alternative Analysis, Phase 1, Levels 1-2 Screening Matrices, March 25, 2005 /June 21, 2005 and Early Implementation Alternatives Illustrations, June 21, 2005.
PREPARED BY: Ricondo & Associates, Inc., October 2016.

Table 3-3: Phase 1 Early Implementation Measures

MEASURE NUMBER	RUNWAY	MEASURE DESCRIPTION[1/]
1/14/15	04R	Develop a Departure Procedure to Fly Over the Nahant Causeway
	04R	Develop a Departure Procedure to Maintain Runway Heading for 5 DME then turn right (north of Nahant)
2/14/15	09	Develop RNAV/FMS Departure Procedure to Turn at Higher Altitude
	09	Develop Classic Procedure for non-FMS/GPS Equipped Aircraft to Increase Altitudes Over Land
3/14/15	15R	Develop RNAV/FMS Departure Procedure to Increase Altitudes Over Land
	15R	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land
5/14/15	22R/L	Develop RNAV/FMS Departure Procedure to Increase Altitude Over Land
	22R/L	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land
6	22R/L	Develop RNAV/FMS Approach Procedure to that Maximizes Flight Over Water
	22	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures
7	27	Develop RNAV/FMS Approach Procedure to Runway 27 That Maximizes Flight Over Water
	27	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures
11	33L	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water
	33L	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures
	33L	Turn onto Final Over Water
Measures Recommended by BOS/TAC, but Not Recommended by CAC as Early Implementation Measures		
8	15R	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water
	15R	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures
9	04L/R	Develop an RNAV/FMS Arrival Procedure for Left Traffic Turbojets to Remain West of the City
	04L/R	Develop a Classic Arrival Procedure to Mirror RNAV Procedure
12	4R, 15R, 22L, 33L	Raise Intercept Altitudes for ILS
13	15R, 22L/R	Develop Nighttime Departure Procedures for Props to Follow the Same Nighttime Procedures as Jets

NOTE:

1/ See Table 3-1 for additional details regarding each Measure.

SOURCE: BLANS Alternative Analysis, Phase 1, Levels 1-2 Screening Matrices, March 25, 2005 /June 21, 2005 and Early Implementation Alternatives Illustrations, June 21, 2005.

PREPARED BY: Ricondo & Associates, Inc., March 2017.

Table 3-4 Phase 1 Measures Carried Forward to Phase 2

MEASURE NUMBER	RUNWAY	MEASURE DESCRIPTION[1/]
27	4L/R	Develop Offset Approaches From the East and West
4	14	Develop RNAV/FMS Departure Procedure to Increase Altitude Over Land
	14	Develop Classic Departure Procedure for non-FMS/GPS Equipped Aircraft To Increase Altitudes Over Land
16	32	Develop RNAV/FMS Approach Procedure That Maximizes Flight Over Water
	32	Develop Classic Arrival Procedures to Mirror RNAV Arrival Procedures
17	27/33L	Develop RNAV/FMS and Classic Departure Procedures for Fanning
18	'04L/R, 09, 27, 33L	Cockpit Departure Procedures
19	27	Discontinue Departures from this Runway.
20	4L and 22R	Remove Noise Emission Restriction
21	All	Develop Fanning Departure Procedures Based on Route of Flight.
22	4L/R and 22L/R	Develop Runway Use Procedure to More Evenly Use Runways 4L/R and 22L/R in Small Tailwind Conditions
23	27/15	Arrive on Runway 27 and Depart on Runway 15 During Late Night Hours
24	27	PATTS Departure Procedure
26	27	Modify the Runway 27 WYL YY Departure Procedure so that Aircraft are Fanned after the Second Gate.

NOTE:

1/ See Table 3-1 for additional details regarding each Measure.

SOURCE: BLANS Alternative Analysis, Phase 1, Levels 1-2 Screening Matrices, March 25, 2005 /June 21, 2005 and Early Implementation Alternatives Illustrations, June 21, 2005.

PREPARED BY: Ricondo & Associates, Inc., November 2016.

4. Phase 2

Phase 2 continued the work conducted by FAA, Massport and CAC in Phase 1. Phase 2 considered: (1) candidate measures carried over from Phase 1 that did not qualify as Early Implementation Measures, (2) ground noise measures that were not part of the Phase 1 scope of work, (3) additional noise abatement measures identified by the CAC that met their noise abatement goals and objectives, and (4) whether the existing PRAS should continue.

4.1 Phase 1 Implementation

4.1.1 EARLY IMPLEMENTATION MEASURES

As summarized in Sections 3.4 and 3.5, of the 55 Phase 1 candidate measures considered, 23 were initially recommended as Early Implementation Measures and combined into 13 for further consideration. Of those 13, 9 measures were ultimately recommended by the CAC in January 2007. The CAC voted not to support candidate measures 8, 9, 12, and 13.[15]

FAA subsequently determined that the nine measures recommended by the CAC met FAA Order 1050.E categorical exclusion criteria and prepared the necessary documentation. **Table 4-1** summarizes the Phase 1 Early Implementation Measures. The FAA published the Categorical Exclusion and ROD on October 16, 2007[16]. The document is available on the BLANS website and is included as **Appendix H**.

4.1.2 EARLY IMPLEMENTATION MEASURES

After the ROD was issued, FAA began the process of implementing the approved procedures. The procedures involved either conventional or Area Navigation (RNAV) means of navigation. Using a phased approach, all early implementation procedures were implemented by November 18, 2010, with some minor modifications to the procedures implemented subsequently.

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15 Boston Logan Airport Noise Study, Phase 1 Project Website, Phase 1 Summary Findings, http://www.bostonoverflight.com/Flash/BOSBONS_Early_Implementation_Alternatives_Summary.html, accessed December 07, 2016.

16 Department of Transportation, Federal Aviation Administration, *Documented Categorical Exclusion, Record of Decision, Boston Logan International Airport, Boston, Massachusetts Phase 1 Procedures/Alternatives Recommended for Implementation from the Boston Overflight Noise Study*, October 16, 2007.

Table 4-1: FAA Approved Phase 1 Early Implementation Measures

MEASURE(S)	RUNWAY	TECHNOLOGY	INTENT	ROUTE CHANGE DESCRIPTION
1/14/15	4R Departures	RNAV/ Conventional	Increase the accuracy and narrow the track of departures over the Nahant Causeway; Increase shore altitude crossings; Keep southbound departures east of Minot's Light prior to crossing the shoreline.	Establish an RNAV SID for turbojet aircraft departures to route aircraft over the causeway north of Nahant and south of Swampscott, then east over the water. For shoreline crossings, develop RNAV route design to provide the maximum crossing altitude possible, provide dispersions where possible and, if possible, route aircraft over non-noise sensitive areas. Conventional procedure will approximate the published RNAV SID.
2/14/15	9 Departures	RNAV/ Conventional	Increase the altitude of jet aircraft departures from Runway 9; Increase the altitude of aircraft crossings over the South and North Shores; Keep southbound departures east of Minot's Light prior to shoreline crossing.	Establish an RNAV SID for all Runway 9 turbojet departures. For shoreline crossings, an RNAV route design will provide the maximum altitude possible for aircraft crossing the shoreline, provide dispersion where possible and, if possible, route aircraft over non-noise sensitive areas. Conventional procedure will approximate the published RNAV SID.
3/14/15	15R Departures	RNAV/ Conventional	To avoid, to the extent practicable, Runway 15R departure overflights of the Hull peninsula Increase the altitude of crossings over the South and North Shores; Keep southbound departures east of Minot's Light prior to shoreline crossing	Establish an RNAV SID for all Runway 15R turbojet departures. For shoreline crossings, an RNAV route design will provide the maximum altitude possible for aircraft crossing the shoreline, provide dispersion where possible and, if possible, route aircraft over non-noise sensitive areas. Conventional procedure will approximate the published RNAV SID.
5/14/15	22L/R Departures	RNAV/ Conventional	To avoid, to the extent practicable, Runway 15R departure overflights of the Hull peninsula Increase the altitude of crossings over the South and North Shores; Keep southbound departures east of Minot's Light prior to shoreline crossing	Establish an RNAV SID for all Runway 22L/R turbojet departures. For shoreline crossings, an RNAV route design will provide the maximum altitude possible for aircraft crossing the shoreline, provide dispersion where possible and, if possible, route aircraft over non-noise sensitive areas. Conventional procedure will approximate the published RNAV SID.
6	22L Arrivals	Conventional	To reduce noise exposure for the communities located under the NORWICH Standard Terminal Arrival Route left downwind arrival to Runway 22L by relocating aircraft at the DRUNK intersection from the NORWICH STAR	Alternative focuses on jet aircraft routed along the Providence arrival fix that use the NORWICH STAR, routed along the left downwind arrival to Runway 22L.
7	27 Arrivals	Conventional	To reduce noise exposure for the communities located south of the airport under the NORWICH STAR south arrival route to Runway 27.	NORWICH STAR would be adjusted to extend the STAR to the DRUNK intersection through either radar vectoring or other conventional means. Aircraft would pass the DRUNK intersection at or above 6,000 feet mean sea level.
11	33 Arrivals	Conventional	To reduce noise exposure for South Shore communities.	Establish a chartered visual approach to Runway 33 for jet aircraft using traditional navigation augmented by RNAV derived waypoints. Alternative focuses jet aircraft routed along the Gardner arrival fix, the Providence arrival fix, and the SCUPP intersection.

SOURCE: Federal Aviation Administration, Categorical Exclusion, Record of Decision, Boston Logan International Airport, Phase 1 Procedures/Alternatives Recommended for Implementation from Boston Overflight Noise Study, October 16, 2007.

PREPARED BY: Ricondo & Associates, Inc., November 2016.

4.2 Existing Conditions Update

Early in Phase 2, an updated noise modeling analysis was performed by the PC for Calendar Years 2005 and 2007. The analysis/modeling included six runway operating configurations for 2005 and seven for 2007. Utilization of each runway was determined from the runway log data, segregated by aircraft type (heavy jets, large jets, small jets, and propeller).[17]

Table 4-2 lists the estimated population (based on 2000 census data) subjected to noise levels from DNL 55 to greater than DNL 75 in each year of analysis (2005 and 2007).

Table 4-2: Study Area 2005 and 2007 Noise Exposure Population Estimates

	ESTIMATED POPULATION WITHIN DNL RANGES				
YEAR	**DNL 55-60**	**DNL 60-65**	**DNL 65-70**	**DNL 70-75**	**DNL 75+**
2005	93,314	35,620	7,838	585	2
2007	69,807	34,632	10,473	373	0

SOURCE: Wyle Laboratories, Inc.; Landrum & Brown, Ricondo & Associates, Boston Logan Airport Noise Study CY 2005 and 2007 Noise Modeling Analysis, May 2010, Tables 3-14 and 5-15.
PREPARED BY: Ricondo & Associates, Inc., November 2016.

4.3 Additional Measures Identified for Assessment in Phase 2

Concept development for Phase 2 evaluations began with the 12 measures (grouped from an original list of 14) that were deferred from Phase 1 (see Table 3-4). The 12 original measures were further refined and several concepts were added for consideration. By late November 2007, the CAC had also preliminarily agreed upon a list of ground noise abatement concepts to be analyzed in Phase 2. The proposed measures were presented to the BOS/TAC on February 28, 2008, with a subsequent FAA-sponsored status update meeting for elected officials on May 30, 2008, at which two representatives provided additional noise abatement proposals. The full list of 60 ground and flight concepts identified for evaluation as well as the results of the evaluation is provided in Section 4.4.3.

[17] Wyle Laboratories, Inc.; Landrum & Brown, Ricondo & Associates, Boston Logan Airport Noise Study CY 2005 and 2007 Noise Modeling Analysis, May 2010.

4.4 Evaluation of Phase 2 Measures

As with the Phase 1 screening of candidate measures, the screening evaluations in Phase 2 were carried out in three levels. Level 1 screening eliminated measures that would diminish safety or otherwise present substantial operational hurdles. Level 2 screening included more detailed definitions of the remaining measures and those that would not meet operational criteria were eliminated. Measures found to be operationally feasible were carried forward to the Level 3 screening analysis. The Level 3 screening analysis focused on aircraft noise exposure and the results of the analysis were used by the CAC to further evaluate each measure to develop the final recommendations to bring forward to the FAA and to Massport for implementation.

4.4.1 IDENTIFICATION OF MEASURES TO BE EVALUATED

The Phase 2 analysis included the 14 measures deferred from Phase 1 (combined into 12 measures) for further evaluation to determine potential impacts to communities and noise sensitive areas, three Early Implementation Measures from Phase 1 (carried over for budgetary purposes), additional measures related to ground noise sources (i.e. aircraft taxiway movements and run-ups), and other measures identified through the public involvement process.

4.4.2 SCREENING OF PHASE 2 MEASURES

The Phase 2 measures were passed through a three-level screening process with measures being eliminated, passed through to the next level, or further refined for additional screening. The following paragraphs briefly describe the process for each screening level. The final results of the screening are presented in Section 4.4.3. More detailed information is available in documents referenced for each screening level.

4.4.2.1 Level 1 Screening

Level 1 screening focused on the elimination of measures that would diminish safety or present substantial operational impediments (e.g., exceeds air traffic facility capabilities, requires airspace redesign) or be inconsistent with CAC goals. During Level 1 screening, FAA and Massport conducted separate and independent meetings to assess the measures using criteria that were deemed to be under their authority to implement. In addition, the Team also met to conduct a Level 1 screening assessment of the additional measures proposed by the elected representative's prior to a CAC vote on the measures.

As FAA and Massport evaluated the proposed measures, each primarily considered whether the intent of the measures satisfied the Level 1 criteria. In some cases, the initial information provided warranted elimination of the measure, but the FAA and/or Massport suggested adjustments that would deem the measure "Passed to Level 2 with Conditions." Elected representative measures were added in sequence with measures proposed by CAC. Elected representative measures that had already been proposed by CAC were designated as "duplicates of CAC measures."

The FAA also evaluated five non-runway use related measures carried over from Phase 1 that CAC had previously rejected. These measures included fanning departures, offset approaches to Runways 4L and 4R,

and a right turn from Runway 27. As discussed at the February 28, 2008, BOS/TAC meeting, the FAA could not support the reasons provided by CAC for rejecting those measures at that time due to the uncertainty of the criteria applied. Several conference call discussions occurred, including three "mini-summit" meetings, to address the need for clear CAC goal and associated objectives.

In all, 53 of the 60 measures identified were considered during Level 1 screening. Those not considered during the Level 1 screening were retained for Level 2 screening. The results are documented in the *Level 1 Screening Analysis* report[18] available on the BLANS website and included as **Appendix I**.

4.4.2.2 Level 2 Screening

The purpose of Level 2 screening was to better define measures retained from Level 1 screening and to determine which measures would meet operational criteria and should be modeled for their noise reduction potential. Criteria were developed, defined, and agreed upon in conjunction with BOS/TAC and CAC to determine the benefit or impact of each measure on noise exposure on noise-sensitive land uses.

The FAA and Massport conducted separate and independent meetings to assess the measures based on Level 2 criteria that were deemed to be under their authority to implement. Utilizing the refined definitions of the measures, FAA personnel carried out a detailed analysis of the measures and identified any that would significantly compromise their organizational goals and stated mission. In addition, the FAA also considered information in the FAA National Airspace System Capital Investment Plan 2008-2012, which lists Capital Investment Plan (CIP) projects that were aligned to the goals, objectives, and performance targets in the FAA Flight Plan 2007-2011 and the Department of Transportation's (DOT) strategic plan.

During the screening process, the FAA recognized the overall purpose of the BLANS and remained open to opportunities to meet the original intent without significantly compromising FAA's mission and goals. In all, 32 measures were considered during Level 2 screening and 10 passed through the screening and forwarded to Level 3. The results are documented in the *Level 2 Screening Analysis* report[19] available on the BLANS website and provided as **Appendix J**.

4.4.2.3 Level 3 Screening

The intent of the Level 3 screening analysis was to quantitatively examine the ability of each measure to meet the objectives of the BLANS through operational and noise modeling and to determine which measures would be recommended by the CAC to the FAA and Massport for implementation. The INM was used to model a future baseline at that time, reflecting forecast aircraft activity for the average annual day (AAD) at the Airport in 2015 and incorporating the measures recommended and approved for implementation during Phase 1. The 2015 baseline forecast was developed based on the FAA's 2009 *Terminal Area Forecast* (TAF) for the Airport and available aircraft fleet mix data, including known aircraft orders by airlines and other aircraft operators

[18] Ricondo & Associates, Inc., *Final Report, Boston Logan Airport Noise Study, Level 1 Screening Analysis*, October 2009.

[19] Ricondo & Associates, Inc., *Final Report, Boston Logan Airport Noise Study, Level 2 Screening Analysis*, November 2011.

and anticipated industry trends at the time. **Exhibit 4-1** depicts the 2015 Baseline Noise Exposure Contours developed for the Level 3 screening in Phase 2 of the BLANS.

As noted above, 10 measures passed the Level 2 screening analysis and were forwarded to the Level 3 screening analysis - two measures related to ground movements and eight measures related to flight procedures. Eight of the measures were assessed using noise analysis and evaluation against a series of separate criteria established by the CAC and the FAA.

The CAC's stated goal was to "safely reduce the aircraft flight and ground noise exposure from BOS-related operations[20] on as many residents of communities in the Boston area as practicable[21]. In order to evaluate the measures against the stated goal, the CAC established the criteria listed below to evaluate the measures in terms of noise exposure[22].

