Portland International Jetport
Federal Aviation Regulation Part 150
Noise Exposure Map and
Noise Compatibility Program Updates

August 2005

Prepared for:

Portland International Jetport
Portland, Maine

Prepared by:

HARRIS MILLER MILLER & HANSON INC.

In association with:
Simat, Helliesen & Eichner, Inc.
and
Vanasse Hangen Brustlin, Inc.

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HMMH Report No. 298410
August 2005

Prepared for:

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Portland, ME 04102

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CERTIFICATION

This is to certify the following:

(1) That the Noise Compatibility Program, revised Noise Exposure Maps, and associated documentation for Portland International Jetport submitted in this volume to the Federal Aviation Administration under Federal Aviation Regulations Part 150, Subpart B, Section 150.21, are true and complete under penalty of 18 U.S.C. Part 1001;

(2) All interested parties have been afforded opportunity to submit their views, data, and comments concerning the correctness and adequacy of the revised existing and forecast conditions noise exposure map, and of the descriptions of forecast aircraft operations; and

(3) The proposed Noise Compatibility Program elements are recommended by the City of Portland, Maine and not by a consultant or other third party.

By: _____

Title: _____

Date: _____

Airport Name:	Portland International Jetport
Airport Owner:	City of Portland, Maine
Airport Operator:	City of Portland, Maine
Address:	1001 Westbrook Street Portland, Maine 04102

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1 INTRODUCTION

Part 150 of the Federal Aviation Regulations (FAR), "Airport Noise Compatibility Planning,"[1] sets forth standards for airport operators to use in documenting noise exposure in their airport environs and for establishing programs to minimize noise-related land use incompatibilities. A formal submission to the Federal Aviation Administration (FAA) under Part 150 includes two principal elements: (1) a Noise Exposure Map (NEM) and (2) a Noise Compatibility Program (NCP).

The City of Portland completed its first Part 150 Study for Portland International Jetport (also known by the FAA's three-letter identifier, PWM) in 1989. The FAA completed its review of the NEM and found it in compliance with Part 150 requirements, publishing a notice of its determination in the *Federal Register* on 27 March 1990. The FAA approved the Jetport's Noise Compatibility Program in July 1990.

In 2001, the City of Portland retained a team of consulting firms to update the 11-year old Part 150 study, including a comprehensive evaluation of the previously-approved program elements, development and documentation of an updated NEM, investigation of new alternatives, and preparation of the required NCP documentation.

This volume presents the updated NEM and NCP documentation for PWM required by the specific provisions of Part 150 Subpart B, Section 150.21, and Appendix A.

1.1 FAR Part 150 Overview

In establishing the requirements for the development of noise compatibility programs at airports, FAR Part 150 prescribes specific standards and systems for:

- Measuring noise;
- Estimating cumulative noise exposure
- Describing other means to assess the impacts of noise (including single event levels);
- Coordinating NCP development with local land use officials and other interested parties;
- Documenting the analytical process used in developing compatibility program;
- Conducting public participation efforts; and
- Submitting documentation to the FAA for approval.

1.1.1 Noise Exposure Map

The NEM describes baseline conditions -- the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs and the resulting noise/land use compatibility conflicts. The NEM must address two time frames: (1) data representing the year of submission (the "existing conditions") and (2) the fifth calendar year following the year of submission (the "forecast conditions"). The year of submission for this update is 2004; the five-year forecast case represents activity and land use incompatibilities in 2009. At PWM as at most airports, this required information is too extensive to present in a single "map". Thus, at a minimum, the NEM document typically includes multiple graphics depicting existing and future noise exposure from aircraft and of land uses in the airport environs, and it also describes the data collection and analysis undertaken in its development.

[1] 14 CFR Part 150

1.1.2 Noise Compatibility Program

The NCP is the other half of the required FAR Part 150 documentation; it evaluates and presents the actions the airport proprietor proposes to undertake to minimize the existing and future noise/land use incompatibilities. The NCP must recount the development of the program, including a description of all measures considered, the reasons that individual measures were accepted or rejected, how measures will be implemented and funded, and the predicted effectiveness of individual measures and the overall program.

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

The existing Noise Compatibility Program includes the following elements:

- Noise Abatement Measures
  - Noise barrier at approach end of Runway 18
  - Hush house on the east end of the airport property
  - Preferential use of Runway 29
  - Preferential arrival route
  - Runway 11 preferential departure routes
  - Use of FAA Advisory Circular (AC) 91-53 Noise Abatement Departure Profiles
- Monitoring and Review Measures
  - Monitor proposals for new scheduled operations between 11:30 pm and 6:15 am
  - Noise Abatement Committee review of implementation
  - Quantitative review of changes in noise exposure
  - Recomputation of contours with changes in airport layout or operation
  - Minimum interval between preparation of new contours
- Land Use Measures
  - Land acquisition and relocation
  - Soundproofing
  - Easement acquisition
  - Airport zoning overlay district
  - Real estate disclosure
  - Undeveloped land acquisition

These measures are discussed in detail in Chapter 5.

1.2 Project Roles and Responsibilities

Several groups had major roles in the development of the NEM and NCP, including the City, the consulting team, the Noise Advisory Committee (NAC), and the FAA.

1.2.1 City of Portland

As the "airport operator", the City has authority over the Part 150 update, including ultimate responsibility for determining what elements will be included in the NCP when it is submitted to the FAA for review. The City is responsible for pursuing implementation of adopted measures.

The City retained a team of consultants to conduct the technical work required to fulfill Part 150 analysis and documentation requirements. Section 1.2.2 describes the composition of the consulting team and the general assignment of responsibilities among its members.

The Noise Advisory Committee (NAC) was established during the time of the first Part 150 study, and has continued its involvement in Jetport noise issues and in the current Part 150 update, ensuring that the appropriate outside entities and groups are given official representation in the study process. The NAC is the key element of the comprehensive public involvement program that the City conducted over the course of the update, as described in Chapter 7.

1.2.2 Consulting team

Under a contract with the City of Portland, the firm of Harris Miller Miller & Hanson Inc. (HMMH) has overall project management responsibility, as well as responsibility for all noise-related technical elements of the Part 150 Update. Vanasse Hangen Brustlin, Inc. (VHB), as a subcontractor to HMMH, is responsible for land use data collection and related mitigation measures. Another subcontractor to HMMH, Simat Helliesen & Eichner, Inc. (SH&E), is responsible for the development of the five-year forecast of operations at PWM.

1.2.3 Noise Advisory Committee (NAC)

The NAC includes representation from a broad spectrum of entities with interest in the Part 150 update process and its products. These entities include the City of Portland, the City of South Portland, the Town of Westbrook, Portland's Chamber of Commerce, and representatives of several affected communities in the airport's environs.