1. Reduce the number of persons who are exposed to aircraft noise in excess of 60 decibels of DNL (60 Ldn[23]).
2. Enact air traffic measures that will reduce or minimize increasing the noise level on people currently exposed to aircraft noise above 55 decibels of DNL (55Ldn). An increase of more than 1½ DNL on people within the 55 DNL will be considered to be of substantial concern to the CAC.
3. Enact air traffic procedures that will minimize the introduction of aircraft noise above 55 decibels of DNL (55 Ldn) onto people not currently exposed to noise of that level, unless necessary to reduce noise on people exposed to 60 Ldn or more. Further, a change of 3 DNL or more within 50 Ldn will be considered to be of substantial concern to the CAC; a change of 5 DNL or more within 45 Ldn will be considered to be of substantial concern to the CAC.
4. Reduce, to the greatest extent practicable, the existing total number of persons exposed to cumulative daily aircraft noise in excess of 55 decibels of DNL (55 Ldn).
5. Reduce, at each grid assessment point, to the greatest extent practicable, the number of single-event flight operations with maximum noise levels in excess of 60 decibels (60 dBA Lmax), using the NEA60 metric.
6. Reduce, to the greatest extent practicable, the existing total number of persons exposed to cumulative daily aircraft noise in excess of nighttime exposure of more than 55 decibels of Leq(n).
7. Reduce, at each grid assessment point, to the greatest extent practicable, form the existing total daily duration, the amount of time (TA60 as modeled in minutes per average annual day) of aircraft in flight, and separately on taxiways, at the gate, at maintenance facilities, or elsewhere during a ground operation at BOS, above 60 decibels.

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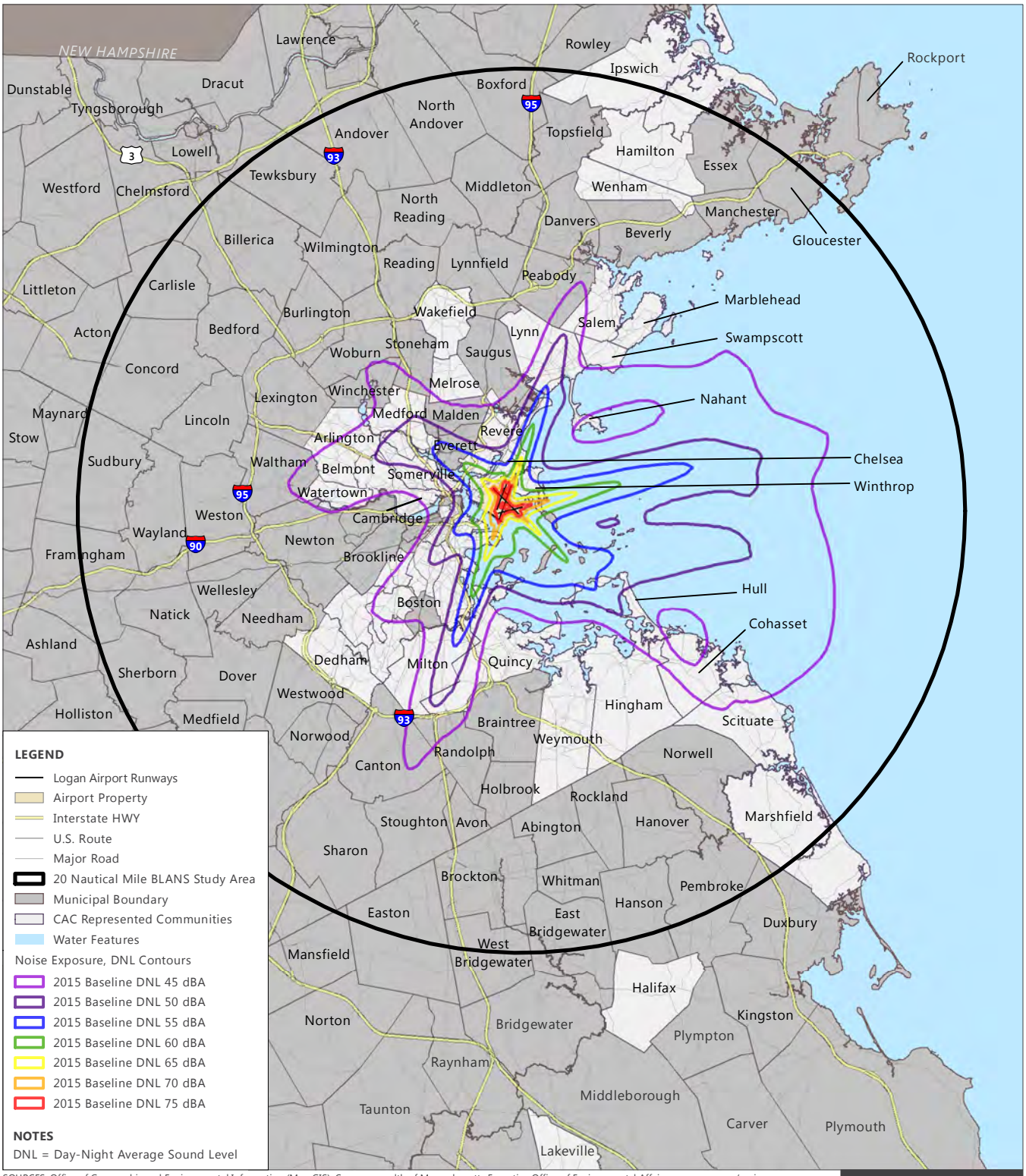
20 "BOS-related operations are those which takeoff, land at Boston Logan Airport, or are controlled by air traffic controllers located at the Boston Logan Air Traffic Control Tower." (Taken verbatim from the presentation referenced in the following footnote.)

21 Presentation by Landrum & Brown, Inc., *CAC Goals and Objectives Update,* May 28, 2009.

22 Ricondo & Associates, Inc., *Boston Logan Airport Noise Study, Level 2 Screening Analysis*, November 2011.

23 DNL and Ldn are used interchangeably.



SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, August 2016 (updated baseline noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 4-1

NORTH 0 40,000 ft.

BOS Noise Exposure (DNL 45-75 dBA) Contours, BLANS Study Area - 2015 Baseline, Phase 2

W:\Projects\BOS\BLANS_ 2015_ Baseline\FINAL\Ex4-1_BLANS_2015Baseline_2017-03-07.mxd

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The FAA followed its established criteria for reviewing the recommendations of the CAC to determine: (1) whether the recommended measures would be consistent with FAA policy in terms of aircraft noise exposure, and (2) the type of environmental document that would need to be prepared prior to implementation of any measures to meet the requirements of NEPA. Specifically, the FAA applied the following criteria for the purposes of the Level 3 screening analysis[24].

1. The number of people exposed to DNL 65 and higher and whether an increase or decrease would occur with implementation of a specific measure. DNL 65 and higher is considered by FAA to be significant aircraft noise exposure.
2. The number of people exposed to DNL 65 and higher that would experience an increase or decrease of DNL 1.5 or great as a result of implementation of a specific measure. A change of DNL 1.5 or greater within an area exposed to DNL 65 and higher is considered by FAA to be a significant change.
3. The number of people exposed to DNL 60 to DNL 64.9 that would experience an increase or decrease of DNL 3.0 or greater as a result of implementation of a specific measure. As required by FAA Order 1050.1E,[25] changes of DNL 3.0 or greater on noise-sensitive land uses within the DNL 60 to DNL 64/9 noise exposure range are to be reported for changes in air traffic procedures.
4. The number of people exposed to DNL 45 to DNL 59.9 that would experience an increase or decrease of DNL 5.0 or greater as a result of implementation of a specific measure. As required by FAA Order 1050.1E, changes of DNL 5.0 or greater on noise-sensitive land uses within the DNL 45 to DNL 59.9 noise exposure range are to be reported for changes in air traffic procedures.

The Level 3 screening results are documented in the *Level 3 Screening Analysis* report[26] available on the BLANS website and as provided as **Appendix K**.

4.4.3 PHASE 2 SCREENING RESULTS

Table 4-3 presents a matrix containing all of the measures considered during Phase 2 and the determinations made by the FAA, Massport, or CAC. The first set includes aircraft ground noise abatement measures (those with a Measure ID that starts with 'G'). The second set includes flight procedure measures (those with a Measure ID that starts with 'F'). The third set includes non-runway use related measures carried over from Phase 1. The identification codes for each measures proposed by an elected representative end with 'ER'.

The matrix also identifies a limited number of measures that were already, or could be, implemented without additional noise analysis or formal federal action that would require a NEPA analysis. Those measures were designated as "implemented" and eliminated from further evaluation. Some measures were already evaluated in the BOS Airside Environmental Impact Statement (EIS). Those measures were identified as "completed" or "recommended to be implemented." For those measures that FAA or Massport suggested modifications that were accepted by CAC to deem the measures "Passed to Level 3" as described in Section 4.4.2.1, an additional identifier ("v2", "v3", or "v4") was added to the measure designation.

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24 Ricondo & Associates, Inc., *Boston Logan Airport Noise Study, Level 3 Screening Analysis*, December 2012.

25 The latest version of Order 1050 at the time of the analysis.

26 Ricondo & Associates, Inc., *Final Report, Boston Logan Airport Noise Study, Level 3 Screening Analysis*, December 2012.

Table 4-3 (1 of 3): Phase 2 Screening Results

MEASURE DESIGNATOR	MEASURE	LEVEL 1	LEVEL 2	LEVEL 3
	Ground Concepts			
G-A	Tow Aircraft to Runway End	x PE	-	-
G-B	Single Engine Taxi Away from Communities	x	-	-
G-B (v2)	Encourage Single Engine Taxi Away from Communities	⇨	x	-
G-C	Taxiway N for 22/Centerfield for 22L	x	-	-
G-D	Runway 4R Arrival on Centerfield	⇨	▶ IP	-
G-E	Add Fillets for Runway 4R Egress	x	-	-
G-F	Limit Arrival Reverse Thrust	▶	▶ IP	-
G-G	Noise Barrier on Community Side	⇨	▶ CP	-
G-H	Floating Noise Barrier - Taxiway N	x	-	-
G-I	Ground Runup Enclosure	⇨	x	-
G-I (v2)	Preferred Location for Run Ups Away from Communities	-	⇨	▶ CAC
G-J	Holding Area for Departures	x	-	-
G-J (v2)	Holding Area for Delayed Departures	-	⇨	▶ CAC
G-K	Replace APU/GPU with Electric Power	x	-	-
G-L	Change National On-time Departure Rule	x	-	-
G-M	Noise Barrier for Runway 15R Departures	⇨	x	-
	Flight Procedure Concepts: Approach			
F-A	Continuous Descent Approach	▶	x	-
F-B	Move DRUNK East Over Water	x	-	-
F-C	Raise DRUNK Arrival Crossing Altitude	x	-	-
F-D	Disperse Arrivals Over Marshfield	x	-	-
F-E	Move Jet Arrivals Over Marshfield South	x	-	-
F-F	Runway 32 Over Water Approach	x	-	-
F-G	Runway 32/33L RNAV/Visual Approach North of Hull (Nighttime)	▶	▶	▶ CAC
F-H	Runway 32 Visual Approach (Similar to RNAV Approach)	⇨	⇨	▶ CAC
F-I	Maintain 3 nm Separation for Arrivals	⇨	x	-
F-J	Maintain Last Assigned Altitude on Visual Approach Until Glide Stop	x	-	-
F-W (ER)	Raise Approach Altitude and DCA Over Marshfield	x	-	-
F-X (ER)	Adopt CDA for Runway 32	x	-	-
F-Y (ER)	Move F-F and F-G Outside of Marshfield Boundary	x	-	-

Table 4-3 (2 of 3): Phase 2 Screening Results

MEASURE DESIGNATOR	MEASURE	LEVEL 1	LEVEL 2	LEVEL 3
	Flight Procedure Concepts: Approach (continued)			
F-Z (ER)	Move Phase 1 Alt 6, 7, and 11 Jet Arrivals Over Marshfield Further South	x	-	-
F-AA (ER)	Move the Entire Phase 1 Arrival Corridor South of Marshfield	x	-	-
F-BB (ER)	Move DRUNK Intersection East Over Water More than 2 Miles	x	-	-
F-CC (ER)	Raise the Jet Arrival Altitude over Drunk by More than 8,000 feet	x	-	-
F-GG	New Approach Crossing Point up to 2 nm East and Several Miles South of DRUNK	⇨	x	-
F-GG (v2)	New Approach Crossing Point up to 2 nm East and Several Miles South of DRUNK	-	▶	▶ CAC
	Flight Procedure Concepts: Departure			
F-K	Extend Runway 27 RNAV Departure Gates Further South	⇨	x	-
F-K (v2)	Extend Runway 27 RNAV Departure Gate 1 nm Southwest of Existing WYLLY Waypoint	-	▶	▶ CAC
F-L	Apply all Available Technology to Enhance Runway 27 RNAV Goals	x	-	-
F-M	Runway 14 Departures Stay North of Hull and Raise Altitude North of Hull	⇨	⇨	▶ CAC
F-N	Runway 15R Nighttime Departures Further North of Hull	▶	x	-
F-O	Split Runway 22L/R Departures South and East	x	-	-
F-P	Runway 33L Departures Follow Mystic River	x	-	-
F-Q	Right Turn for Runway 9 Departures	x	-	-
F-R	Runway 4R Departures - Shift Alternative 1 Waypoint East	▶	▶	▶ CAC
F-S	Runway 4R, 9, 27, and 33L - Thrust/Climb close-In vs. Distant Profiles	▶	x	-
F-DD (ER)	Move all Jet Departures over Marshfield Out Over Water	⇨	x	-
F-EE (ER)	Relocate Jet Departures West of Marshfield to Allow for Jet Arrival to be Raised	x	-	-
F-FF (ER)	Extend Runway 33L Designated Heading until 7 DME	x	-	-
F-HH	Runway 33L Departures Follow Mystic River up to 7 DME and 5,000 ft. Before Turn	⇨	x	-
F-HH (v2)	Runway 33L Departures Follow Compatible Land Use to the Maximum Extent Practical up to 5 DME or 5,000 feet Before Turn	-	x	-
F-HH (v3)	Runway 33L Departures Stay North of Admiral's Hill and Follows the Compatible Land Use to the Maximum Extent Practical up to 5 DME or 5,000 ft. above MSL Before Departure Fix Transition Turn	-	⇨	▶ CAC

Table 4-3 (3 of 3): Phase 2 Screening Results

MEASURE DESIGNATOR	MEASURE	LEVEL 1	LEVEL 2	LEVEL 3
	FLIGHT PROCEDURE CONCEPTS: LOCAL TRAFFIC			
F-T	Establish Altitude Floor Over Downtown Area	⇨	x	-
F-U	Establish Required Helicopter Routes Over Downtown Area	⇨	x	-
F-V	Extend Propeller Departure Course Until Reaching 2,000 feet MSL	⇨	x	-
F-V (v2)	Utilize 260 Course Heading from Runway 22R in lieu of 290 for Props/Turboprops heading North, Northwest, or West until 2,000 feet	-	▶	▶ CAC
	OTHER PHASE 1 CARRY OVER MEASURES			
M17	Runway 27/33L Fanned headings	x	-	-
M21	All Runways - Fanned Headings	x	-	-
M26	2nd Gate Fanning - Runway 27 WYLYY Departure	x	-	-
M27	Offset Approach to Runway 4L/R	x	-	-
M28	Right Turn - Runway 27 Departure.	x	-	-

LEGEND:

▶ Measure Passed to Next Level: IP - Recommended for Implementation, CAC – Recommended by CAC, CP – Measure Completed.

⇨ Measure Passed to Next Level with Conditions.

x Measure Eliminated from Further Evaluation: PE - Previously Evaluated, CAC - Rejected by CAC.

SOURCES: Ricondo & Associates, Boston Logan Airport Noise Study, Level 1 Screening Analysis, October 2009; Ricondo & Associates, Boston Logan Airport Noise Study, Level 2 Screening Analysis, November 2011; Ricondo & Associates, Boston Logan Airport Noise Study, Level 3 Screening Analysis, December 2012.

PREPARED BY: Ricondo & Associates, Inc., January, 2017.

4.5 Measures Recommended for Implementation

The results of the Level 3 analysis were presented to the CAC, the FAA, and Massport during a BOS/TAC meeting on October 21, 2011. The analysis was refined to account for anomalies in the population impact results. Also, two measures related to flight movements were modified in an attempt to alleviate the adverse noise effects associated with those measures.

As shown in Table 4-3, ten measures, including two related to ground movements and eight related to flight procedures, were carried forward from the Level 2 screening analysis for quantitative evaluation in Level 3. By passing the Level 2 screening analysis, the ten measures were found to be operationally feasible by the FAA and also presumed to have the potential to meet the goals and objectives established by the CAC. Each measure carried forward from the Level 2 screening analysis and listed in Table 4-4, with the exception of

measures G-J(v2)[27] and F-M,[28] was modeled independently to compare with the 2015 Baseline noise to assess the noise exposure effects of each measure independently.

The CAC reviewed the analysis results and worked with the IC to evaluate each alternative against the CAC goals and objectives and criteria presented in Section 4.4.2.3.