The NAC members are responsible for representing their constituents throughout the study process, including commenting on the adequacy and accuracy of collected data, simplifying assumptions, and technical analyses. The NAC also serves as a forum for the varied interest groups to discuss complex issues and share their differing perspectives on aircraft noise issues.

Section 7.1 discusses the NAC process during the development of the NEM.

1.2.4 Federal Aviation Administration

The FAA has ultimate review authority over the noise compatibility program submitted under Part 150. Its review encompasses the details of technical documentation as well as broader issues of safety and constitutionality of recommended noise abatement alternatives.

FAA involvement includes participation by staff from at least three levels in the agency: (1) local, (2) regional, and (3) national.

- The airport's **Air Traffic Control Tower (ATCT)** provides significant input in several areas, including: operational data from their files, judgment regarding safety and capacity effects of alternative noise abatement measures, and input on implementation requirements.

- On a regional level, the FAA's **New England Region** also has several roles. The **Air Traffic Division** staff will support the ATCT role, with final review and decision authority over changes in flight procedures. When the City submits the NEM and NCP to the FAA for review, the **Airports Division** will determine whether or not it satisfies all requirements and conduct the initial FAA review of the NCP submission.
- On a national level, the FAA's Washington headquarters is responsible for the final review of the NEM and NCP submissions for adequacy in satisfying technical and legal requirements.

1.3 FAA Noise Exposure Map and Noise Compatibility Program Checklists

The FAA has developed checklists for their internal use in reviewing NEM and NCP submissions. The FAA prefers that the Part 150 documentation include copies of the checklists. Table 1 presents a completed copy of the NEM checklist. Table 2 presents a copy of the NCP checklist.

Table 1. Part 150 Noise Exposure Map Checklist

FAR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
I. IDENTIFICATION AND SUBMISSION OF MAP DOCUMENT			
A. Is this submittal appropriately identified as one of the following, submitted under Part 150:			
1. an NEM only	N/A		
2. an NEM and NCP	N/A		
3. a revision to NEMs, which have previously been determined by FAA to be in compliance with Part 150?	Y	Ch. 1, sec. 1, pg. 1	Original approval in 1990
B. Are the airport name and the qualified airport operator identified?	Y	Ch. 1, sec. 1, pg. 1	
C. Is there a dated cover letter from the airport operator, which indicates the documents are submitted under Part 150 for appropriate FAA determinations?	Y		Transmitted with document
II. CONSULTATION: [150.21(B), A150.105(A)]			
A. Is there a narrative description of the consultation accomplished, including opportunities for public review and comment during map development?	Y	Ch.1, sec. 1.2, pgs. 2-4; also Ch.7, pg. 103	
B. Identification:			
1. Are the consulted parties identified?	Y	Ch.1, sec. 1.2 & App. F	
2. Do they include all those required by 150.21(b) and 150.105(a)?	Y		
C. Does the documentation include the airport operator's certification, and evidence to support it, that interested persons have been afforded adequate opportunity to submit their views data, and comments during map development and in accordance with 150.21(b)?	Y	Page iii & App. F	
D. Does the document indicate whether written comments were received during consultation and, if there were comments, that they are on file with the FAA region?	Y	Ch. 7, sec. 7.3, pg. 103	
III. GENERAL REQUIREMENTS: (150.21)			
A. Are there two maps, each clearly labeled on the face with year (existing condition year and 5-year)?	Y	Ch. 3, sec. 3.4, Fig. 24, pg. 64 & Ch. 4, Fig. 26, pg. 71	
B. Map currency:			
1. Does the existing condition map year match the year on the airport operator's submittal letter?	N		
2. Is the 5-year map based on reasonable forecasts and other planning assumptions and is it for the fifth calendar year after the year of submission?	N		
3. If the answer to 1 and 2 above is no, has the airport operator verified in writing that data in the documentation are representative of existing conditions and 5-year forecast conditions as of the date of submission?	Y	Ch. 3, sec. 3.5, pg. 62	
C. If the NEM and NCP are submitted together:			
1. Has the airport operator indicated whether the 5-year map is based on 5-year contours without the program vs. contours if the program is implemented?	Y	Ch. 6, sec. 6.6, pg. 93 & Fig. 38, pg. 97	
2. If the five year map is based on program implementation:			

FAR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
a. are the specific program measures, which are reflected on the map, identified?	Y	Ch. 6, sec. 6.6, pg. 93	
b. does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	Y	Ch. 6, secs. 6.7 & 6.8, pgs. 99 & 100	
3. If the 5-year NEM does not incorporate program implementation, has the airport operator included an additional NEM for FAA determination after the program is approved which shows program implementation conditions and which is intended to replace the 5-year NEM as the new official 5-year map?	N/A		
IV. MAP SCALE, GRAPHICS, AND DATA REQUIREMENTS: [A150.101, A150.103, A150.105, 150.21(A)]			
A. Are the maps of sufficient scale to be clear and readable (they must be not be less than 1" to 8,000'), and is the scale indicated on the maps?	Y		
B. Is the quality of the graphics such that required information is clear and readable?	Y		
C. Depiction of the airport and its environs.			
1. Is the following graphically depicted to scale on both the existing condition and 5-year maps:		Ch. 3, sec. 3.4, Fig. 24, pg. 64 & Ch. 4, Fig. 26. pg. 71 Major roads only; see Figs. 27-30 Areas not computed See again Figs. 24 & 26	
a. airport boundaries	Y		
b. runway configurations with runway and numbers	Y		
2. Does the depiction of the off-airport data include:			
a. a land use base map depicting streets and other identifiable geographic features	Y		
b. area within 65 DNL (or beyond, at local discretion.)	N		
c. clear delineation of geographic boundaries and the names of all jurisdictions with planning and land use control authority within the 65 DNL (or beyond, at local discretion).	Y		
D. 1. Continuous contours for at least DNL 65, 70, and 75?	Y	Same as above	Scoped to show contours down to 55 DNL
2. Based on current airport and operational data for the existing condition year NEM, and forecast data for the 5-year NEM?	Qualified Y	Ch. 3, sec. 3.2.2 presents forecast for existing conditions, because 2001 data were negatively affected by 9/11	
E. Flight tracks for the existing condition and 5-year forecast time frames (these may be on supplemental graphics which must use the same land use base map as the existing condition and 5-year NEM), which are numbered to correspond to accompanying narrative?	Y	Ch. 3, sec. 3.2.3, Figs. 16 & 17, and App. C	
F. Locations of any noise monitoring sties (these may be on supplemental graphics which must use the same land use base map as the official NEMs)	Y	Ch. 3, sec. 3.1.2, Fig. 2	
G. Incompatible land use identification:			
1. Are incompatible land uses within at least the 65 DNL depicted on the maps?	Y	Ch. 5, sec.5.1 & 5.2, Figs. 27-30 Fig. 27 shows sites out to DNL 55;	
2. Are noise sensitive public buildings identified?	Y		
3. Are the incompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	Y		None are within the 65 DNL contour

FAR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
4. Are compatible land uses, which would normally be considered incompatible, explained in the accompanying narrative?	Y	Ch. 5, sec. 5.1 & 5.2, pgs. 73-75	
V. NARRATIVE SUPPORT OF MAP DATA: [150.21(A), A150.1, A150.101, A150.103]			
A. 1. Are the technical data, including data sources, on which the NEMs are based, adequately described in the narrative?	Y	Chs. 3, 4, and 5	
2. Are the underlying technical data and planning assumptions reasonable?	Y		
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	Y	Used INM 6.0c; see Ch. 3, sec. 3.2, pgs. 38-51 for discussion of inputs	
a. is it FAA approved?	Y		
b. was the same model used for both maps?	Y		
c. has AEE approval been obtained for use of a model other than those with previous blanket FAA approval?	N/A		
2. Correct use of noise models:			
a. does the documentation indicate the airport operator has adjusted or calibrated FAA-approved noise models or substituted one aircraft type for another?	Y	Ch. 3, sec. 3.4, pgs. 59-62 describe adjustments for over-water propagation and terrain	
b. if so, does this have written approval from AEE?	Qualified Y	Ch. 3, sec. 3.4, pg. 60	
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?	Y	Ch. 3, sec. 3.1.3, pg. 21	
4. For noise contours below 65 DNL, does the supporting documentation include explanation of local reasons? (Narrative explanation is desirable but not required.)	Y	Ch. 2, sec. 2.1, pg. 15 & sec. 2.3, pg. 18	
C. Noncompatible Land Use Information:			
1. Does the narrative give estimates of the number of people residing in each of the contours (DNL 65, 70 and 75, at a minimum) for both the existing condition and 5-year maps?	Y	Ch. 5, sec. 5.3, Table 20	
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	Y	Ch. 2, sec. 2.3, pg. 18	
a. If a local variation to Table 1 was used:			
(1) does the narrative clearly indicate which adjustments were made and the local reasons for doing so?	N/A		
(2) does the narrative include the airport operator's complete substitution for Table 1?	N/A		
3. Does the narrative include information on self-generated or ambient noise where compatible/incompatible land use identifications consider non-airport/aircraft sources?	N/A		
4. Where normally incompatible land uses are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?	N/A		
5. Does the narrative describe how forecasts will affect land use compatibility?	Y	Ch. 4, pg. 69	
VI. MAP CERTIFICATIONS: [150.21(B), 150.21(E)]			

FAR PART 150 NOISE EXPOSURE MAP CHECKLIST-PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
A. Has the operator certified in writing that interested persons have been afforded adequate opportunity to submit views, data, and comments concerning the correctness and adequacy of the draft maps and forecasts?	Y	Certification statement, Pg. iii	
B. Has the operator certified in writing that each map and description of consultation and opportunity for public comment are true and complete?	Y		

Table 2. Part 150 Noise Compatibility Program Checklist

FAR PART 150 NOISE COMPATIBILITY PROGRAM CHECKLIST--PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
I. IDENTIFICATION AND SUBMISSION OF PROGRAM:			
A. Submission is properly identified:			
1. FAR 150 NCP?	N/A		
2. NEM and NCP together?	N/A		
3. Program Revision?	Y	Ch. 1, sec. 1, pg. 1	
B. Airport and Airport Operator's name identified?	Y	Ch. 1, sec. 1, pg. 1	
C. NCP transmitted by airport operator's cover letter?	Y	See cover letter	
II. CONSULTATION: [150.23]			
A. Documentation includes narrative of public participation and consultation process?	Y	Ch.1, sec. 1.2, pgs. 2-4; also Ch.7, pg. 103	
B. Identification of consulted parties:			
1. all parties in 150.23(c) consulted?	Y	Ch. 1, pgs. 2-4 & Ch. 7, pg. 103	
2. public and planning agencies identified?	Y	Ch. 6, sec. 6.8, pg. 99	
3. agencies in 2., above, correspond to those indicated on the NEM?	Y	Ch. 3, Fig. 24, pg. 64; (fig. also includes other jurisdictions outside 65 DNL)	
C. Satisfies 150.23(d) requirements:			
1. documentation shows active and direct participation of parties in B., above?	Y	Ch. 6, sec. 6.4, pg. 91, sec. 6.8, pg. 99, Ch. 7 & App. F	
2. active and direct participation of general public?	Y	Ch. 7 & App. F	
3. participation was prior to and during development of NCP and prior to submittal to FAA?	Y	Ch. 7 & App. F	
4. indicates adequate opportunity afforded to submit views, data, etc.?	Y	Ch. 7 & App. F	
D. Evidence included of notice and opportunity for a public hearing on NCP?	Y	Ch. 7 & App. F	
E. Documentation of comments:			
1. includes summary of public hearing comments, if hearing was held?	Y	App. F for meeting minutes and hearing transcript	
2. includes copy of all written material submitted to operator?	Y		
3. includes operator's response/disposition of written and verbal comments?	Y		
F. Informal agreement received from FAA on flight procedures?	Y	For all operational measures in Ch. 6	Also see App. F for meeting notes
III. NOISE EXPOSURE MAPS: [150.23, B150.3; 150.35(f)] (This section of the checklist is not a substitute for the Noise Exposure Map checklist. It deals with maps in the context of the Noise Compatibility Program submission.)			
A. Inclusion of NEMs and supporting documentation:			
1. Map documentation either included or incorporated by reference?	Y	Ch. 3	