Following review of the noise results, Measure F-R and Measure F-HH(v3) were modified in an attempt to alleviate adverse noise effects associated with those measures. The CAC requested these modifications at the October 21, 2011, BOS/TAC meeting. Although Measure F-R would result in an overall decrease in noise, it would also result in newly exposed populations in Winthrop with some additional concern about shifting flights farther east, closer to Nahant. As a result, Measure F-R(v2) was developed and subsequently modeled for consideration. Measure F-HH(v3) was also a concern to the CAC due to the increase in noise exposure. As a result, Measure F-HH(v4) was developed and subsequently modeled for consideration, increasing the total measures considered for recommendation from 10 to 12.

The CAC voted on the measures to recommend for implementation at its meeting on April 3, 2012. The resulting vote was subsequently provided to the FAA for consideration. Of the 12 measures evaluated, 8 were recommended for implementation by the CAC and 4 were rejected. Both measures related to ground movements and 6 of the 10 measures related to flight procedures were recommended by CAC for implementation. The FAA and Massport reviewed the CAC recommendations to determine which measures would meet their criteria and would therefore be implemented under BLANS. The FAA and Massport determined that both measures related to ground movements would meet their criteria for implementation; however, FAA determined that none of the six measures related to flight procedures met the overall goal of the BLANS in terms of reducing noise impacts to communities surrounding the Airport. The results of the CAC evaluations and the findings of the FAA and Massport are summarized in **Table 4-4** and further described in the Phase 2 *Level 3 Screening Analysis* report.

[27] Measure G-J(v2) was not modeled, as it applies to conditions when aircraft are held due to a traffic management initiative at the Airport or within the National Airspace System. Therefore, it was not possible to predict such occurrences on the average annual day.

[28] Measure F-M was not modeled, as Runway 14 has historically been used for less than 1.0 percent of all departures, and no departures were modeled on Runway 14 under the No Action alternative.

Table 4-4 (1 of 2): Results of CAC Vote on Phase 2 Level 3 Measures

MEASURE DESIGNATOR	DESCRIPTION	RESULTS OF CAC VOTE	FAA/MASSPORT RESPONSE	NOTES[1/]
G-I(v2)	Preferred Location for Runups away from Communities	Recommended	Move to Implement	Massport has already tested this measure and identified a new location at the end of Runway 32 to be used when operationally feasible.
G-J(v2)	Holding Area for Delayed Departures	Recommended	Move to Implement	Massport is prepared to commit to working with the FAA to seek approval and funding (subject to FAA operations/safety approval, environmental review, Massport capital budget process, availability of FAA funds) for construction of a hold pad to allow for short term staging of aircraft at or near the midpoint of the airfield.
F-G	Runway 32/33L RNAV/Visual Approach North of Hull (Nighttime)	Recommended	Will Not Implement	"There are no DNL decreases in noise. The costs to implement and maintain procedures in the national airspace system are in the thousands of dollars. This would be an additional procedure at Boston Logan."
F-H	Runway 32 Visual Approach (Similar to RNAV Approach)	Recommended	Will Not Implement	"There are no DNL decreases in noise. The costs to implement and maintain procedures in the national airspace system are in the thousands of dollars. This would be an additional procedure at Boston Logan."
F-GG(v2)	Cross at DRUNK with Aircraft Crossing at 8,000 feet above MSL	Recommended	Will Not Implement	"There are no DNL decreases in noise. Although FAA will not implement Measure F-GGv2 under the umbrella of the BLANS, FAA will (and currently does) have aircraft crossing DRUNK at 8,000 feet to Runways 27 and 22L."
F-K(v2)	Extend Runway 27 RNAV Departure Gate 1 nm Southwest of Existing WYLYY Waypoint	Recommended	Will Not Implement	"There are no DNL decreases in noise, but slight increases in noise to populations exposed to DNL 55 and higher. This is inconsistent with the overall purpose and goals of the BLANS. Although FAA will not implement Measure F-Kv2 under the umbrella of the BLANS, FAA plans to modify the RNAV procedure for Runway 27 in the near future as part of FAA's NextGen program. This action will be subject to the National Environmental Policy Act (NEPA) and will undergo the usual FAA environmental review process which provides CAC an opportunity for input/comment."
F-M	Runway 14 Departures Stay North of Hull and Raise Altitude over Shoreline	Recommended	Will Not Implement	"There are no DNL decreases in noise. The costs to implement and maintain procedures in the national airspace system are in the thousands of dollars. This would be an additional procedure at Boston Logan."
F-R	Runway 4R Departure – Shift prior Alternative 1 Waypoint East	Rejected	Will Not Implement	--[2/]

Table 4-4 (2 of 2): Results of CAC Vote on Phase 2 Level 3 Measures

MEASURE DESIGNATOR	DESCRIPTION	RESULTS OF CAC VOTE	FAA/MASSPORT RESPONSE	NOTES[1/]
F-R(v2)	Runway 4R Departure – Shift prior Alternative 1 Waypoint East	Rejected	Will Not Implement	--[2/]
F-HH(v3)	Runway 33L Departures Stay North of Admiral's Hill and Follow Compatible Land Use to the Maximum Extent Practical up to 5 DME or 5,000 Feet above MSL before Departure Fix Transition Turn	Rejected	Will Not Implement	--[2/]
F-HH(v4)	Runway 33L Departures Stay North of Admiral's Hill and Follow Compatible Land Use to the Maximum Extent Practical up to 5 DME or 5,000 Feet before Departure Fix Transition Turn	Recommended	Will Not Implement	"Overall, this measure showed substantial DNL population increases in noise and lesser decreases, CAC voted to implement this for reasons stated [by the CAC]. This is inconsistent with the overall purpose and goals of the BLANS. Although FAA will not implement Measure F-HHv4 under the umbrella of the BLANS, FAA plans to establish an RNAV procedure for Runway 33 in the near future as part of FAA's NextGen program. This action will be subject to the National Environmental Policy Act (NEPA) and will undergo the usual FAA environmental review process which provides CAC an opportunity for input/comment."
F-V(v2)	Use 260 degree Course Heading from Runway 22R in Lieu of 290 degrees for Props/Turboprops Heading North, Northwest, or West until 2,000 Feet above MSL	Rejected	Will Not Implement	--[2/]

NOTES:

1/ With the exception of Measures G-I(v2) and G-J(v2), the information provided in this column reflects FAA's responses regarding those measures recommended by the CAC. Information presented in quotations is quoted directly from the jointly signed letter from the FAA and Massport as cited below, except as required for reference as noted in brackets.

2/ FAA and Massport would not move to implement any measure that was not recommended by the CAC. For additional information, see the jointly signed letter from the FAA and Massport to Sandra Kunz, President, Logan Airport Community Advisory Committee, dated August 3, 2012. This letter is found in Appendix B.

SOURCE: Ricondo & Associates, Inc., May 2012, based on Community Advisory Committee findings document presented at the April 3, 2012, CAC meeting and the jointly signed letter from the FAA and Massport to Sandra Kunz, President, Logan Airport Community Advisory Committee, dated August 3, 2012.

PREPARED BY: Ricondo & Associates, Inc., October, 2016.

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5. Phase 3

Phase 3 began in July 2013 and was to include the development of a recommended Runway Use Program (RUP), consistent with FAA regulations, to supersede PRAS[29] and other items to complete BLANS, including final documentation. Work on Phase 3 concluded in December 2016.

The original intent of Phase 3 also included completion of any environmental documentation for flight procedures identified in Phase 2 that would require further processing in accordance with NEPA. The CAC recommended that 8 measures, including 2 related to ground movement and 6 related to flight procedures, be implemented. The FAA and Massport determined that both measures related to ground movements would meet their criteria for implementation; however, the FAA determined that none of the six measures related to flight procedures reduced noise impacts to communities surrounding the Airport. As a result, because no additional measures related to flight procedures would be implemented following the Phase 2 Level 3 screening analysis, no federal action was proposed and no NEPA analysis was required in Phase 3 for measures related to flight procedures.

Over the course of Phase 3, the approach to developing a RUP evolved and included the development and conduct of live operational tests that focused on providing respite from continuous overflights of individual areas for extended periods. Particular runway use percentage goals were not established during Phase 3. The discussion of Phase 3 in the following sections provides a brief history and discussion of PRAS, followed by a summary of the runway use tests and the accompanying analysis completed within the Phase 3 schedule.

5.1 Preferential Runway Advisory System

PRAS was a system that produced recommendations to the FAA controllers to assist in determining runway configurations that would provide for equitable distribution of the Airport's noise impacts on the surrounding communities. The long-term goals established in the early 1980s for the PRAS at Logan included:

- Reduction of the annual average total noise impact from Logan operations on the affected communities without significantly increasing the impact on any populated area within the 65dB noise contour.
- Maximize the use of Runway 15R for over-water departures and Runway 33L for over-water arrivals.

[29] CAC voted to abandon PRAS in April 2012, stating "PRAS has failed to provide the noise abatement it had intended."

Short-term goals were also developed to provide temporary relief to affected neighborhoods that experience extended noise exposure resulting from the use of the same runways several days in a row:

- Providing relief from excessive *dwell* (duration of continuous operations during each day between the hours of 7 a.m. and midnight).
- Providing relief from excessive *persistence* (prolonged utilization of a given runway during the hours of 7 a.m. and midnight in a period of three consecutive days).[30]

In 2012, the CAC determined that, given the system's failure in meeting long-term and short-term goals, coupled with other technological and operational changes that surpassed the PRAS software capabilities, it would withdraw support for the system and focus on developing a replacement RUP.

During Phase 2 of the BLANS, the CAC:

> Voted in April of 2012 by a majority of those communities casting votes to abandon the Preferential Runway Advisory System (PRAS). The CAC has concluded that since its inception in 1982, PRAS has failed to provide the noise abatement that it had intended. However, there exists within the Record of Decision, Article VIII. Section 6 the opportunity to assess other methods of reducing noise including but not limited to runway end use. The CAC intends to take advantage of this opportunity to reduce noise over the communities and will work with Massport and the FAA to develop a program that will be effective to replace PRAS.[31]

5.2 2015 Baseline Noise Analysis Update

An updated and expanded 2015 Baseline noise analysis was completed during Phase 3 to reflect changes in noise exposure associated with FAA rules affecting operations on non-intersecting, converging runways (CRO) and other changes that affected operations/procedures within the Study Area. In addition, following their implementation, some changes to the Early Implementation Measures were made to improve performance. The updated and expanded 2015 Baseline noise analysis included noise exposure down to DNL 45 as well as grid point analyses for the census tract centroids and an intruding events analysis[32].

5.2.1 CHANGES INCLUDED IN UPDATED AND EXPANDED NOISE 2015 BASELINE ANALYSIS

The following paragraphs summarize changes in procedures that were addressed in the updated and expanded 2015 Baseline Noise Analysis.

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30 Functionality of the dwell and persistence reporting was abandoned in early 2000 after FAA changed its traffic management software management software, resulting in incompatibility between the two systems.

31 Excerpt from letter from Sandra M. Kunz, President, Logan Airport Community Advisory Committee, Inc., to Flavio Leo. Deputy Director of Aviation Planning and Strategy, Massachusetts Port Authority, dated June 4. 2012.

32 The intruding events analysis is defined and presented in Section 5.2.2.2.

5.2.1.1 Changes in FAA Runway Separation Rules

Amendments to FAA Order JO 7110.65 Air Traffic Control, effective January 15, 2014, established separation standards between an arriving aircraft that aborts their approach and goes around and any combination of arriving or departing aircraft operating on a non-intersecting runway where the arrival or departure paths may intersect. These conditions are referred to as non-intersecting converging runway operations (CRO). At BOS, the new rule created a dependency between departures on Runway 22R and arrivals on Runway 27 and increased air traffic control separation requirements for aircraft. To determine how the increased separation standards on the Airport's non-intersecting converging runway operations would affect runway use, FAA carried out operational testing (CRO test) for six months during the time of year when the runways normally experience increased use due to prevailing west/southwesterly winds.[33]

The CRO test was conducted by the FAA from April 1, 2014 to September 30, 2014. Radar data were collected during the test and compared with the baseline condition to determine the potential effects of the new rules during west/southwest wind conditions. The CRO test showed that the rules created operational impacts and resulted in changes in arrival runway use when Runways 22L and 22R and Runway 27 are in use. However, the changes did not result in a significant increase in noise off Airport, or create a significant change in aircraft noise on or off Airport.[34,35] NEPA review was completed by FAA and the determination for the permanent implementation of the amended Order at BOS was issued under a Categorical Exclusion on May 1, 2015.[36] The federal action, implementation of converging runway operations at Boston Logan International Airport and modification of existing procedures to implement the CRO included:

- FAA amended Order JO 7110.65 (January 15, 2014)
- Notice N JO 7110.652, Converging Runway Operations (January 15, 2014)
- Notice BOS ATCT N7110.59, Runway 27-22R Arrival-Departure Window (January 15, 2014, and
- Notice A90 TRACON N7110.58 Right Downwind use during Converging Runway Operations

The resulting change in the use of Runways 22L and 27 for arrivals when the Airport is operating in the west/southwest configuration was reflected in the updated and expanded 2015 Baseline noise analysis. The rules were officially implemented on May 1, 2015.

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33 Federal Aviation Administration, *Categorical Exclusion Declaration, Operational Test to Determine Effects at Boston-Logan from Amendments to FAA Order JO 7110.65 on Non-Intersecting Converging Runways*, December 24, 2013.

34 Noise in the reportable range was a +/- 3 dB increase in the 60-65 DNL range and +/- 5 dB increase in the 45-60 DNL range.

35 Federal Aviation Administration, Operations Support Group, Operational and Environmental Review of Non-intersecting Converging Runways Test at Boston-Logan International Airport, April 1, 2015.

35 Federal Aviation Administration *Categorical Exclusion Declaration*, implementation of converging runway operations and modification of existing procedures to implement Order 7110.65, May 1, 2015.

5.2.1.2 Standard Instrument Departure (SID) Procedures from Runways 33L and 27

After the completion of Phase 2, a SID for Runway 33L and two new SIDs for Runway 27 were developed. These procedures were included in the updated and expanded 2015 Baseline noise analysis.

Runway 33L SID

Several potential departure procedures from Runway 33L were considered and evaluated during Phase 1 and Phase 2 of the BLANS. Although one was recommended by the CAC for implementation, FAA did not accept it for implementation under BLANS as it did not result in a reduction in DNL noise exposure. In fact, it would have resulted in significant increases in some areas. FAA then developed and implemented the Runway 33L SID, providing area navigation (RNAV) guidance for aircraft departing on the runway to obtain the operational benefits of the RNAV procedures and to tie into the RNAV SIDs implemented as Early Implementation Measures from Phase 1. The SID was designed to overlay to the extent possible the existing conventional departure for the runway until reaching a point about 4.25 NM from the runway before transitioning to meet other RNAV routes from other runways at the Airport. CAC input on the design of the RNAV procedure in Phase 2 was taken into consideration. The FAA prepared an EA for the procedure and issued a Finding of No Significant Impact (FONSI) and ROD in May 2013[37]. The documents are available on the BLANS website or by contacting the FAA. The procedures were implemented on June 5, 2013.

Runway 27 SIDs

Two new RNAV SIDs from Runway 27 were developed that overlay existing procedures from the runway. The purpose of developing and implementing the SIDs was to provide operational benefits for air traffic control, to continue to align with the noise abatement procedures already in place from a 1996 ROD for jet departure procedures from the runway,[38] and to tie into the RNAV SIDs implemented as Early Implementation Measures from Phase 1. An Initial Environmental Review (IER) was prepared in February 2013 in accordance with FAA Order JO 7400.2K[39] and a Categorical Exclusion Declaration was subsequently issued in March 2013[40] in accordance with FAA Order 1050.1E. These are available on the BLANS website or by contacting the FAA. The procedures were implemented on March 7, 2013.

5.2.1.3 Modifications to 15R Arrival Procedures

Following implementation of the Phase 1 Early Implementation Measures, FAA made minor adjustments to the arrival procedures to Runway 15R that were implemented on May 26, 2016 to improve performance. The adjustments resulted in minor changes to the flight tracks modeled for arrivals to the runway.

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37 Department of Transportation Federal Aviation Administration, *Finding of No Significant Impact (FONSI) & Record of Decision (ROD) For the Implementation of an Area Navigation (RNAV) Standard Instrument Departure (SID) for Runway 33L at Boston-Logan International Airport*, May 2013.

38 Department of Transportation Federal Aviation Administration, *Record of Decision, Implementation of New Air Traffic Control Turbojet Departure Procedure for Runway 27 at Boston-Logan International Airport*, August 30, 1996.

39 Federal Aviation Administration, *Order JO 7400.2K, Procedures for Handling Airspace Matters*, April 3, 2014.

40 Department of Transportation Federal Aviation Administration, *Categorical Exclusion Declaration, Boston Consolidated TRACON (A90)/Boston Logan Airport Establishment of Area Navigation (RNAV) Standard Instrument Departures (SIDs) off RY27*, May 2013.

5.2.1.4 Modifications to Runway 15R, 22R, and 22L Departures

The departure procedures from Runways 15R, 22R, and 22L implemented as Early Implementation Measures from Phase 1 were modified to enhance the performance of aircraft on the initial turn after departure, and to address flyability issues experienced by many aircraft on the original procedure while maintaining the original intent of the 2007 ROD. The new procedures were implemented on March 7, 2013.

5.2.2 UPDATED AND EXPANDED 2015 BASELINE NOISE ANALYSIS

The updated and expanded 2015 Baseline condition was developed using the 2015 Baseline established earlier in Phase 2, with the addition of the effects of the CRO rules on arrival runway use, the Runway 33 SID and the Runway 27 SIDs, the refinements to the arrival procedures to Runway 15R, and modified departure procedures from Runways 15R, 22R, and 22L. The noise analysis for the updated and expanded 2015 Baseline conditions were prepared as follows:

- The INM 7.0c was used for the noise analysis, consistent with the original 2015 Baseline noise analysis completed in Phase 2[41]
- The population centroids that represent the geographic centroids of the census tracts were used for the population impact analysis; however, the population data were updated from the 2000 to the 2010 census for the analysis
- A grid analysis was conducted for all of the census tract centroids to obtain DNL values for each that were then used for additional analyses of noise levels within specific communities and for level weighted population (LWP)[42] calculations

During the latter courses of Phase 3, the IC, working with the CAC began the development of the *Boston Logan Airport Noise Abatement Report, Including FAA ATCT Monthly Runway Use Guidelines*[43] (CAC Noise Abatement Report) as a report to Massport and FAA. The final BLANS version of the draft report is provided in **Appendix L**.[44] Because of the extensive nature of some of the data presented in the CAC Noise Abatement Report, references to certain sections are made herein, rather than reproducing and including the full sets of data.

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41 The FAA issued the Aviation Environmental Design Tool (AEDT) in May 2015 for use in modeling noise and emissions from aircraft operations, replacing the INM. The FAA Office of Environment and Energy approved the continued use of INM 7.0c for the BLANS to maintain consistency with prior analyses conducted for the BLANS. The noise analyses conducted for BLANS are not to be used for approval under the National Environmental Policy Act (NEPA). Such approval would require the use of AEDT for the noise analyses.

42 Level weighted population is defined in Section 5.2.2.3.

43 Landrum & Brown, Inc., *BOS Logan Airport Noise Abatement Report, Including FAA ATCT Monthly Runway Use Guidelines*, *Draft, Report Version 11*, December 16, 2016.

44 The CAC Noise Abatement Report represents work that was completed by the IC and the CAC prior to the conclusion of the BLANS, but does not represent a Runway Use Program or Runway Use Programs guidelines that have been reviewed and accepted by Massport or FAA.

5.2.2.1 Noise Exposure Contours

Exhibit 5-1 and **Exhibit 5-2** depict the updated and expanded 2015 Baseline noise exposure contours for the entire Study Area and for the Central Area[45], respectively. The latter exhibit provides more detail showing the Boston neighborhoods and surrounding areas. **Exhibit 5-3** depicts a comparison between the updated and expanded 2015 Baseline with the original 2015 Baseline developed in Phase 2. **Table 5-1** provides a side-by-side comparison of the population exposed to various ranges of noise exposure (e.g., DNL 50 – 55) as well as the cumulative population exposed to various noise levels (e.g., 55 and higher [55+]) for the original 2015 Baseline developed in Phase 2 and the updated and expanded 2015 Baseline noise exposure contours.

Table 5-1: Population Exposed to 2015 Baseline Noise

DNL RANGE	PHASE 2 2015 BASELINE	UPDATED AND EXPANDED 2015 BASELINE	CUMULATIVE DNL RANGE	PHASE 2 2015 BASELINE	UPDATED AND EXPANDED 2015 BASELINE
DNL 45-50	681,162	698,622	**DNL 45+**	1,071,349	1,104,843
DNL 50-55	282,784	292,118	**DNL 50+**	390,187	406,221
DNL 55-60	69,433	75,275	**DNL 55+**	107,403	114,103
DNL 60-65	35,148	34,650	**DNL 60+**	37,970	38,828
DNL 65-70	2,615	4,010	**DNL 65+**	2,822	4,178
DNL 70-75	207	168	**DNL 70+**	207	168
DNL 75+	-	-	**DNL 75+**	-	-

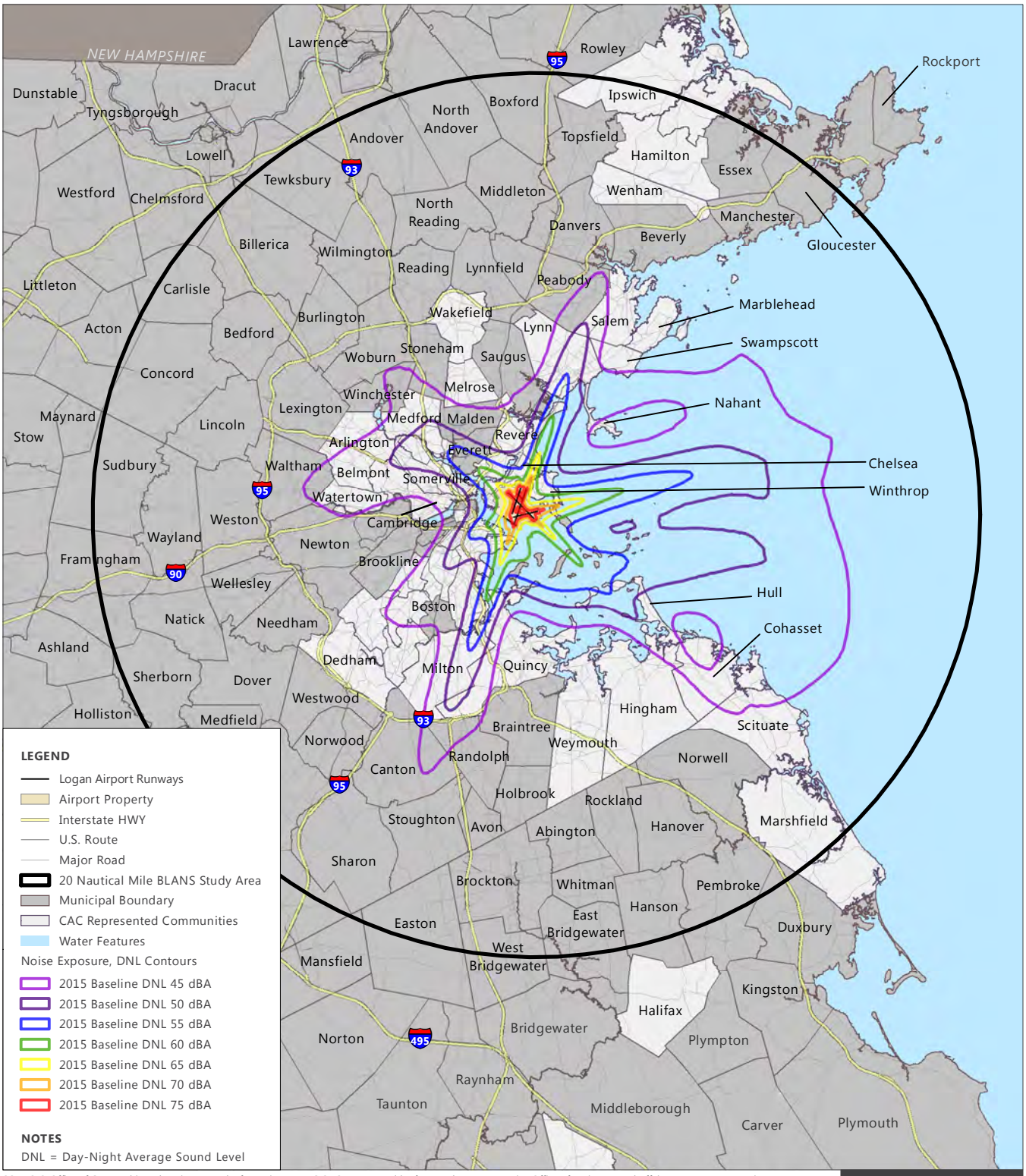
SOURCE: Ricondo & Associates, Inc., *BLANS Phase 3 2015 Baseline Contour Update*, September 13, 2016 (revised).
PREPARED BY: Ricondo & Associates, January 2017.

The CAC Noise Abatement Report introduced in Section 5.2.2 and found in Appendix L includes comprehensive tables that report average DNL and population exposed by DNL range by community. **Table 4-4a** in Appendix L reports the average DNL and the population exposed to each DNL range for each community, with the communities listed alphabetically. **Table 4-4b** in Appendix L reports the same data, with the communities by highest to lowest overall average DNL.

5.2.2.2 Intruding Events Analysis

In addition to DNL noise exposure contours and population impacts, an intruding events analysis was completed for the updated and expanded 2015 Baseline. For the purposes of BLANS, intruding events were defined as those that generated noise of 70 dBA and higher during the daytime hours (7:00 a.m. to 9:59 p.m.) and 60 dBA and higher during the nighttime hours (10:00 p.m. to 6:59 a.m.). The noise level of 60 dBA during the nighttime hours was used to reflect the generally higher annoyance from noise during those hours. The use of the 10-decibel difference for the nighttime hours is consistent with the calculation of DNL, which includes a 10-decibel penalty for operations occurring during the nighttime hours.

[45] The Central Area refers to the City of Boston and immediately adjacent communities and has been established to provide a better view of the Boston neighborhoods.



SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, August 2016 (updated baseline noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 5-1

NORTH 0 40,000 ft.

BOS Noise Exposure (DNL 45-75 dBA) Contours, BLANS Study Area - 2015 Baseline, Updated and Expanded

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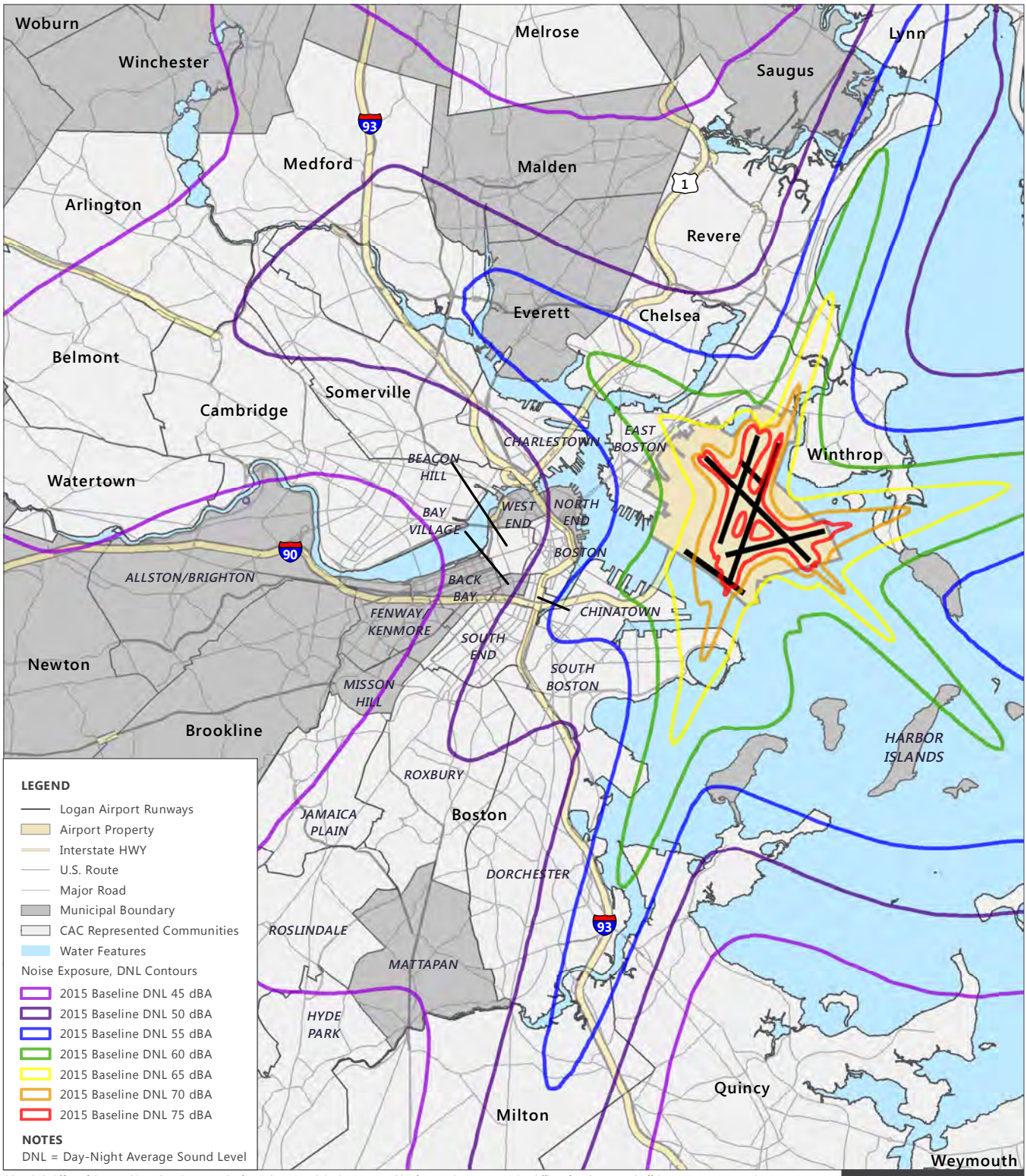

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, August 2016 (updated baseline noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 5-2

NORTH 0 10,000 ft.

BOS Noise Exposure (DNL 45-75 dBA) Contours, Central Area – 2015 Baseline, Updated and Expanded

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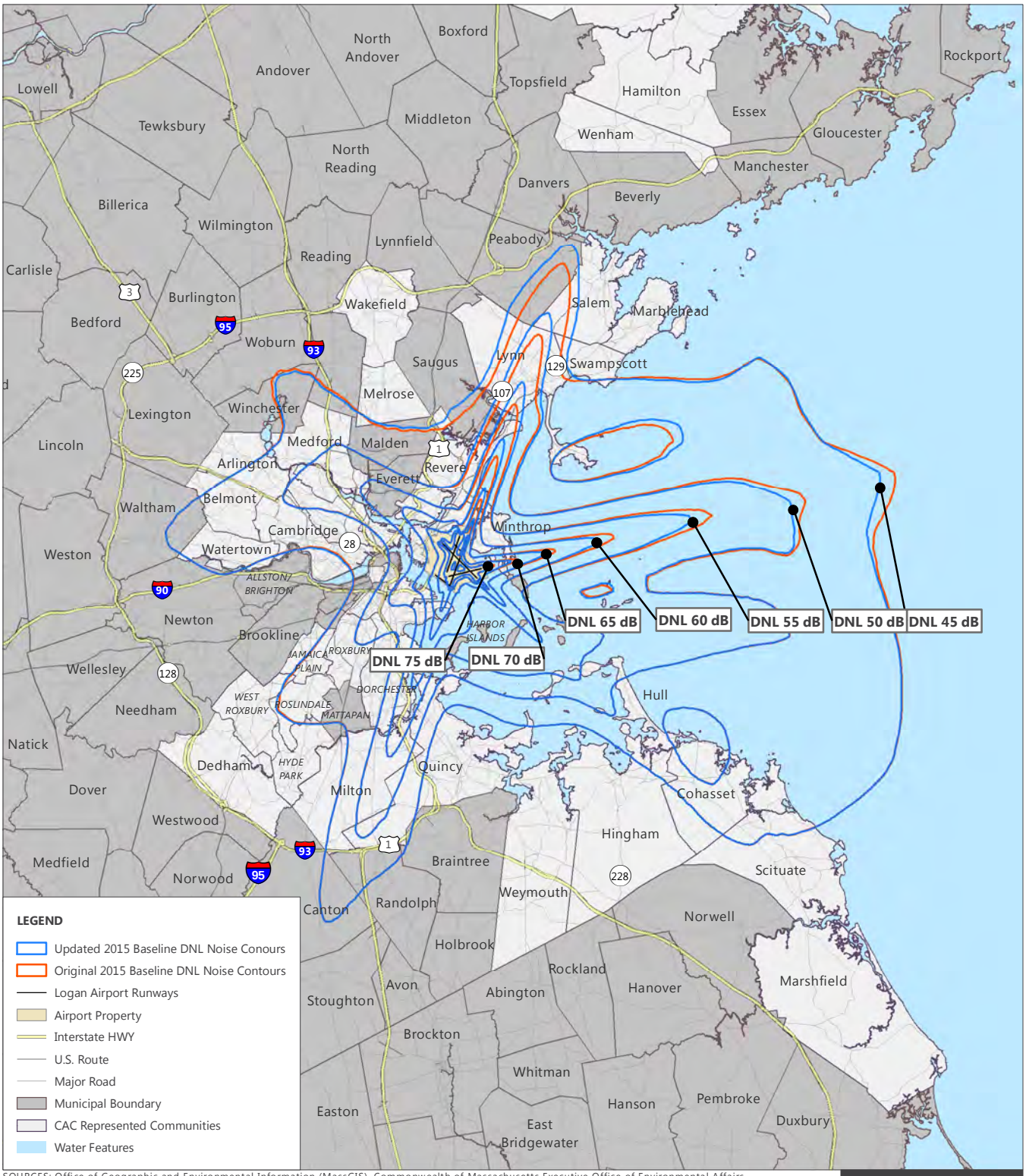

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, December 2016 (noise contours); Wyle (original baseline noise contours); Ricondo & Associates, Inc., September 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

NORTH 0 40,000 ft.