FAR PART 150 NOISE COMPATIBILITY PROGRAM CHECKLIST--PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
2. Maps previously found in compliance by FAA?	N	Ch. 1, pg. 1	NEM & NCP submitted as single document
3. Compliance determination still valid?	N/A		
4. Does 180-day period have to wait for map compliance finding?	Y		
B. Revised NEMs submitted with program: (Review using NEM checklist if map revisions included in NCP submittal)	Y	Ch. 1, pg. 1	
1. Revised NEMs included with program?	Y	Ch. 4, Fig. 26	
2. Has airport operator requested FAA to make a determination on the NEM(s) when NCP approval is made?	Y	Cover letter	
C. If program analysis uses noise modeling:			
1. INM, HNM or FAA-approved equivalent?	Y	Ch. 3, sec. 3.2, pg 38	
2. Monitoring in accordance with A150.5?	Y	Ch. 3, sec. 3.1.3, pg. 21	
D. Existing condition and 5-year maps clearly identified as the official NEMs?	Y	Ch. 4, pg. 69	
IV. CONSIDERATION of ALTERNATIVES: [B150.7, 150.23(e)]			
A. At a minimum, are the alternatives below considered?			
1. land acquisition and interests therein, including air rights, easements, and development rights?	N	Ch. 6, sec. 6.8, pgs. 99 & 100	
2. barriers, acoustical shielding, public building soundproofing	Y	Ch. 6, sec. 6.8, pgs. 99 & 100	
3. preferential runway system	Y	Ch. 6, sec. 6.5, pgs. 91 & 92	
4. flight procedures	Y	Ch. 6, secs. 6.1– 6.3, pgs. 84-90	
5. restrictions on type/class of aircraft (at least one restriction below must be checked): a. deny use based on Federal standards b. capacity limits based on noisiness c. noise abatement takeoff/approach procedures d. landing fees based on noise or time of day e. nighttime restrictions	Y	Noise abatement departure profiles was approved in original NCP and will continue in effect. See Ch. 3, sec. 3.3.6, pg. 57	
6. Responsible implementing authority identified for each considered alternative?	Y	Ch. 6, pgs. 86-102	
7. Other FAA recommendations	N/A		
B. Responsible implementing authority identified for each considered alternative?	Yes		
C. Analysis of alternative measures:			
1. measures clearly described?	Y	Ch. 6, pg. 83	
2. measures adequately analyzed?	Y		
3. adequate reasoning for rejecting alternatives?	Y		
D. Other actions recommended by the FAA?	N/A		
V. ALTERNATIVES RECOMMENDED for IMPLEMENTATION: [150.23(e), B150.7(c); 150.35(b), B150.5]			
A. Document clearly indicates:			
1. alternatives recommended for implementation?	Y	Ch. 6, pgs. 86-102	

FAR PART 150 NOISE COMPATIBILITY PROGRAM CHECKLIST--PART I			
Airport Name: Portland International Jetport	REVIEWER:		
	Yes/No/ NA	Page/Other Reference	Notes/ Comments
2. final recommendations are airport operator's, not those of consultant or third party?	Y	Certification statement, pg. iii	
B. Do all program recommendations:			
1. relate directly or indirectly to reduction of noise and incompatible land uses?	Y	Ch. 6, secs. 6.6 & 6.7, pgs. 93-99	
2. contain description of contribution to overall effectiveness of program?	Y		
3. noise/land use benefits quantified to extent possible?	Y		
4. include actual/anticipated effect on reducing noise exposure within incompatible areas shown on NEM?	Y		
5. effects based on relevant and reasonable expressed assumptions?	Y		
6. have adequate supporting data to support its contribution to the noise/land use compatibility?	Y		
C. Analysis appears to support program standards set forth in 150.35(b) and B150.5?	Y		
D When use restrictions are recommended:			
1. Are alternatives with potentially significant noise/compatible land use benefits thoroughly analyzed so that appropriate comparisons and conclusions can be made?	N/A		
2. use restrictions coordinated with APP-600 prior to making determination on start of 180-days?	N/A		
E Do the following also meet Part 150 analytical standards?:			
1. formal recommendations that continue existing practices?	Y	Ch. 3, sec. 3.3.6, pg. 57; updated NCP does not propose FAA re-evaluation of existing measure; see Ch. 6 for all new proposals	
2. new recommendations or changes proposed at end of Part 150 process?	Y		
F Documentation indicates how recommendations may change previously adopted plans?	Y	Ch. 6	
G. Documentation also:			
1. identifies agencies that are responsible for implementing each recommendation?	Y	Ch. 6	
2. indicates whether those agencies have agreed to implement?	N/A	City of Portland will proceed with implementation following FAA approval of NCP	
3. indicates essential government actions necessary to implement recommendations?	Y	Ch. 6	

2 BASICS OF PART 150 NOISE ASSESSMENTS

Noise is defined very simply as unwanted sound. But noise is a complex physical quantity, and it produces a broad range of subjective interpretations. Thus, the properties, measurement, and documentation of not only existing noise but of future noise, require specialized terminology that is often difficult to understand but must always be defined and described carefully to minimize confusion over an already complicated subject.

Throughout this study, three primary metrics are used to help explain the noise around Portland International Jetport. The Part 150 regulation, itself, requires the use of the Day-Night Average Sound Level (DNL) to describe the cumulative daily noise exposure at an airport, but it also permits the use of supplemental metrics to further elaborate on the nature of the environment. In this case, maximum Sound Levels (L_{max}) and Sound Exposure Levels (SEL) are used as supplemental metrics to describe the noise of individual events that comprise the cumulative daily exposure. Additional metrics describing the hourly noise levels that occur throughout the day are also reported. Readers and reviewers of this document should be familiar with all of these metrics. For reference, Appendix A, entitled "Introduction to Acoustics and Noise Terminology," provides an overview to fundamentals of acoustics and noise metrics used in this study; it also includes discussion of the effects of noise on human activity as quantified by these metrics. An essential summary of that material is included below.

2.1 DNL

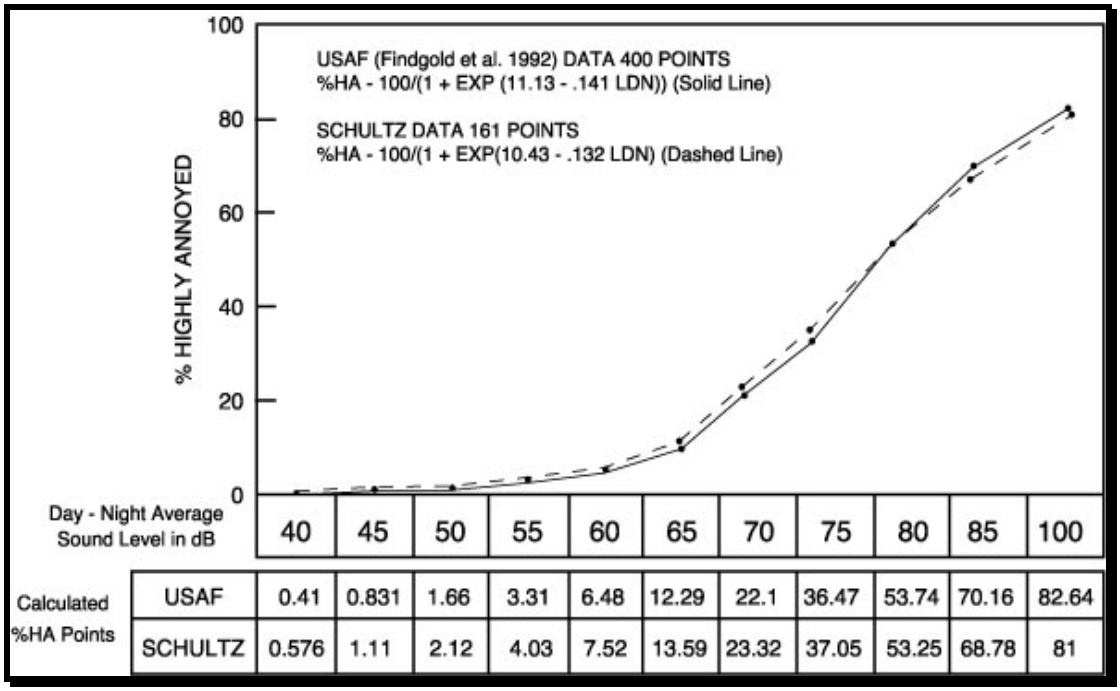
DNL is the average noise level over a 24-hour period except that noises occurring at night (defined as 10:00 p.m. to 7:00 a.m.) are artificially increased by 10 decibels (dB). This weighting is intended to reflect the added intrusiveness of nighttime noise events attributable to the fact that community background noise levels decrease at night. DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, depicted in terms of equal-exposure noise contours (much as topographic maps show contours of equal elevation). Part 150 requires that the 65, 70 and 75 dB DNL contours be modeled and depicted. The Noise Advisory Committee that also guided much of the work of this Part 150 Update requested that contours also be shown for DNL levels down to 55 dB. This level is typical of exposure in suburban neighborhoods and is the value identified by the U.S. Environmental Protection Agency as "requisite to protect public health and welfare with an adequate margin of safety"[2].

2.2 Community Annoyance

Numerous psychoacoustic surveys provide substantial evidence that individuals' reactions to noise vary widely for a given noise exposure level. However, since the early 1970's researchers have determined and subsequently confirmed that a community's aggregate response is generally predictable and relates reasonably well to measures of cumulative noise exposure such as DNL.

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

Figure 1 shows the widely recognized relationship between environmental noise and the percentage of people "highly annoyed," annoyance being the key indicator of community response usually cited in this body of research.



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

Figure 1. Percentage of People Highly Annoyed

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

This relationship indicates that at levels as low as the EPA's identified DNL of 55 dB, on the order of 3 to 4 percent of the exposed population will still be highly annoyed, while the percentage increases to 12 to 13 percent at DNL levels of 65 dB, and 22 to 23 percent at DNL levels of 70 dB.

2.3 Noise/Land Use Compatibility Guidelines

The FAA, other federal agencies, and several states have utilized the information on community reaction to noise to create guidelines for identifying which land uses are compatible with which noise exposure levels – the more noise-sensitive the land use, the lower the noise exposure should be in order to achieve compatibility. Thus, DNL estimates have two principal uses in a Part 150 study:

1. To provide a basis for comparing existing noise conditions with the future effects of noise abatement procedures and/or forecast changes in airport activity; and
2. To provide a quantitative basis for identifying potential noise impacts.

Both of these functions require the application of objective criteria for evaluating noise impacts. Part 150 provides the FAA's recommended guidelines for determining noise/land use compatibility.

Table 3. FAR Part 150 Noise/Land Use Compatibility Guidelines

Source: FAR Part 150, Appendix A, Table 1

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

Key to Table 3

SLCUM:	Standard Land Use Coding Manual.
Y(Yes):	Land use and related structures compatible without restrictions.
N(No):	Land use and related structures are not compatible and should be prohibited.
NLR:	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35:	Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes for Table 3. FAR Part 150 Noise/Land Use Compatibility Guidelines

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

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

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

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

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

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

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30

(8) Residential buildings not permitted.

* * * * * * *

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

Part 150 permits airports and local land use control jurisdictions to adopt land use compatibility criteria that differ from the guidelines reproduced in Table 3 (see Notes above), but none of the jurisdictions surrounding Portland International Jetport has taken such a step. Thus, formal identification of any incompatible use near the Jetport is based on the FAA guidance as set forth above. This does not, however, preclude the evaluation of noise mitigation measures that benefit noise-sensitive land uses below 65 DNL. In fact, many of the noise compatibility measures explored in this Part 150 Update focus on DNL levels less than 65 dB.

3 EXISTING AIRCRAFT NOISE LEVELS AND FACTORS AFFECTING THEM

At the most basic level, noise around Portland International Jetport is produced primarily by aircraft, whether they are landing, taking off, taxiing to and from gate or apron areas, or engaging in maintenance activities. Noise "exposure" experienced in the surrounding communities is determined by how loud these events are as well as how often and at what times of day or night they occur. Additionally, the exposure depends on how easily the sound propagates away from the aircraft and into the community. Factors affecting propagation include wind, temperature, humidity, air density, and whether the sound travels through the open air or across land, around buildings, or over water. This chapter summarizes the noise levels that exist around PWM, both as measured and as predicted by computer model based on operational and sound propagation factors that influence the noise people experience in their communities. The section begins with a discussion of the noise measurement program.

3.1 Measured Noise Levels in the Vicinity of Portland International Jetport

Part 150 does not require airport operators to measure noise levels. However, measurements provide important input to an understanding of the noise environment, as long as it is recognized that measurements with portable noise monitors over relatively short periods of time are really only capturing a small percentage of the total set of aircraft operations that occur during the baseline year of study. Measurements are a "snapshot", both in terms of temporal as well as spatial coverage of an airport's true noise environment. They may miss (under-represent) typical loud events, or they may capture excessive numbers of (over-represent) atypical loud events. They may also misrepresent typical traffic flows, weather conditions, and effects of non-aircraft noise sources in the community. All of these factors can combine to make measured levels far less representative of long-term conditions than many would normally believe. Thus it is usually good practice for measurements to be conducted with trained observers logging and reviewing activities occurring during the measurement periods; also, for radar data to be acquired over the measurement period so that the aircraft creating the noise events can be more easily identified. Under these conditions, measurements can provide some very valuable insights to the kinds of noise events that contribute to one's daily exposure.

3.1.1 Measurement Program Objectives, Design and Evaluation

The portable noise measurement program had two principle objectives:

1. To obtain short-term samples of *cumulative noise levels* at a variety of noise-sensitive locations, for comparison with modeled noise exposure contours. Cumulative exposure is important for land use planning purposes, for evaluating noise exposure trends in the long term, and for evaluating procedures that affect the distribution of noise levels over large areas.

(10) To obtain representative information on aircraft and non-aircraft *single event noise levels* at a broad range of sites, primarily in residential areas. Single event levels are important for responding to citizen concerns about specific operations, evaluating noise abatement flight tracks and comparing the relative noisiness of different aircraft types.

3.1.2 Noise measurement site selection

To accomplish the measurement objectives, HMMH solicited suggestions from the Noise Working Group for up to ten monitoring locations. At its 4 April 2002 meeting, committee members were asked to submit two to four suggested sites in their communities. As discussed at the meeting, final selection criteria would include the following major factors:

- Most sites ought to be near major flight corridors, to maximize the number of operations monitored.

Equipment security must be a consideration in selecting a site. Once security is deemed acceptable, specific sites should be selected to isolate the monitors from non-aircraft noise, such as high levels of traffic noise, barking dogs, etc.