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EXHIBIT 5-3

BOS Noise Exposure (DNL 45-75 dBA) Contours, 2015 Baseline - Updated and Expanded Compared with Phase 2

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The output from the INM for the updated and expanded 2015 Baseline conditions was further analyzed using post-processing software to develop contours reflecting the numbers of individual aircraft noise events above (NA) the referenced noise levels around the Airport. **Exhibit 5-4** and **Exhibit 5-5** depict the resulting NA contours for the updated and expanded 2015 Baseline conditions for the BLANS Study Area and the Central Area, respectively. Similar to the concept of DNL contours, each NA contour represents a line along which the number of events above 70 dBA during the daytime hours and above 60 dBA during the nighttime hours is constant. For example, the contour labeled NA 10 indicates that a total of 10 events of either 70 dBA or higher during the daytime hours or 60 dBA or higher during the nighttime hours, or some combination thereof, would be expected along that line and that a higher number would be expected in the areas inside the contour line.

Table 5-2 provides a summary of the population within each of the NA contours for the updated and expanded 2015 Baseline condition.

Table 5-2: Estimated Population Exposed to Intruding Events, 2015 Baseline Updated and Expanded

ESTIMATED POPULATION EXPOSED BY NUMBER OF EVENTS ABOVE[1/]			
NUMBER OF EVENTS ABOVE RANGE	**POPULATION**	**CUMULATIVE NUMBER OF EVENTS ABOVE**	**POPULATION**
5-10	243,177	**5+**	565,762
10-19	155,753	**10+**	322,585
20-49	86,627	**20+**	166,832
50-99	58,223	**50+**	80,205
100-199	20,363	**100+**	21,982
200-399	1,619	**200+**	1,619
400+	-	**400+**	-

NOTE:

1/ Average Annual Day number of events above 70 dBA during the daytime hours (07:00 a.m. to 9:59 p.m.) and above 60 dBA during the nighttime hours(10:00 p.m. to 06:59 a.m.). Individual aircraft noise events at these levels are considered intruding events.

SOURCES: Wyle Laboratories, November 2016 (numbers of events); U.S. Census Bureau, 2010 Decennial Census, Massachusetts Census Block Data, 2010. (population data)

PREPARED BY: Ricondo & Associates Inc., December 2016.

The CAC Noise Abatement Report provides a comprehensive list of exposure to intruding events by community. The list is provided in **Table 4-5** in Appendix L.

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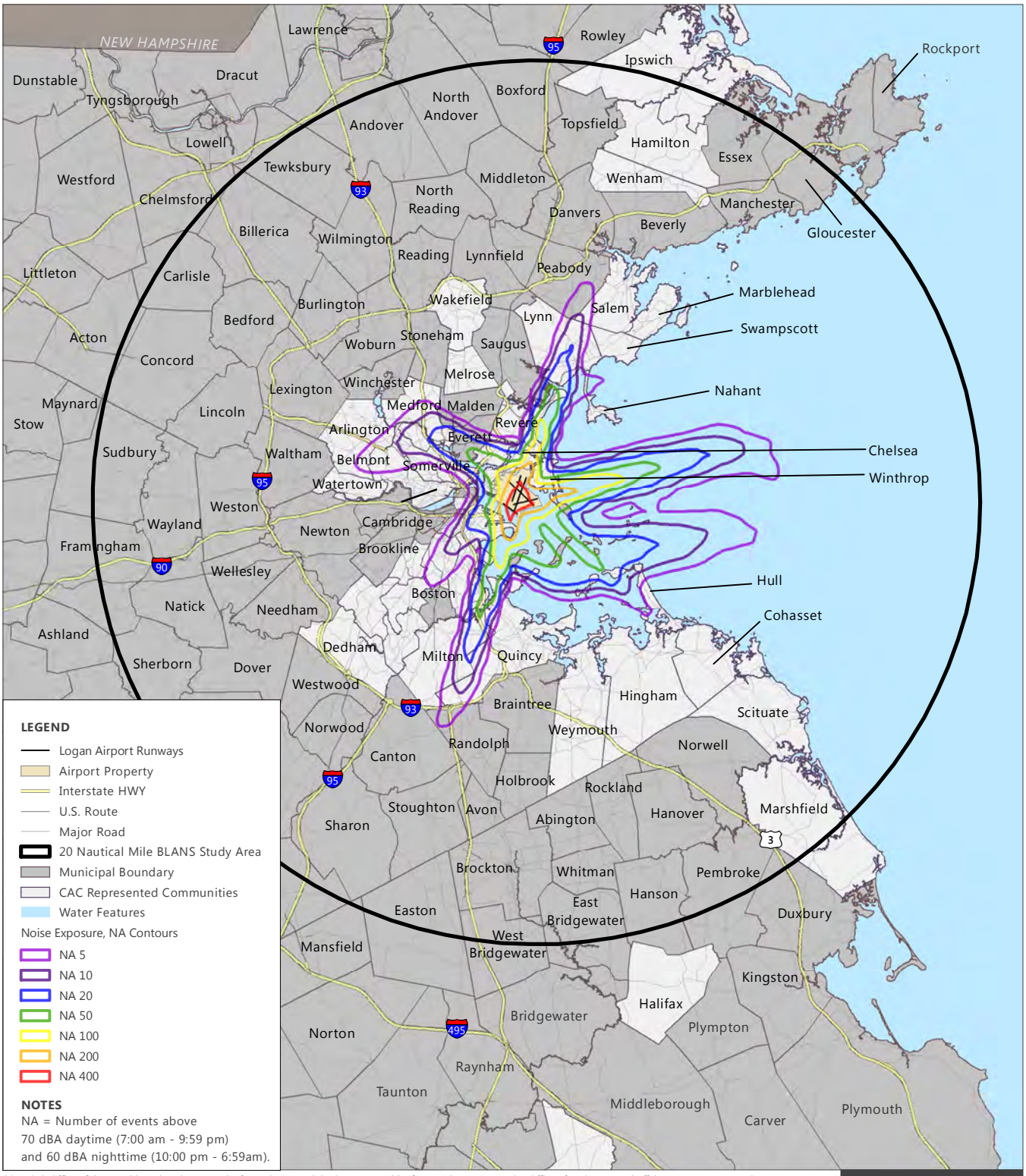

SOURCES: Office of Geographic and Environmental Information(MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, August 2016 (updated baseline noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 5-4

NORTH 0 40,000 ft.

BOS Noise Exposure (NA 70 dBA Day + 60 dBA Night) Contours, BLANS Study Area - 2015 Baseline, Updated and Expanded

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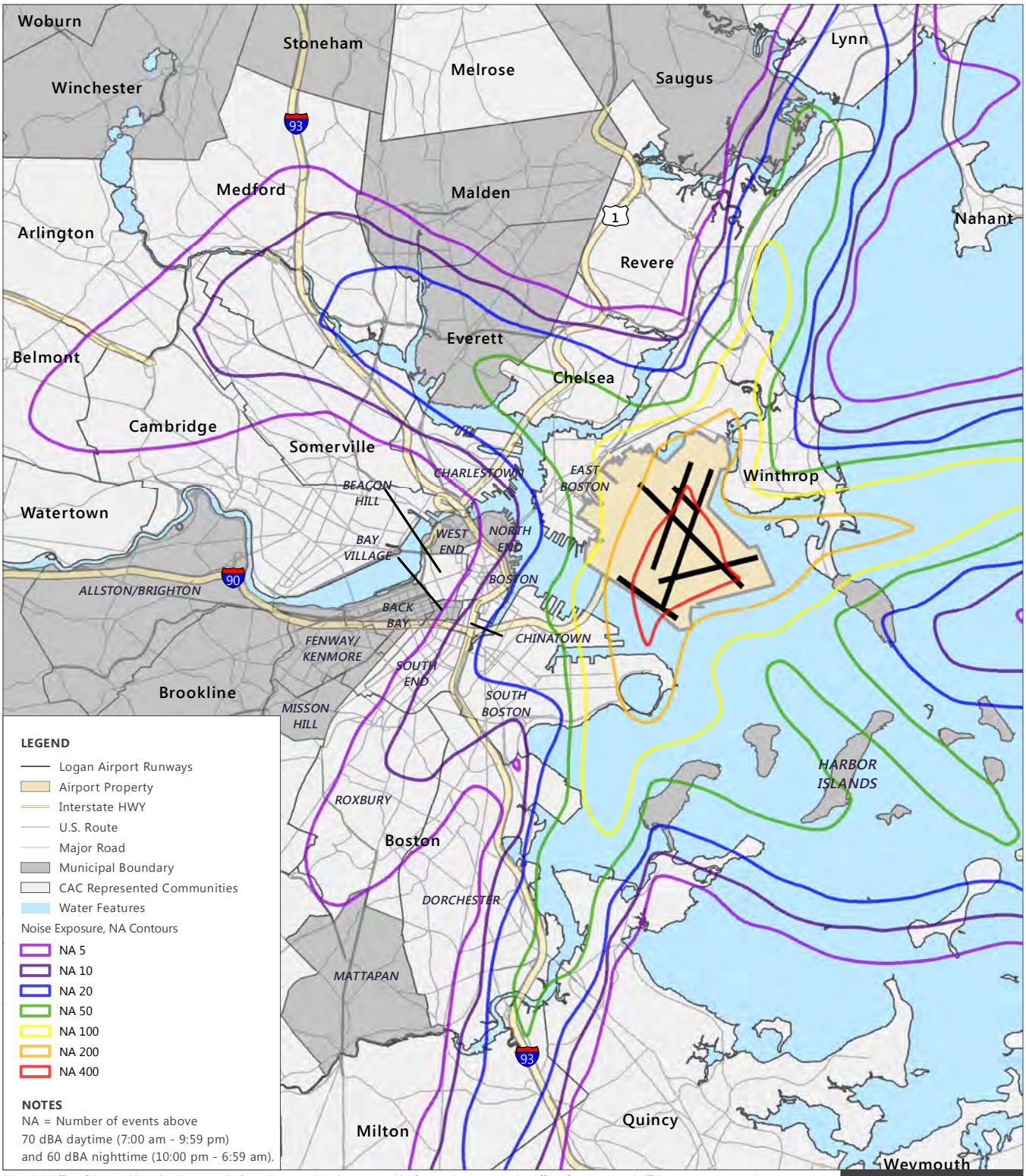

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, August 2016 (updated baseline noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., April 2017.

EXHIBIT 5-5

NORTH 0 10,000 ft.

BOS Noise Exposure (NA 70dBA Day + 60 dBA Night) Contours, Central Area - 2015 Baseline, Updated and Expanded

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5.2.2.3 Level Weighted Population

The level weighted population (LWP) is a metric used to calculate the number of people within a population likely to be highly annoyed by aircraft noise. The calculation of LWP applies a percentage of the population expected to be annoyed within the various ranges of DNL. The percentage increases as the noise level increases. **Table 5-3** lists the percentage annoyance by ranges of DNL used in the calculation of LWP.

Table 5-3: Percentage Annoyed by DNL Range for Level Weighted Population Calculation

DNL RANGE	PERCENT ANNOYED
DNL 45-50	1.2%
DNL 50-55	2.3%
DNL 55-60	4.6%
DNL 60-65	9.0%
DNL 65-70	16.6%
DNL 70-75	28.8%

SOURCE: Landrum & Brown, Inc., *BOS Logan Airport Noise Abatement Report, Including FAA ATCT Monthly Runway Use Guidelines, Draft, Report Version 11,* December 16, 2016.
PREPARED BY: Ricondo & Associates, Inc., December 2016.

The CAC Noise Abatement Report includes comprehensive tables of LWP calculated for both DNL and intruding events. **Table 5-4a** and **Table 5-4b** in Appendix L provide a listing of population exposure by community for DNL and LWP with communities listed alphabetically and by highest to lowest LWP, respectively. **Table 5-5** in Appendix L provides a listing of LWP by ranges of intruding events by community listed alphabetically.

5.3 Runway Use Program Development

With the development of a Runway Use Program (RUP) to replace PRAS as the focus of Phase 3, the initial Phase 3 scope of services included a process by which CAC would work with Massport, with technical assistance from the FAA, to identify a preliminary list of runway use measures, including preferential, priority, and rotational systems; restrictions; and other procedures, to be assessed for their ability to achieve the goals of the CAC. Information regarding preferential or other noise abatement runway use programs at other U.S. airports and international airports prepared by the IC in early phases of the BLANS would be reviewed and updated as necessary to assist in developing the preliminary list. Five runway use measures had been identified during Phase 1 of the BLANS. It was agreed to defer assessment of the runway use measures until the analysis of arrival and departure procedures measures were evaluated and agreed upon through Phase 1 and Phase 2. The runway use measures, as initially identified in Phase 1 included:

- Runway 27 Departures: establish balanced use of Runways 27 and 33L for departures. The intent of this measure is to minimize noise to close-in communities

- Runway 4L Departures and 22R Arrivals: remove noise emission restriction to achieve more utilization of this runway. The intent of this measure is to develop a more equitable distribution of noise impacts
- Runways 4R/L and 22R: develop runway use procedure to more reasonably distribute operations between these runways in meteorological conditions with small tailwind components. The intent of this measure is to provide more equitable distribution of noise impacts from Runways 4R/L and 22L/R
- Runway 27 Arrivals and Runway 15 Departures: arrive on Runway 27 and depart on Runway 15 during late night hours. The intent of this measure is to minimize noise impacts on South Shore/Hull
- Runway 15R Departures: implement a preferential runway use procedure during operational (FAA) nighttime hours (midnight to 6 a.m.) that places all departures on Runway 15R, unless tailwinds exceed 11 knots or departures exceed 60 per hour. The intent of this measure is to reduce aircraft noise exposure during nighttime hours for communities in the departure area of Runway 27

The IC worked with the CAC at the beginning of Phase 3 and several meetings were held with FAA and Massport to assist in the development of the preliminary list of RUP measures. The IC presented various types of runway use programs to assist in the discussions, although no final type of RUP was agreed upon. The IC suggested that rather than attempting to identify specific measures to test through noise analyses or other means, a series of live runway use tests could be conducted to assist in identifying and testing RUP measures that could provide effective noise relief in the communities surrounding the Airport. The PMT and the CAC agreed to this approach of performing the runway use tests.

5.4 Runway Use Program Tests

As described in the previous section, it was recommended by the IC and agreed upon by the PMT and CAC that a series of runway use tests be conducted to evaluate potential runway use measures that could be recommended as part of the RUP. Initially, the intent was to conduct four 3-month tests over the course of a year that would allow the FAA to determine the feasibility of implementing the procedures and for the CAC and PMT to evaluate the effectiveness of the procedures in terms of achieving the CAC goals of reducing the overall effects of aircraft noise exposure in the communities affected by noise associated with aircraft operations at the Airport, in addition to balancing those effects in an equitable manner. Two live tests of runway use strategies and one information gathering and analysis exercise were conducted. The live tests focused primarily on the concepts similar to those that had been incorporated into the development of PRAS, providing respite from continued noise exposure to communities around the Airport.

The following sections summarize the tests that were conducted and the results of those tests to the extent they have been tabulated and analyzed. Also provided is a discussion of a fourth test that was considered, but not conducted.

5.4.1 RUNWAY USE TEST 1

Runway Use Test 1 (Test 1) began on November 12, 2014 with an initial scheduled end date of February 11, 2015. The end date was extended to May 10, 2015 to allow further evaluation and to allow continued testing

while the plan for a subsequent test could be developed. Test 1 was developed to address one of the most common complaints from the community, which has been anecdotally described as "going to bed and waking up with the same aircraft noise." The CAC recommended the test to Massport, who in turn requested FAA to conduct the test. In order to do so, FAA prepared an Initial Environmental Review (IER) in accordance with FAA Order JO 7400.2K and declared a Categorical Exclusion in accordance with FAA Order 1050.1E. The documentation describing Test 1 and the associated IER and FAA Categorical Exclusion are provided in **Appendix M**.

Test 1 evaluated the feasibility for BOS ATCT to operate the Airport in a different primary runway configuration during the morning (6:00 a.m. to 9:00 a.m.) from that operated during the previous night period (8:30 p.m. to midnight). The following summarizes the primary parameters of the test:

- If more than one configuration was used during the 8:30 p.m. to midnight period, the latest configuration used for at least one hour was identified as the configuration to change from in the morning.
- It was acknowledged that wind, weather, and other operational conditions may require the same primary arrival runway end and primary departure runway end during both of the periods.
- When feasible, in order of preference, the instructions during Test 1 were:
    1) At 6:00 a.m., utilize a configuration that had a different primary arrival runway end and a different primary departure runway end than was being utilized for the 8:30 to midnight period the night prior.
    2) If wind, weather, or operational conditions did not allow for #1 to occur, the second preference was to utilize a configuration that had a different primary departure runway end than was being utilized for the 8:30 p.m. to midnight period the night prior.
    3) If wind, weather, or operational conditions did not allow for #1 and #2 to occur, the third preference was to utilize a configuration that had a different primary arrival runway end than was being utilized for the 8:30 p.m. to midnight period the night prior.

The various priorities for runway use during the morning hours listed above were referred to as M1, M2, M3, and M4. M1 and M2 represented a full change in runway configuration (CAC priority number 1); M3 represented a change in the primary departure runway (CAC priority number 2); and M4 represented a change in the primary arrival runway (CAC priority number 3). FAA was provided a matrix (included in the Test 1 documentation in Appendix M) that listed the morning runway use configurations, in order of the above priorities, to be used depending on the nighttime configuration. It should be noted that the matrix was updated on December 12, 2014, to better match the stated priorities.