Figure 2 on the following page shows the locations at which portable noise monitoring was conducted for this study. All were in populated areas north (Stroudwater), east (the Western Promenade and South Portland), and south (the Maine Youth Center) of the Jetport; no locations were identified to the west. HMMH staff completed initial noise measurements at nine sites in the airport's environs from May 22nd, 2002 to June 3rd, 2002. An additional monitor was set up from July 12th to July 17th. At all ten locations, the measurements covered at least three full days, providing samples of DNL. Measurements at Site 1 covered four days, while measurements at Sites 2, 6, 7, 9, 12, 15, 18, and 19 covered a minimum of five days. The measurement data were ***not*** to be used to "adjust" or "calibrate" the Integrated Noise Model; that procedure would require prior approval from FAA Headquarters. Instead, they were to provide an indication of the reasonableness of eventual baseline DNL contours and to identify the collection of loudest events on which to concentrate abatement measures. Table 4 lists the measurement locations, the dates and times of measurements, and the number of hours of monitoring data.

Table 4. Summary of Noise Measurement Sites

Site #	Address	Start		End		Hours Monitored
		Date	Time	Date	Time	
1	2 Bay Road, Loveitt's Field, So. Portland	7/12/2002	12:00 pm	7/16/2002	4:00 pm	100
2	199 High Street, Ferry Village, So. Portland	5/22/2002	11:00 am	5/28/2002	9:00 am	142
6	38 Bellevue Road, Willard, So. Portland	5/28/2002	7:00 pm	6/3/2002	4:00 pm	141
7	28 Henry Street, Willard, So. Portland	5/28/2002	6:00 pm	6/3/2002	3:00 pm	141
9	1169 Westbrook Road, Stroudwater Village, Portland	5/22/2002	5:00 pm	5/28/2002	11:00 am	138
10	123 Fenway Street, Stroudwater Village, Portland	5/24/2002	6:00 pm	5/28/2002	10:00 pm	88
12	138 Stroudwater Road, Stroudwater Village, Portland	5/28/2002	5:00 pm	6/3/2002	12:00 pm	139
15	Maine Youth Center, So. Portland	5/28/2002	4:00 pm	6/3/2002	12:00 pm	140
18	75 Vaughn Street, Western Promenade, Portland	5/23/2002	10:00 am	5/28/2002	10:00 am	120
19	55 Bowdoin Street Western Promenade, Portland	5/22/2002	3:00 pm	5/28/2002	10:00 am	143

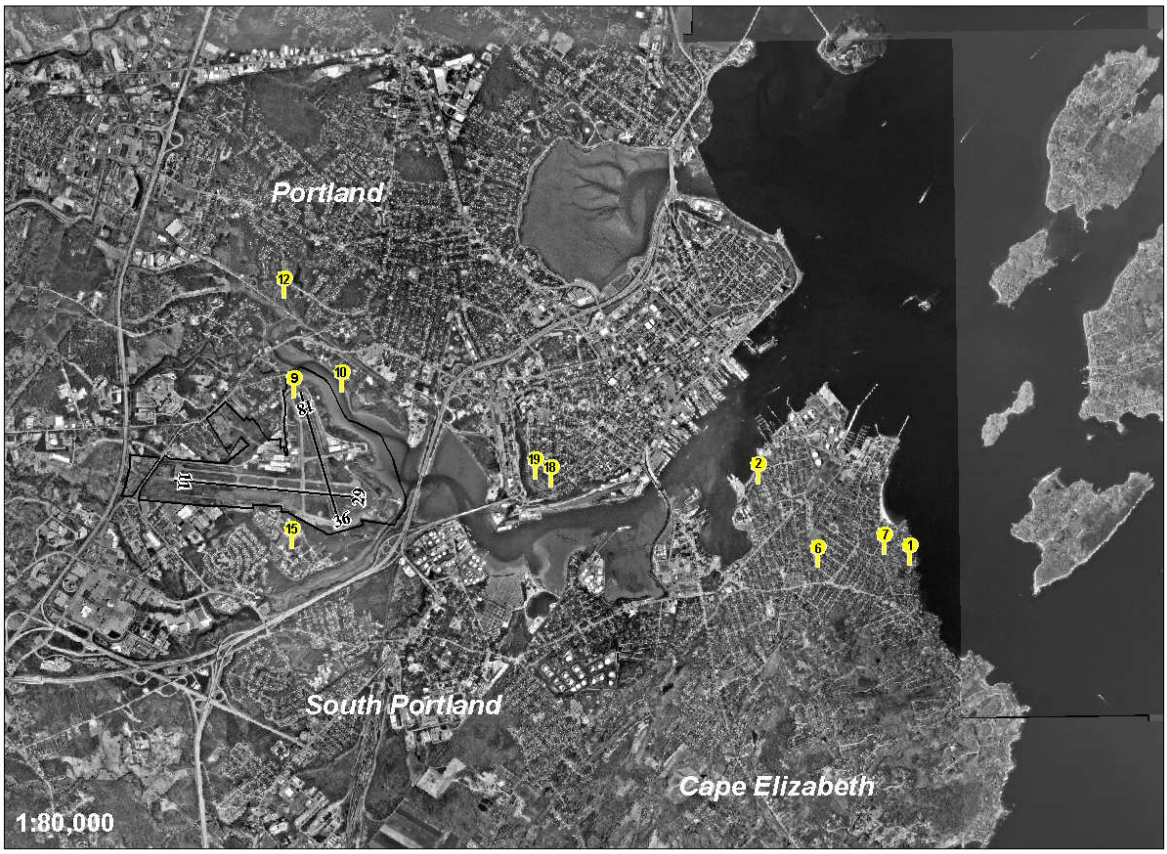


Figure 2. Locations of Portable Noise Monitoring Sites

3.1.3 Noise measurement instrumentation

Measurements at Sites 1, 2, 6, 7, 9, 12, and 19 were conducted with HMMH's Larson-Davis Model 870 ("LD 870") portable noise monitors. Measurements at Sites 10, 15, and 18 were conducted with HMMH's Larson-Davis Model 820 ("LD 820") monitors. These instruments meet American National Standards Institute (ANSI) S1.4-1983 standards for a Type I "precision" sound level meters, and meet or exceed accuracy requirements defined in Part 150 paragraph A150.5. HMMH staff calibrated the equipment in the field before and after each measurement session. The calibrations are traceable to the United States National Institute of Standards and Technology.

Each LD 870 and LD 820 unit was programmed to record a variety of metrics, including integrated levels such as the hourly L_{eq} and daily DNL, as well as single event levels such as the Sound Exposure Level (SEL) and maximum A-weighted sound level. (Section 2 introduced these metrics; Appendix A provides further background material on all of them). All measurements were A-weighted.

The units operated on a 24-hour basis during the measurement session, with breaks for relocation, battery changes, calibration, and essential maintenance requirements. Two HMMH staff members conducted the measurements. To the extent feasible during daylight hours, the staff spent time at the monitoring

locations, to observe and log aircraft and non-aircraft noise-producing events, weather data, and other relevant information.