During the test period, FAA maintained a log of the runway configurations used each nighttime period and the configuration used the following morning. In the event that neither M1 nor M2 could be met, FAA documented the reason. Massport then maintained logs that included the information recorded and provided by FAA, along with meteorological conditions, and jet runway use. This information was compiled as a Microsoft Excel spreadsheet and is available on the BLANS website in the Test 1 section of Phase 3 document library.

Following the test, the IC prepared a draft report that was issued in September 2015. CAC reviewed the report; however a final report was not issued. During the test period, statistics demonstrated that some form of runway use change from the night period to the following morning occurred 73 percent of the time, with a full configuration change occurring 51 percent of the time, the primary departure runway changing 14 percent of the time, and the arrival runway changing 8 percent of the time. While the 73 percent change rate was considered successful by Massport and FAA, the CAC did not consider the test successful as the use of the matrix led to repetitive changes from specific nighttime configurations to the same configurations the following morning. For example if a particular configuration was in use for several nights in a row, the configuration used the following mornings would be the same, when other configurations might have been used the following morning.

5.4.2 RUNWAY USE TEST 2

Runway Use Test 2 (Test 2) was initiated on May 11, 2015, with an initial scheduled end date of August 10, 2015. The end date was extended to November 10, 2015 to allow further evaluation and to allow continued testing while the plan for a subsequent test could be developed. Test 2 was developed to address dwell and persistence issues related to using the same runway configurations for long periods of time. The process for implementing the test was similar to that followed for Test 1 as described in Section 5.4.1. The documentation describing Test 2 and the associated IER and FAA Categorical Exclusion are provided in **Appendix N**.

Test 2 evaluated the feasibility for BOS ATCT to change runway use at the Airport following the morning peak and then again before the afternoon peak, with the overall purpose of minimizing the amount of time runways were used during a 24-hour period as well as over longer periods. The following summarizes the primary parameters of the test:

- The approach was to request FAA to change the runway configuration/use during the day at two specific points as described above. Although specific times for the changes were listed, it was acknowledged that traffic demand and other conditions may require the changes to occur at other times near the specific times.
- It was acknowledged that wind, weather, and other operational conditions may require the same primary arrival runway end and primary departure runway end during both of the periods.
- When feasible, the changes would occur as follows:

9:30 a.m.

1) At 9:30 a.m., utilize a configuration that had a different primary arrival runway end and a different primary departure runway end than was being utilized for the 6:00 a.m. to 9:30 a.m. period.
2) If wind, weather, or operational conditions do not allow for #1 to occur, the second preference was to utilize a configuration that had a different primary departure runway end than was being utilized for the 6:00 a.m. to 9:30 a.m. period.
3) If wind, weather, or operational conditions did not allow for #1 and #2 to occur, the third preference was to utilize a configuration that had a different primary arrival runway end than was being utilized for the 6:00 a.m. to 9:30 a.m. period.

4) If more than one configuration is used during the 6:00 a.m. to 9:30 a.m. period, the latest configuration used for at least one hour was identified as the configuration to change from.

2:30 p.m.

1) At 2:30 p.m., utilize a configuration that had a different primary arrival runway end and a different primary departure runway end than was being utilized for the 9:30 a.m. to 2:30 p.m. period.
2) If wind, weather, or operational conditions did not allow for #1 to occur, the second preference was to utilize a configuration that had a different primary departure runway end than was being utilized for the 9:30 a.m. to 2:30 p.m. period.
3) If wind, weather, or operational conditions did not allow for #1 and #2 to occur, the third preference was to utilize a configuration that had a different primary arrival runway end than was being utilized for the 9:30 a.m. to 2:30 p.m. period.
4) If more than one configuration was used during the 9:30 a.m. to 2:30 p.m. period, the latest configuration used for at least one hour was identified as the configuration to change from.

The priorities for runway configuration/use selection at each change point were also provided in a matrix; however, a greater number of options were provided to change to from each configuration than had been provided in Test 1 in response to concerns raised regarding repetitively changing to the same configuration from a given configuration during Test 1.

FAA and Massport maintained similar information to that for Test 1. The information was compiled as a Microsoft Excel spreadsheet and is available on the BLANS website in the Test 2 section of Phase 3 document library. No formal analysis of the reported data was completed, however it was determined that the FAA was less successful in changing runway use at or near the specified times than they were at changing the runway configuration from the nighttime to morning period. Of the two specified periods, FAA was more successful in changing runway use during the morning period (monthly percentage of time changing runways ranging from 30 percent to 70 percent) than during the afternoon period (monthly percentage of time changing runways ranging from 17 percent to 40 percent). Operational and weather conditions were the majority of reasons for which runway use could not be changed.

5.4.3 RUNWAY USE TEST 3 - INFORMATION GATHERING

Runway Test Period 3 was an information gathering exercise regarding noise and operational restrictions in place at the Airport as well as an assessment of nighttime aircraft operations at the Airport. The PC worked with Massport and FAA to compile the list of restrictions and summarized them in a table entitled "Summary of Runway Use Restrictions," dated May 2, 2016.

Massport provided the CAC with a spreadsheet containing records of all aircraft operations between the hours of 10:00 p.m. and 6:59 a.m. for the year period of October 2015 through September 2016. Using those data, the IC prepared a first draft of a BOS Night Flights Report[46]. The report includes summaries of aircraft operations by various statistics, including events sorted by hour, late night-early morning sleep period, FAR

[46] Landrum & Brown, Inc., *BOS Logan Airport Night Flights Summary Reporting, Draft, Report Version 1*, December 2, 2016.

Part 36 noise stage[47], aircraft model, airline, and runway. The CAC drafted a simpler version 2, focusing on events by FAR Part 36 aircraft model, and airline for both the night period and the late night-early morning sleep period. The CAC has stated its desire for this version 2 to be a regular report from Massport.

Both the summary of operational and runway use restrictions and both versions of the nighttime operations report are available on the BLANS website in the Test 3 section of the Phase 3 document library and are includes as **Appendix O**.

At the request of the CAC, Massport has prepared and provided graphics depicting radar flight tracks for arrivals and departures on various runways over maps showing the procedures defined as Early Implementation Measures from Phase 1. The graphics have been provided for illustrative purposes to assist in the development of metrics and monitoring of the use of the procedures and include aircraft altitude statistics at particular points along the procedures such as shoreline crossing points. The graphics demonstrate safe and effective aircraft operations within the parameters of the defined procedures. Massport worked with CAC to modify the graphics over time. Flight track graphics for January through August 2016 are found on the BLANS website in the Development of Metrics/Monitoring Program section of the Phase 3 document library. The illustrative August flight track graphics are included in Appendix O.

Massport provided reports of DNL by Runway by Census Block based on data developed for the EDR and prepared by the EDR consultant. Reports for 2007 through 2015 are found on the BLANS website in the Reference Documents and Data section of the Phase 3 document library.

All of the provided data was at the request of the CAC and intended for use by the CAC in the development of a RUP to replace PRAS and for CAC to develop recommended monitoring and reporting for implementation and effectiveness of various noise abatement measures.

5.4.4 RUNWAY USE TEST 4

Following the completion of Test 2, the CAC began the process of identifying another proposed live runway use test. Initially, the test was being developed with one intent of balancing the combined impact of noise exposure associated with Runway 27 departures and Runway 9 arrivals and Runway 33L departures and Runway 15R arrivals. The balance was to be achieved by establishing a goal regarding the split between Runway 27 and Runway 33L departures, which historically have together represented about 25 percent of the departures. A second intent was to reduce the annual use of Runways 4L and 4R for arrivals by five percentage points compared with the average percentage use over the prior 10 years. Arrivals on these runways have historically represented about 35 percent of arrivals. Initially, the PC assisted the CAC in development of the fourth runway use test plan, as contractual matters for the IC were being addressed. This allowed the process of defining the runway use plan to continue while the contractual matters were addressed.

[47] Title 14 Code of Federal Aviation Regulations Part 36, *Noise Standards: Aircraft Type and Airworthiness Certification,* establishes noise standards for aircraft operating within the United States. Civil aircraft operating within the United States are required to meet Part 36 Stage 3 or higher noise standards.

Following several drafts of runway use plan test documents, the CAC was unable to reach agreement on a test involving specific long-term runway use goals during specific operating configurations. The CAC then began development of a runway use plan test that placed a greater emphasis on shorter-term respite, building upon what was learned from Tests 1 and 2. The CAC reached an agreement during its meeting on May 12, 2016 to recommend a test to FAA and Massport intended to decrease the use of the runway end used most heavily over a specified prior period of time. The test would involve runway use reporting that would provide FAA a priority listing to be used when making runway use decisions, as well as reporting mechanisms allowing longer-term tracking that would provide data for on-going refinements. The FAA's runway use selection was to be made from a priority listing based upon the least used to most used runways over specified prior periods.

Massport and FAA reviewed the proposed test description, including the reporting and monitoring procedures and determined that as proposed the procedures did not provide clear guidance to BOS ATCT supervisors regarding runway use decisions. FAA representatives stated that the mechanism for selecting runway use was too complicated and Massport representatives stated that the goals and intent of the test were unclear. Some of the discussion was related to whether departure runway use, arrival runway use, or combined arrival and departure runway use over a physical runway end (e.g., Runway 9 arrivals and Runway 27 departures) would be used to establish the priority.

FAA and Massport then proposed a runway use test on June 2, 2016, under which the runway priority list was based upon departure and arrival runway use over the prior seven days, presented in order from the least used to most used departure and arrival runways. The use of a seven-day period was proposed as an example, and could be more or less based on CAC desires. When making a runway use decision, the FAA Tower supervisor would start at the top of the list and select the first primary departure runway that is compatible with current and forecast wind and weather conditions. Associated arrival runways would then be selected to establish the overall runway configuration to be used. CAC did not recommend this proposal.

On August 19, 2016, FAA issued a letter to Massport summarizing the history of the BLANS and funding provided and stating that "at a minimum the CAC must have a recommendation for a runway use program by September 30, 2016, or we [FAA] will ask Massport to submit final invoices to close the project grant by October 1, 2016.[48]" Conversations continued, however a fourth runway use test plan had not been agreed upon in time for FAA to obtain NEPA approval, train staff, implement the test, and conduct it for an adequate period of time for CAC to make a runway use plan recommendation prior to the completion of the BLANS. The FAA subsequently noted in a letter to Massport dated October 5, 2016, that the scope of services included a path to completing the BLANS by September 30, 2016, and that documentation to close out the grant must be submitted by December 31, 2016[49]. Massport forwarded correspondence to CAC via electronic mail on

[48] Letter from Mary Walsh, Manager, New England Airports Division, to Mr. Edward Freni, Massachusetts Port Authority, dated August 19, 2016.

[49] Letter from Mary Walsh, Manager, New England Airports Division, to Mr. Edward Freni, Massachusetts Port Authority, dated October 5, 2016.

November 15, 2016[50], stating that input from CAC was needed by December 9, 2016, to allow adequate time for invoices to be submitted to close out the grant. The email from Massport to the CAC, which includes the referenced FAA letters is provided in **Appendix P**. With December 9 noted as the specified for input from CAC, no Test 4 was conducted.

5.5 Runway Use Program

As of December 2016, a RUP had not been recommended for the Airport by CAC. However, the CAC instructed the IC to develop a comprehensive CAC Noise Abatement Report that would eventually be used as both a means of providing future guidance to FAA regarding runway use selection as well as on-going tracking of runway use and the associated noise exposure. The enhanced reporting is intended to be updated on a regular basis to inform the future development of an RUP as well as on-going modifications or adjustments to the RUP in efforts to reduce noise exposure and to provide a more equitable distribution of noise in the vicinity of the Airport.

As noted in Section 5.2.2, the latest version of the CAC Noise Abatement Report completed as part of the BLANS is provided in Appendix L. The CAC Noise Abatement Report includes a history leading to its development and a discussion of noise modeling as background. The tables and figures then report three levels, with metrics for both longer-term (yearly) and shorter-term (month and day) periods as requested by the CAC:

- Level 1, Airplane Flight Operations, including runway use, persistence and dwell – arrivals and departures, and total by each of the six runway ends.
- Level 2, Community Noise Exposure, including noise exposure by runway end and community, and intruding events (as defined in Section 5.2.2.2) by community
- Level 3, Population Noise Impacts, including LWP (as defined in Section 5.2.2.3) by runway end and community, and intruding events, population, and LWP by community

The various runway configurations and wind patterns at the Airport are also presented in the report.

Finally, the CAC Noise Abatement Report includes a draft section entitled "FAA ATCT Monthly Runway Use Program Guidelines" that includes Logan CAC recommended definitions and statistics for runway use and persistence, but does not provide guidance or a recommendation regarding runway use that would be required for a RUP. The Noise Abatement Report is the sole responsibility of the Logan CAC and does not reflect Massport or FAA review or input.

[50] Electronic Mail from Gordon M. Carr, Acting Director, Communications Relations, to Boston Logan Airport Community Advisory Committee (Logan CAC), dated November 15, 2016.

The CAC Noise Abatement Report states that:

> It [the CAC Noise Abatement Report] is intended by the Logan CAC to be the basis for a new Runway Use Program. And, that it will be used by the intended Noise Abatement Committee for a Monitoring Program for implementation and effectiveness.

Work on BLANS concluded on December 31, 2016, and any further work on the CAC Noise Abatement Report or development of a RUP would be outside of the context of BLANS.

During its December 1, 2016 meeting, the following motions were made and adopted by the CAC[51]:

- The Logan CAC requests and recommends Massport improve their annual MEPA Environmental Data Report. Including expanding their noise analysis study area to match the larger BLANS study area, 20 NM. Including Public download availability at massport.com/noise before the end of the first quarter following every calendar year.
- The Logan CAC requests and recommends Massport implement the monthly Flight Tracks Report which they have developed with the Logan CAC. Including Public download availability at massport.com/noise before the end of each month for the prior month. And, that Massport implement remaining Logan CAC requests for improvements and further refinements with use. Including a Public review session at least quarterly.
- The Logan CAC requests and recommends Massport complete the BOS Noise Abatement Report [CAC Noise Abatement Report] being developed by the Logan CAC. Addressing the punch list to complete the draft. Including Public download availability at massport.com/noise of Runway Use, Persistence, and Dwell by Runway End before the end of each month for the prior 12 months. Including an annual report with Aircraft Flight Operations, Community Noise Exposures, and Population Noise Impacts before the end of the first quarter following every calendar year. Including a Public review session at least quarterly.

Massport has acknowledged that it will continue to work with the Massport Community Advisory Committee to further develop and maintain reports following the completion of the BLANS.

5.6 Noise Sensitivity Scenario

As a potential aid in the development of a RUP for the Airport, and particularly in the potential recommendation to reduce operations on some runways, thereby increasing operations on other runways, the CAC requested that a noise sensitivity test be conducted. The purpose of the sensitivity test was to identify the potential changes in noise exposure that would result from incremental changes in runway use (i.e., annual

[51] Excerpt from Darryl Pomicter, President, Logan Airport Community Advisory Committee, "RE: BLANS Draft Final Report—DP Comments 1.-6—Motions," email to John Williams, Terry English, Flavio Leo, Chris Sandfoss, January 13, 2017.

increases or decreases in runway use of less than 2 percent.) The results are presented herein as resource information only and do not represent a recommendation regarding a RUP.

The noise exposure analyses for the BLANS has historically been conducted by generating noise contours for each of the various runway use configurations used at the Airport and then annualizing the results using the percentages that each configuration is used. As a result, it was not possible to change runway use individually. However, it was possible to change the percentage use of the various configurations instead and generate new annual contours that reflect changes in runway configuration usage. The goal of this type of analysis is to provide insight into the effects of runway use changes as arrival and departure runways are operated in various configurations and a change in the arrival runway(s) generally results in a change in the departure runway(s) as well.

The sensitivity analysis was completed by reducing the use of two of the configurations at the Airport by 2 percentage points each and increasing the use of two others by two percentage points each. **Table 5-4** lists the configuration usage percentages for the updated and expanded 2015 Baseline Condition and the Sensitivity Scenario.

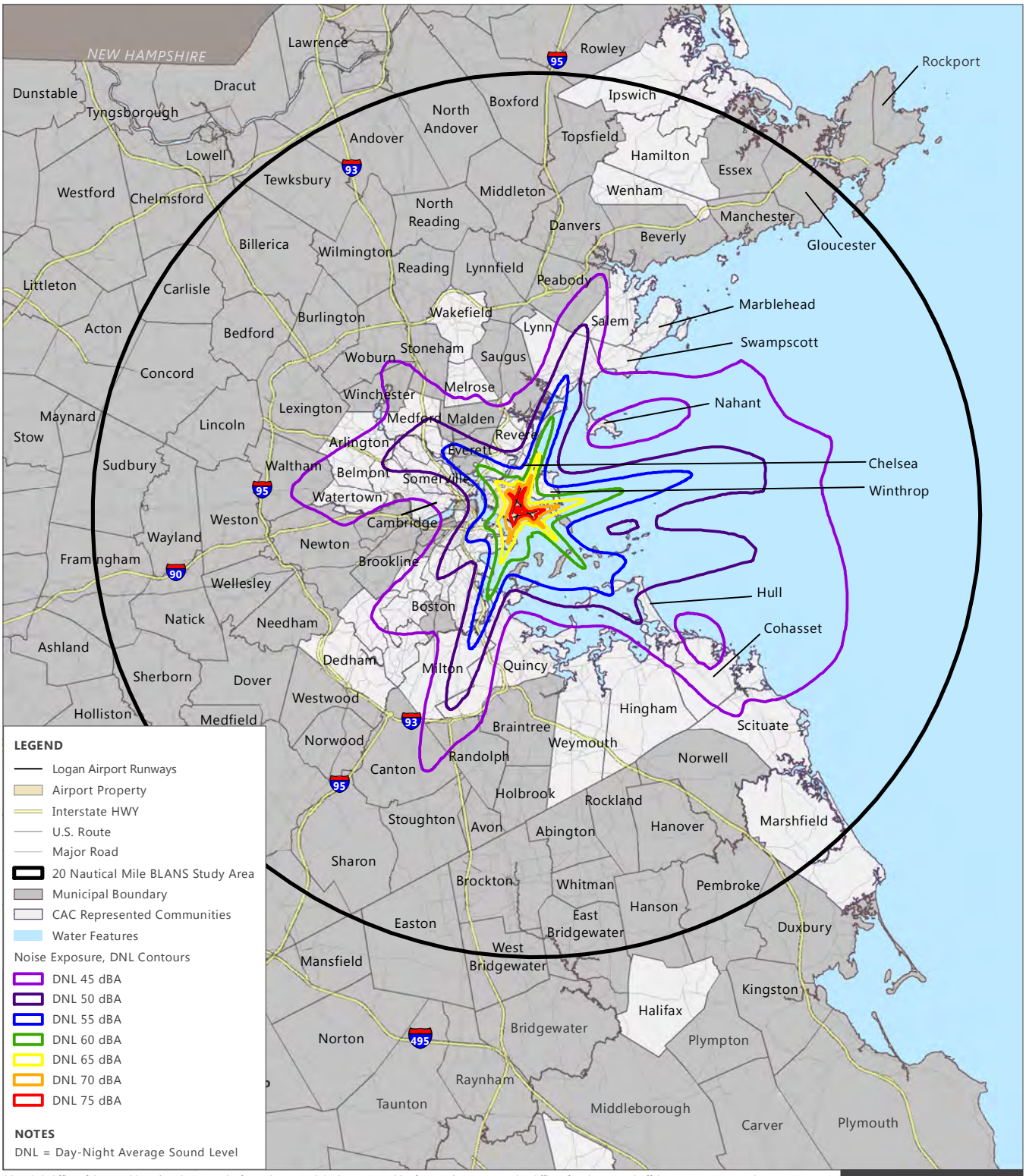
Table 5-4: Sensitivity Analysis Configuration Use Percentages

CONFIGURATION	ARRIVAL RUNWAYS	DEPARTURE RUNWAYS	2015 BASELINE PERCENTAGE	SENSITIVITY SCENARIO PERCENTAGE
1	4L, 4R	4L, 4R, 9, 15R	29.5%	27.5%
2	4R	4L, 4R, 9, 15R	10.3%	10.3%
3/4	22L, 22R	22L, 22R, 15R	8.0%	8.0%
5	33L, 32, 33R	33L, 27	6.5%	8.5%
6	27, 22L	22L, 22R	29.0%	27.0%
7	27,32, 33L	33L, 27	16.7%	18.7%

SOURCE: Ricondo & Associates, Inc., December 2016
PREPARED BY: Ricondo & Associates, Inc., January 2017.

The percentage changes in configuration use were intended to demonstrate the effects of moving aircraft operations from more heavily used runways to lesser used runways.

Exhibit 5-6 and **Exhibit 5-7** depict the Sensitivity Scenario noise exposure contours for the Study Area and for the Central Area, respectively. **Exhibit 5-8** depicts a comparison between the Sensitivity Scenario noise exposure contours and the updated and expanded 2015 Baseline noise exposure contours. **Table 5-5** provides a side-by-side comparison of the population exposed to various ranges of noise levels (e.g., DNL 50 – 55) as well as the cumulative population exposed to various noise levels (e.g., 55 and higher [55+]) for the Sensitivity Scenario and the updated and expanded 2015 Baseline noise exposure contours.



SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, December 2016 (noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

EXHIBIT 5-6

NORTH 0 40,000 ft.

BOS Noise Exposure (DNL 45-75 dBA) Contours, BLANS Study Area - Sensitivity Analysis Scenario

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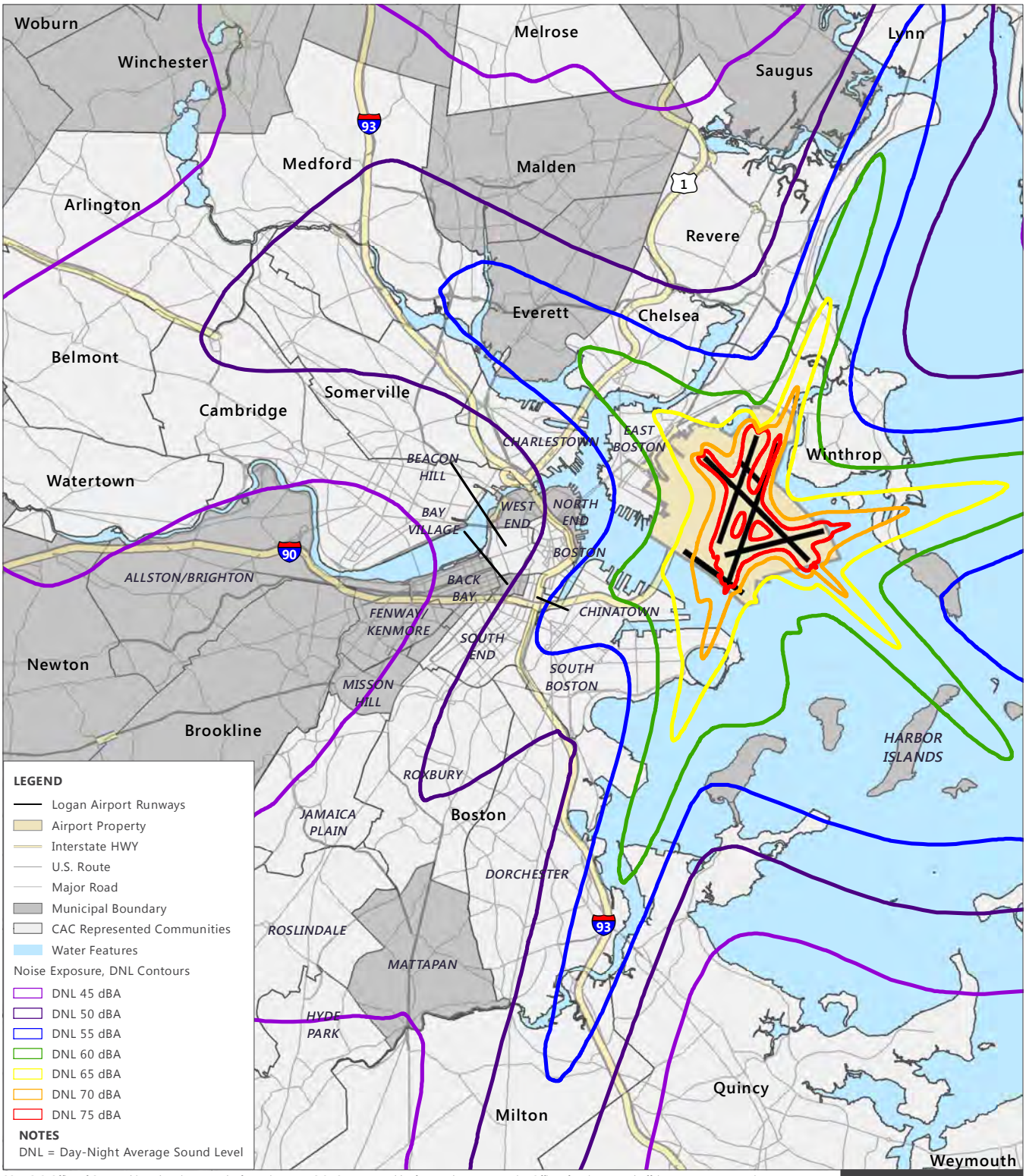

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, December 2016 (noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

EXHIBIT 5-7

NORTH 0 10,000 ft.

BOS Noise Exposure (DNL 45-75 dBA) Contours, Central Area – Sensitivity Analysis Scenario

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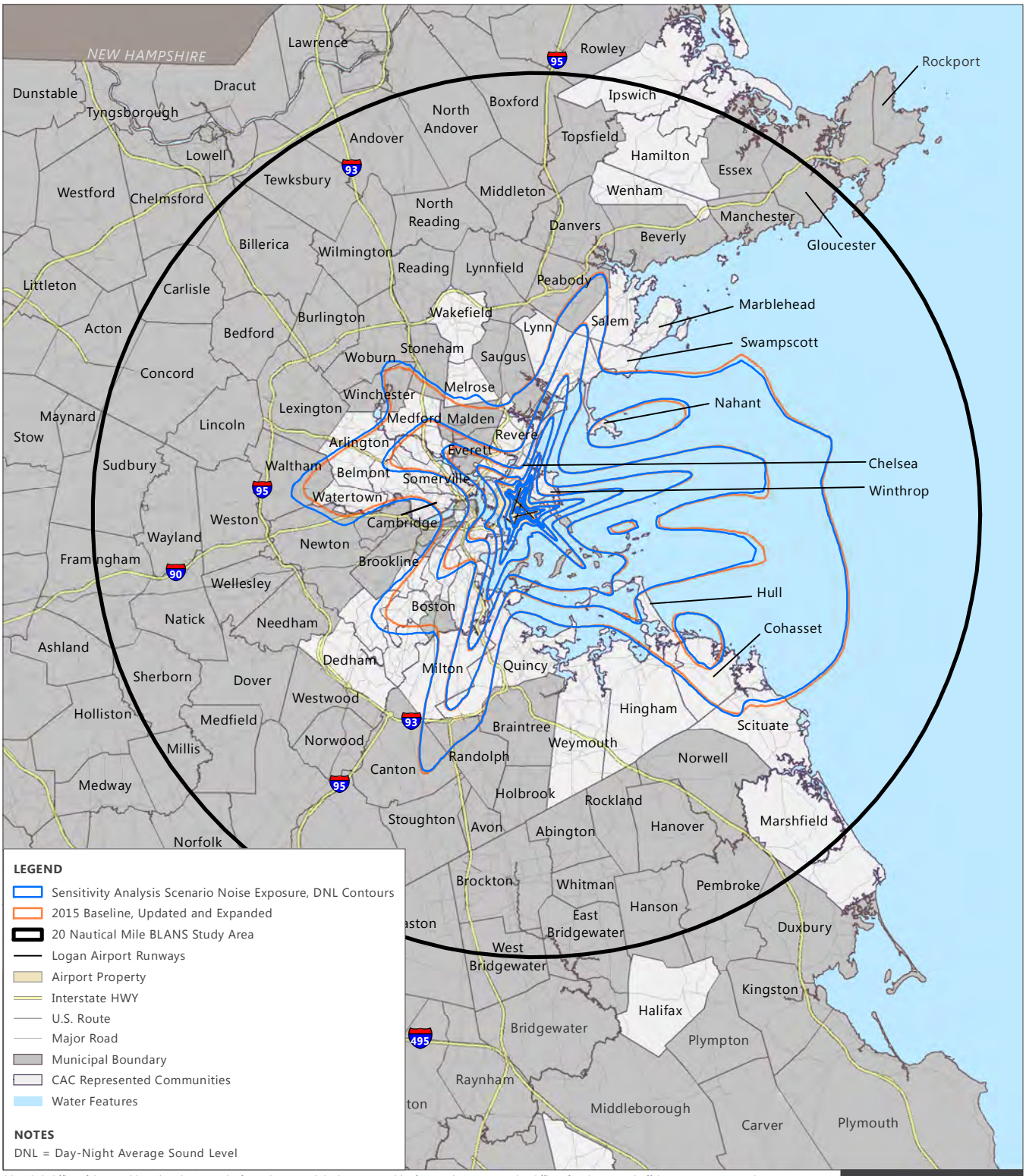

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, December 2016 (noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

EXHIBIT 5-8

NORTH

0 40,000 ft.

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BOS Noise Exposure (DNL 45-75 dBA) Contours, Sensitivity Analysis Scenario Compared with 2015 Baseline, Updated and Expanded

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Table 5-5: Population Exposed to Sensitivity Scenario and Updated and Expanded 2015 Baseline Noise

DNL RANGE	SENSITIVITY SCENARIO	UPDATED AND EXPANDED 2015 BASELINE	CUMULATIVE DNL RANGE	SENSITIVITY SCENARIO	UPDATED AND EXPANDED 2015 BASELINE
DNL 45-50	719,941	698,622	**DNL 45+**	1,167,977	1,104,843
DNL 50-55	328,969	292,118	**DNL 50+**	448,036	406,221
DNL 55-60	76,018	75,275	**DNL 55+**	119,067	114,103
DNL 60-65	37,602	34,650	**DNL 60+**	43,049	38,828
DNL 65-70	5,279	4,010	**DNL 65+**	5,447	4,178
DNL 70-75	168	168	**DNL 70+**	168	168
DNL 75+	-	-	**DNL 75+**	-	-

SOURCE: Ricondo & Associates, Inc., based on Sensitivity Scenario contours prepared by Wyle, and *BLANS Phase 3 2015 Baseline Contour Update*, September 13, 2016 (revised). January 2017

PREPARED BY: Ricondo & Associates, January 2017.

Exhibit 5-9 and **Exhibit 5-10** depict the NA contours for the Sensitivity Alternative for the Study Area and the Central Area, respectively. **Table 5-6** provides a side-by-side comparison of the population within each of the NA contours for the Sensitivity Alternative and the updated and expanded 2015 Baseline.

Table 5-6: Population Exposed to NA Contours for Sensitivity Scenario and 2015 Baseline Noise

NUMBER OF EVENTS ABOVE RANGE	SENSITIVITY SCENARIO	UPDATED AND EXPANDED 2015 BASELINE	CUMULATIVE DNL RANGE	SENSITIVITY SCENARIO	UPDATED AND EXPANDED 2015 BASELINE
5-10	242,709	243,177	**5+**	602,092	565,762
10-19	185,391	155,753	**10+**	359,383	322,585
20-49	92,769	86,627	**20+**	174,992	166,832
50-99	60,013	58,223	**50+**	81,223	80,205
100-199	19,625	20,263	**100+**	21,210	21,982
200-399	1,585	1,619	**200+**	1,585	1,619
400+	-	-	**400+**	-	-

SOURCE: Ricondo & Associates, Inc., based on Sensitivity Scenario NA contours prepared by Wyle, and *BLANS Phase 3 2015 Baseline Contour Update*, September 13, 2016 (revised)., January 2017

PREPARED BY: Ricondo & Associates, January 2017.

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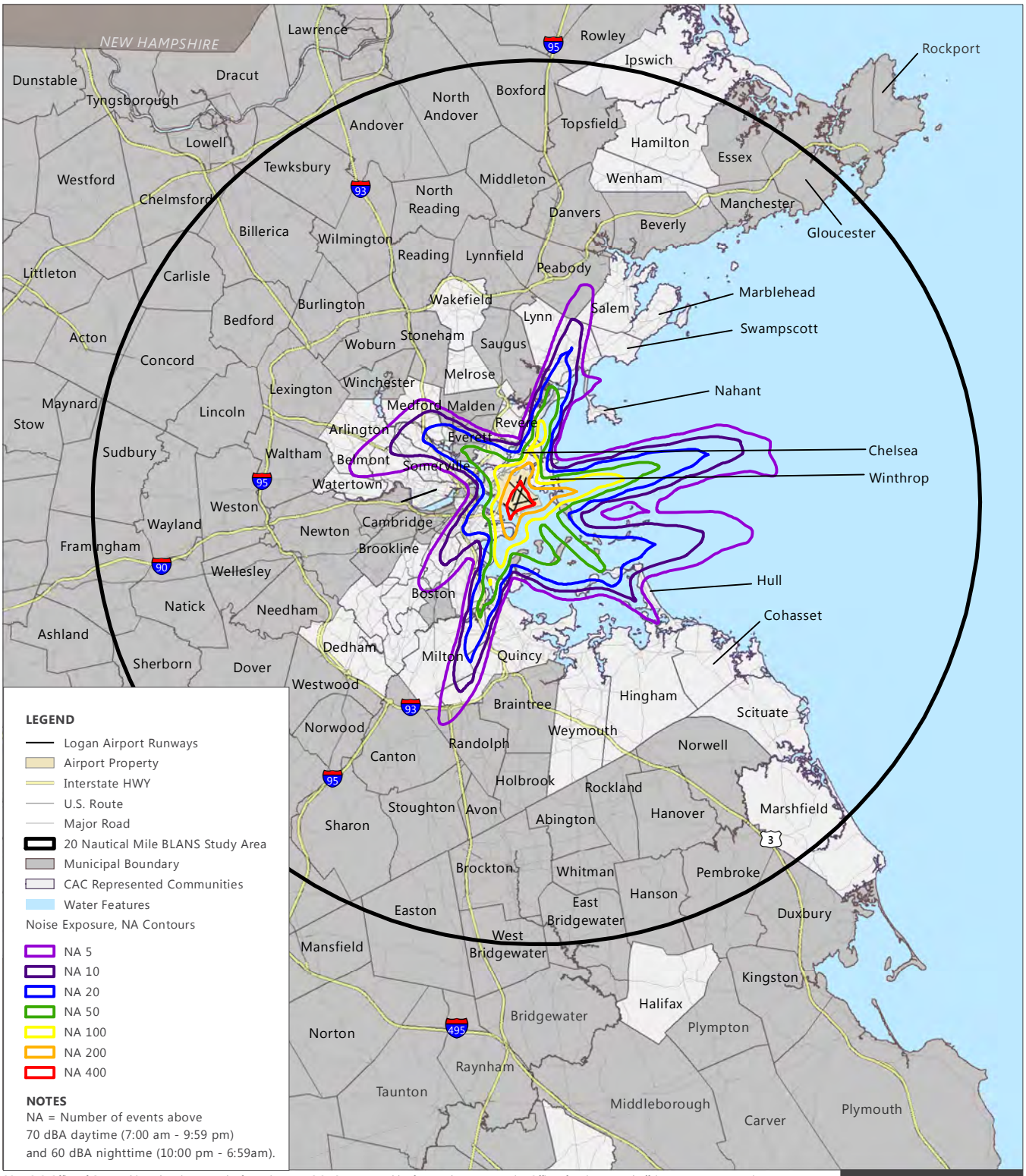

SOURCES: Office of Geographic and Environmental Information(MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, March 2016 (noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

EXHIBIT 5-9

NORTH 0 40,000 ft.