3.1.4 Day-Night Average Sound Level Results

Table 5 summarizes the daily DNL measurement results for each of the initial nine monitoring locations. Estimated DNL values are also included for the first and last days of each period, but are based on calculations using less than a full 24 hours of data. For example, measurements at Site 2 were started at 11:00 a.m. on May 22nd. The DNL reported for that day is computed based on 13 hours of data -- 11 hours of daytime noise (11:00 a.m. to 10:00 p.m.) and two hours of nighttime noise (10:00 p.m. to 12 midnight).

The far-right column in Table 5 presents the decibel-, or energy-averaged value of DNL for the multiple days of data. The energy-averaged value is usually slightly higher than the more intuitive arithmetically-averaged value, because it weights higher daily values more heavily than lower ones, exactly comparable to the manner in which decibel levels are combined for noise modeling. (Again, see Appendix A). Also, remember that these measured values are averages of only about a week of noise data and include many noise events caused by sources other than aircraft, while the DNL contours presented later in this chapter represent average daily noise levels over an entire year and ignore all non-aircraft sources. Measured values under these circumstances are usually higher than modeled values.

The 10th location, identified as Site 1 in Loveitt's Field, was monitored for four consecutive days from July 12th to July 16th 2003, and had a resulting average DNL of 60 dB, nearly the same average value as occurred at nearby Site 7 approximately 6 weeks earlier.

Table 5. Summary of Day-Night Average Sound Level (DNL) Measurements

Source: HMMH, 2002

Site #	Daily DNL (dB)													Average DNL (dB)
	Wed. 5/22	Thu. 5/23	Fri. 5/24	Sat. 5/25	Sun. 5/26	Mon. 5/27	Tues. 5/28	Wed. 5/29	Thu. 5/30	Fri. 5/31	Sat. 6/1	Sun. 6/2	Mon. 6/3	
2	58	59	61	62	56	59	57	--	--	--	--	--	--	59
6	--	--	--	--	--	--	58	56	60	63	56	56	51	59
7	--	--	--	--	--	--	57	59	59	61	56	60	53	59
9	63	66	60	57	60	56	55	--	--	--	--	--	--	61
10	--	--	59	58	59	57	55	--	--	--	--	--	--	58
12	--	--	--	--	--	--	55	55	58	60	54	55	55	57
15	--	--	--	--	--	--	58	59	61	62	62	63	64	62
18	--	64	60	59	59	58	60	--	--	--	--	--	--	60
19	60	59	62	58	57	57	59	--	--	--	--	--	--	59

3.1.5 Site-by-Site Results

This section provides a brief site-by-site discussion of each monitoring location. Measurement results reported for each location include levels associated with individual aircraft operations, defined in terms of their weighted Sound Exposure Levels (SELs), the term "weighted" referring to the fact that 10

decibels have been added to the measured value if the event occurred at night between 10:00 p.m. and 7:00 a.m. the following morning. In this way, each individual operation is ordered according to its importance in the calculation of DNL. However, single noise events were also recorded in terms of their maximum A-weighted sound levels, or L_{max}. In most cases, but not all, these maximum levels are caused by aircraft. They are discussed in greater detail below.

Other metrics were also collected at each site, including the L_1, L_{10} and L_{90}. L_1, L_{10} and L_{90} are the noise levels, in dBA, that are exceeded 1 percent, 10 percent and 90 percent of the time, respectively. For any given hour, the L_1 is the noise level exceeded for a total of 0.6 minutes (36 seconds) out of that hour – typical of the louder noise events occurring during the period. At the other end of the range, the L_{90} is the level exceeded 54 minutes out of each hour – typical of the much lower background noise existing at a site and more often than not caused by distant automobile traffic or distant commercial activity (not aircraft). These figures are all plotted hour-by-hour, site-by-site, in Appendix B.

Briefly, in reviewing those plots, the reader will note that because the L_{90} is controlled by ambient (non-aircraft) noise sources, it usually can be seen to decrease significantly (10 dB or more) during late night hours as traffic dies down and the city goes to bed. Ambient levels during those times often reach 40 to 45 dBA. The reader will also note that there are times when the L_{90} stays very low but the L_1 takes a significant jump from one hour to the next. That is an indicator of an intrusive noise imposing on the quiet background, as for example, a night operation by a loud aircraft. Those are the operations that residents will tend to find most annoying. Lastly, the noise monitors recorded the hourly equivalent sound level, or L_{eq}, at each site. The hourly L_{eq} can be thought of as the "average" sound level occurring during the hour, though, again, the "average" is the energy average of the varying levels that take place throughout the hour. It usually tracks very closely with the L_{10}, and it, too, is plotted in Appendix B.

Returning to the L_{max} measurements, they provide one of the easier bases for comparing the loudest sound levels produced by aircraft and non-aircraft sources at any given site, and for comparing single event levels among sites. For each measurement location, a figure has been created to illustrate the L_{max} data in a "thermometer" form. Representative sound levels from typical community sources are on the left of the thermometer. The ranges of L_{max} values for observed aircraft operations are on the right. The figures provide a visual basis for comparing levels caused by different aircraft types and types of operations, and for comparing sound levels at different sites. The aircraft type categories include:

- "Single Piston" – Single engine, piston powered aircraft.
- "Twin Piston" – Twin engine, piston powered aircraft.
- "Turbo-Prop" – Twin engine, turbine powered aircraft.
- "Reg/Corporate Jet" – Turbojet or turbofan powered small or medium Regional Jet or Business Jet aircraft.
- "Helicopter" – Helicopter flight operations.
- "Airline Jet" – Large cargo and airline operations.
- "Military" – Military operations.

3.1.5.1 Site 1: 2 Bay Road, South Portland

Site 1 is approximately four miles east of the center of the airport and is 1,300 feet south of the extended centerline of Runway 11/29. Consequently, aircraft arriving on a straight-in approach to Runway 29 or departing from Runway 11 operate close to this location. It is important to note that because this site is located on the Atlantic Ocean, horns from passing boats created a significant number of noise events. As our sample of radar data did not include the time period that the monitor was located at Site 1, specific aircraft operations could not be matched, however while the monitor was attended, a variety of noise sources were observed including boat horns, breaking surf, and people at the nearby beach.

The hourly L_{eq} varied from 43 to 72 dB. The lowest level occurred during the late night, early morning hours, consistent with other measurement sites. This reflects higher noise levels overall during the day as a result of increased aircraft and community activity. The averaged measured DNL for the entire measurement period at Site 1 was 60 dB.

3.1.5.2 Site 2: 199 High Street, South Portland

This measurement site is located approximately two and a half miles east of PWM and slightly north of the extended centerline of Runway 11/29 on the Fore River.