BOS Noise Exposure (NA 70 dBA Day + 60 dBA Night) Contours, BLANS Study Area - Sensitivity Analysis Scenario

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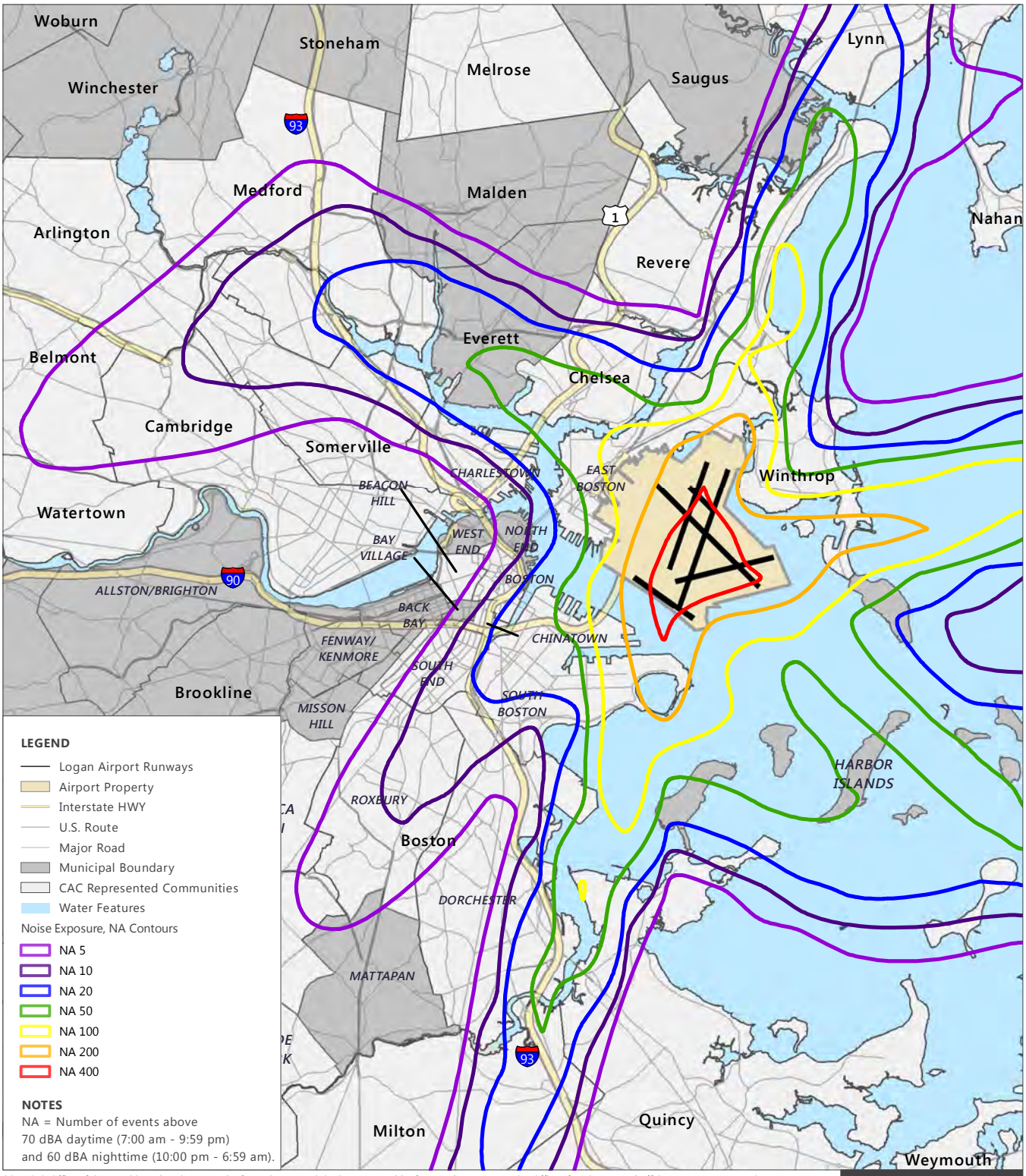

SOURCES: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs www.mass.gov/mgis; Logan roadways and boundary data provided by Massport; Wyle, December 2016 (noise contours); Ricondo & Associates, Inc., November 2016 (Boston neighborhoods).
PREPARED BY: Ricondo & Associates, Inc., March 2017.

EXHIBIT 5-10

NORTH 0 10,000 ft.

BOS Noise Exposure (NA 70dBA Day + 60 dBA Night) Contours, Central Area - Sensitivity Analysis Scenario

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6. Summary of Noise Abatement Initiatives at Boston Logan International Airport

The following sections present an overall summary of noise abatement initiatives at Boston Logan International Airport and include those resulting from BLANS, commitments made by Massport during BLANS, and initiatives already in place, as reported in the EDR.

6.1 BLANS Flight Procedures

Flight procedures implemented through the BLANS include "Early Implementation Measures" (discussed in Section 3.5) that were recommended by the CAC in 2007 are listed in **Table 6-1**, along with the dates of implementation.

6.2 BLANS Ground Procedures

Two ground movement measures evaluated during BLANS Phase 2 were and recommended by the CAC. Both met the Massport and FAA criteria.

- Development of a preferred location for runups away from communities
- Identification of a holding area for delayed departures

Both of these measures have been implemented.

6.3 Runway Use Program

As described in Section 5.5, a RUP to replace PRAS had not been recommended by CAC as of December 2016. An extensive Noise Abatement Report template was designed by CAC to enhance reporting of aircraft flight operations, community noise exposure, and population impacts using longer-term (year) and shorter-term (month and day) metrics at each level. The latest version of the CAC Noise Abatement Report, included herein as Appendix L, represents work that was completed by CAC and the IC prior to the conclusion of the BLANS, but does not represent a RUP or RUP guidelines that have been reviewed and accepted by Massport or FAA. Any further work on the CAC Noise Abatement Report or RUP will occur outside of the context of BLANS.

Table 6-1 (1 of 2): Phase 1 Early Implementation Measures – Implementation Dates

MEASURE NUMBER/ RUNWAY OPERATIONS	MEASURE DESCRIPTION[1/]	IMPLEMENTATION DATE(S)[2/]
1/14/15 Runway 4R Departures	***INTENT:*** To increase the accuracy and narrow the track of jet departures over the Nahant Causeway, increase the altitude of shoreline crossings, and keep southbound departures east of Minot's Light prior to crossing the shoreline. ***DESCRIPTION:*** RNAV SID for all jet departures from Runway 4R Conventional[3/] procedure to approximate the RNAV SID	 May 3, 2010 February 14, 2008
2/14/15 Runway 9 Departures	***INTENT:*** To increase the altitude of shoreline crossings of jet departures from Runway 9 over the South and North Shores and to keep southbound departures east of Minot's Light prior to crossing the shoreline. ***DESCRIPTION:*** RNAV SID for all jet departures from Runway 9 Conventional procedure to approximate the RNAV SID	 February 1, 2010 February 14, 2008
3/14/15 Runway 15R Departures	***INTENT:*** To avoid, to the extent practicable, Runway 15R jet departures overflights of the Hull peninsula, increase the altitude of shoreline crossings over the South and North Shores, and keep southbound departures east of Minot's Light prior to crossing the shoreline. ***DESCRIPTION:*** RNAV SID for all jet departures from Runway 15R Conventional procedure to approximate the RNAV SID	 November 18, 2010 February 14, 2008
5/14/15 Runway 22R/L Departures	***INTENT:*** To avoid, to the extent practicable, Runway 22R and 22L jet departure overflights of the Hull peninsula, increase the altitude of shoreline crossings over the South and North Shores, and keep southbound departures east of Minot's Light prior to crossing the shoreline. ***DESCRIPTION:*** RNAV SID for all jet departures from Runways 22R and 22L Conventional procedure to approximate the RNAV SID	 November 18, 2010 February 14, 2008
6 Runway 22L Arrivals	***INTENT:*** To reduce noise exposure for the communities located under the NORWICH Standard Terminal Arrival Route (STAR) left downwind arrival route to Runway 22L south of the Airport by relocating aircraft to the DRUNK[4/] intersection (located about 25 nautical miles southeast of the Airport near the shoreline in Marshfield) from the NORWICH STAR. ***DESCRIPTION:*** Conventional procedure re-routing jet aircraft to the DRUNK intersection through radar vectoring or other conventional navigation. Aircraft would pass this intersection at or above 6,000 feet mean sea level (MSL)[5/].	 October 1, 2009

Table 6-1 (2 of 2): Phase 1 Early Implementation Measures – Implementation Dates

MEASURE NUMBER/ RUNWAY OPERATIONS	MEASURE DESCRIPTION[1/]	IMPLEMENTATION DATE(S)[2/]
7 Runway 27 Arrivals	***INTENT:*** To reduce noise exposure for communities located south of the Airport under the NORWICH STAR south arrival route to Runway 27. ***DESCRIPTION:*** Conventional procedure routing jet aircraft to the DRUNK intersection through radar vectoring or other conventional navigation. Aircraft would pass this intersection at or above 6,000 feet MSL[6/].	October 1, 2009
11 Runway 33L Arrivals	***INTENT:*** To reduce noise exposure for South Shore communities. ***DESCRIPTION:*** Charted visual approach for jet aircraft landing on Runway 33L using traditional navigation augmented by RNAV waypoints	May 7, 2009
	Special RNAV procedure to overlay the Light Visual Runway 33L Approach [7/]	March 1, 2014

NOTES:

1/ The measure descriptions have been revised to more closely match the descriptions as approved in the 2007 FAA ROD approving the Phase 1 Early Implementation Measures (see Appendix H).

2/ Implementation dates and first use of the procedures may be approximate.

3/ "Conventional" refers to procedures using radar vectors assigned by air traffic controllers or other conventional means of navigation.

4/ The name of this intersection was subsequently changed to DUNKK.

5/ FAA implemented an RNAV STAR for jet aircraft arriving on Runway 22L on December 15, 2011 outside of the context of BLANS. The STAR requires jet aircraft arrivals on Runway 22L from the south to cross a waypoint referred to as KLEBB, located 2.4 nautical miles east of the DUNKK intersection at an altitude of 8,000 feet MSL. The intent was to increase approach altitudes of aircraft arriving from the south to land on Runway 22L.

6/ FAA implemented an RNAV STAR for jet aircraft arriving on Runway 22L on December 15, 2011 outside of the context of BLANS. The STAR requires jet aircraft arrivals on Runway 27 from the south to cross a waypoint referred to as KLEBB, located 2.4 nautical miles east of the DUNKK intersection at an altitude of 8,000 feet MSL. The intent was to increase approach altitudes of aircraft arriving from the south to land on Runway 27.

7/ A JetBlue sponsored RNAV procedure (referred to as the RNAV Visual Runway 33L approach) was established on March 1, 2014, to overlay the Light Visual Approach described in the FAA's 2007 CATEX / ROD . This is a special procedure developed by the FAA working with JetBlue in an effort to increase the use of the late night flight track.

SOURCE: Ricondo & Associates, Inc., March 2017, based on Department of Transportation Federal Aviation Administration, *Documented Categorical Exclusion, Record of Decision, Boston Logan International Airport, Boston, Massachusetts, Phase 1 Procedures/Alternatives Recommended for Implementation from Boston Overflight Noise Study,* October 2007 (measure descriptions), and FAA Air Traffic Organization, March 2017 (implementation dates.)

PREPARED BY: Ricondo & Associates, Inc., March 2017.

6.4 Additional Noise Abatement Commitments

In addition to the recommendations made to FAA and Massport during Phase 2, the CAC, following its meeting on April 3, 2012, requested that six supplemental programmatic measures that had been verbally agreed to by either FAA or Massport be memorialized as part of the BLANS. In a response from FAA and Massport, a letter was attached from Massport to the CAC Co-Chairs dated December 13, 2011 providing Massport's commitment to facilitate and attend meetings with a community noise advisory committee, as well as its commitments regarding the ground measures[52]. The additional measures committed to by Massport and FAA are summarized below, as presented in the Phase 2 Level 3 Screening Report (see Appendix K), with the responsible party in parentheses:

- establish an on-going airport/community noise advisory group that would meet on a regular basis (Massport)[53]
- encourage airlines to use single-engine taxiing (Massport)
- encourage airlines to limit the use of reverse thrust when safe to do so and consistent with airline operational procedures (Massport)
- assess the feasibility of developing a hold pad at or near the midpoint of the airfield for short term staging of aircraft (Massport)
- establish and maintain regular communications with helicopter operators to increase usage of established helicopter routings within and through the downtown area when safe to do so (FAA), and
- establish and maintain regular communications with helicopter and propeller aircraft operators to maintain altitudes of 2,000 feet over the downtown area when safe to do so (FAA).

6.5 Other Measures Implemented by Massport

Table 6-2 presents measures implemented by Massport as part of its ongoing noise abatement efforts, as reported in the EDR.

[52] Letter from David S. Mackey, Interim CEO and Executive Director, Massachusetts Port Authority, to Sandra Kunz and Jerry Falbo, Co-Chairs of the Community Advisory Committed, dated December 13, 2011.

[53] Massport has stated its intent to work with the legislatively established Massport Community Advisory Committee regarding aircraft noise concerns.

Table 6-2: 2015 Noise Abatement Management Plan

NOISE ABATEMENT GOAL	PLAN ELEMENTS	2014 PROGRESS REPORT
Limit total aircraft noise	Limit on cumulative Noise Index (CNI)	The CNI value for 2014 was 152.9 EPNdB which is well below the cap of 156.5 EPNdB.
	Stage 3 percentage requirement in Noise Rules	In 2015, Stage 3 and 4 operations represented 100 percent of Logan Airport's total commercial jet traffic.
Mitigate noise impact	Residential Sound Insulation Program (RSIP)	No additional dwelling units were sound insulated in 2015, leaving the total of treated dwelling units to 11,515 since the start of the program in 1986.
	School Sound Insulation Program	Thirty-six eligible schools have been sound insulated since this program began.
	Noise Abatement Arrival and Departure Procedures	Flight track monitoring and data analysis were used to verify adherence to noise abatement flight procedures.
	Preferential Runway Advisory System (PRAS) Runway End Use Goals	Massport continues to report on runway use compared to PRAS goals.
	Runway Restrictions	Noise-based use restrictions 24 hours per day on departures from Runway 4L and arrivals on Runway 22R were continued.
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe.
Improve Noise Monitoring System	Replace Existing Noise Monitors, Install Multilateration Antennas for Flight Track Monitoring, and Install New Robust Software	The noise monitoring system is completely installed and in use at Logan Airport. The noise monitors provide 1/3 octave band data at all sites to aide with aircraft identification. Noise events, flight events, and complaints are all linked. In 2015, Massport upgraded to FAA's NextGen data feed.
Minimize nighttime noise	Nighttime Stage 2 Aircraft Prohibition	Prohibition on Stage 2 aircraft operations at Logan Airport between 11:00 p.m. and 7:00 a.m. was continued.
	Nighttime Runway Restrictions	Prohibitions on use of Runway 4L for departures and Runway 22R for arrivals between 11:00 p.m. and 6:00 a.m. were continued.
	Maximization of Late-Night Over-Water Operation	Efforts to maximize late-night over-water operations were continued. Use of Runway 15R for departures and Runway 33L for arrivals continued.
	Nighttime Engine Run-up and APU Restrictions	Restriction on nighttime engine run-ups and use of auxiliary power units (APUs) was continued.
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333. In 2015, Massport's Noise Abatement Office responded to 17,685 calls from callers living in 82 communities.
	Special Studies	Massport continued to provide technical assistance and analysis using noise monitoring system to support FAA and others in monitoring jet departure tracks from Runway 27 and Runway 33L, The BLANS Phase 3 is underway and will evaluate and establish a runway use program[1/]. Massport and FAA have begun a RNAV evaluation project designed to identify ways to reduce noise from the RNAV procedure (which concentrates flights).

NOTE:

1\ This table is taken verbatim from the referenced document was completed prior to completion of the BLANS, which did not result in the development of a new Runway Use Program for the Airport.

SOURCE: VHB, Harris Miller Miller & Hanson, Inc., KB Environmental Sciences, Inc., and ICF International, Inc., *Boston-Logan International Airport, 2015 Environmental Data Report*, December 2016, Recreated from Table 6-17.

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