The principal aircraft operations affecting the site include straight-in approaches to Runway 29 and straight-out departures from Runway 11. Aircraft arriving to Runway 29 on the Harbor Visual Approach, a procedure in which aircraft follow the Fore River to the airport, are also audible at this site. Similar to Site 1, the proximity of significant boat activity resulted in higher noise levels. Monitoring data recorded at this site were later matched to radar data provided by the Tower. Table 6 presents the loudest aircraft events at Site 2 during the measurement period.

The hourly L_{eq} ranged from 43 to 68 dB. The lowest levels were recorded during the late night/early morning hours. The average DNL for Site 2 was 59 dB.

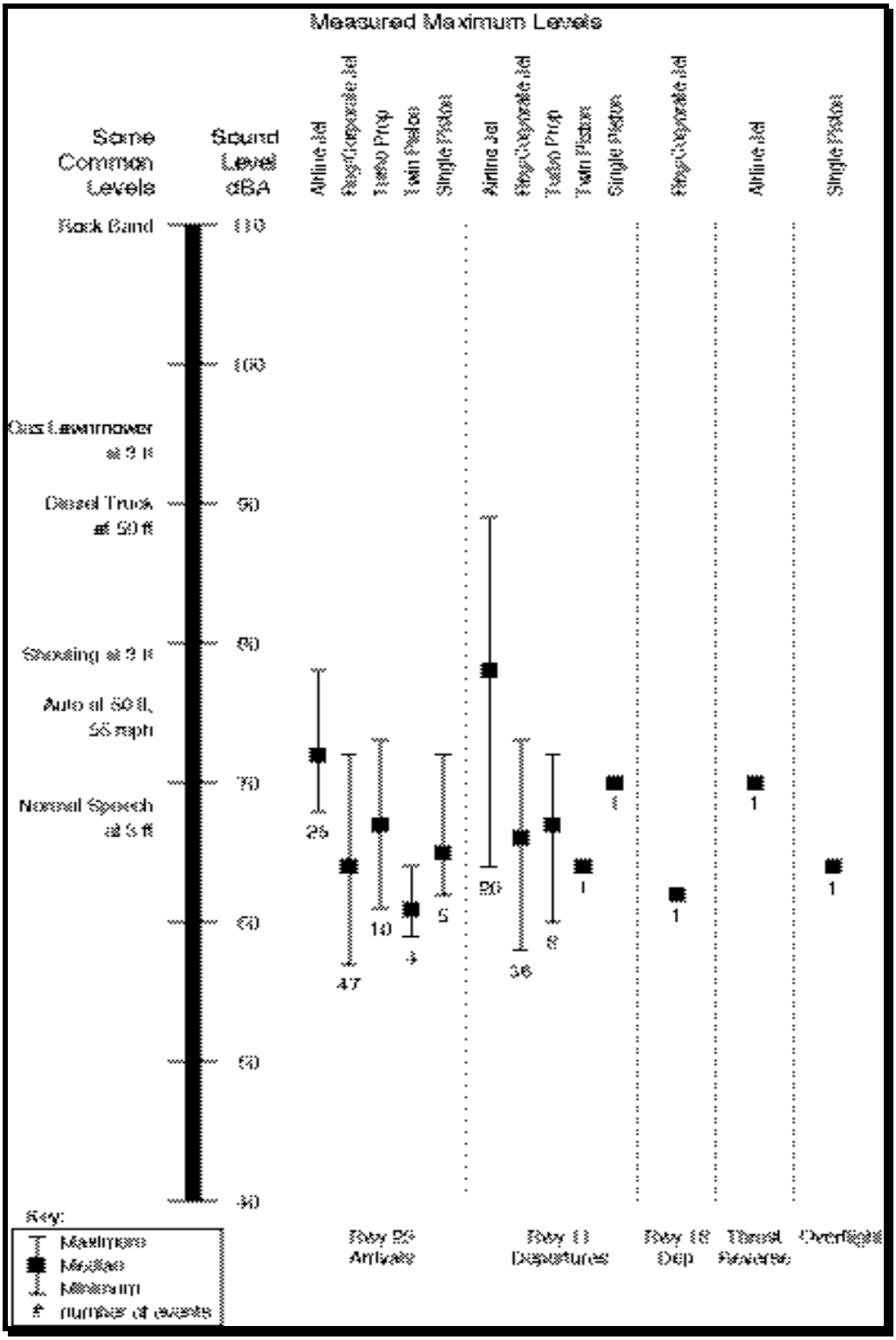
Table 6. Site 2 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
6:28 AM	Federal Express 1491	Boeing 727	Runway 29 Arrival	99	98 sec
6:57 AM	Airborne Express 118	McDonnell Douglas DC-9-30	Runway 29 Arrival	98	90 sec
9:14 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	96	54 sec
6:05 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	96	83 sec
6:18 AM	Federal Express 1491	Boeing 727	Runway 29 Arrival	95	47 sec
9:36 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	94	60 sec
5:37 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	94	63 sec
5:55 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	93	37 sec
6:27 AM	Federal Express 2491	Boeing 727	Runway 29 Arrival	92	33 sec
2:03 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	91	55 sec
8:16 AM	Delta Airlines 1149	McDonnell Douglas DC-9-30	Runway 11 Departure	90	66 sec
6:04 AM	Southwest Airlines 4146	Boeing 737-300	Runway 29 Arrival	90	49 sec
1:57 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	90	55 sec
9:21 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	89	99 sec
10:54 PM	US Airways 532	Boeing 737-400	Runway 29 Arrival	89	27 sec
8:07 AM	Delta Airlines 1149	McDonnell Douglas MD80	Runway 11 Departure	89	60 sec
9:31 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	89	67 sec
3:34 PM	US Airways 2163	Boeing 737-300	Runway 11 Departure	87	31 sec
11:32 PM	US Airways 1730	Boeing 737-300	Runway 29 Arrival	87	25 sec
2:24 PM	US Airways 1415	Boeing 737-300	Runway 11 Departure	86	42 sec

Figure 3 Site 2 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.3 Site 6: 38 Bellevue Avenue, South Portland

Site 6 is located approximately three and one quarter miles east of PWM and slightly south of the extended centerline of Runway 11/29 in the Willard Beach neighborhood. The majority of recorded aircraft noise events at this site were straight in arrivals to Runway 29 and departures off of Runway 11. Table 7 presents the loudest aircraft events at Site 6 during the measurement period. The majority of aircraft using the Harbor Visual Approach to Runway 29 were not audible at this site during the hours it was attended by an HMMH staff member. Notably, however, the highest weighted SELs of the entire measurement program were caused by Federal Express 727s, both on arrival to Runway 29 and on takeoff from Runway 11.

Hourly L_{eq} values measured at Site 6 ranged from 30 to 64 dBA. The lowest L_{eq} value of 30 dBA was measured at 2 am on May 29th. The low value reflects the absence of community noise during early morning hours. The average DNL for Site 6 was 59 dB.

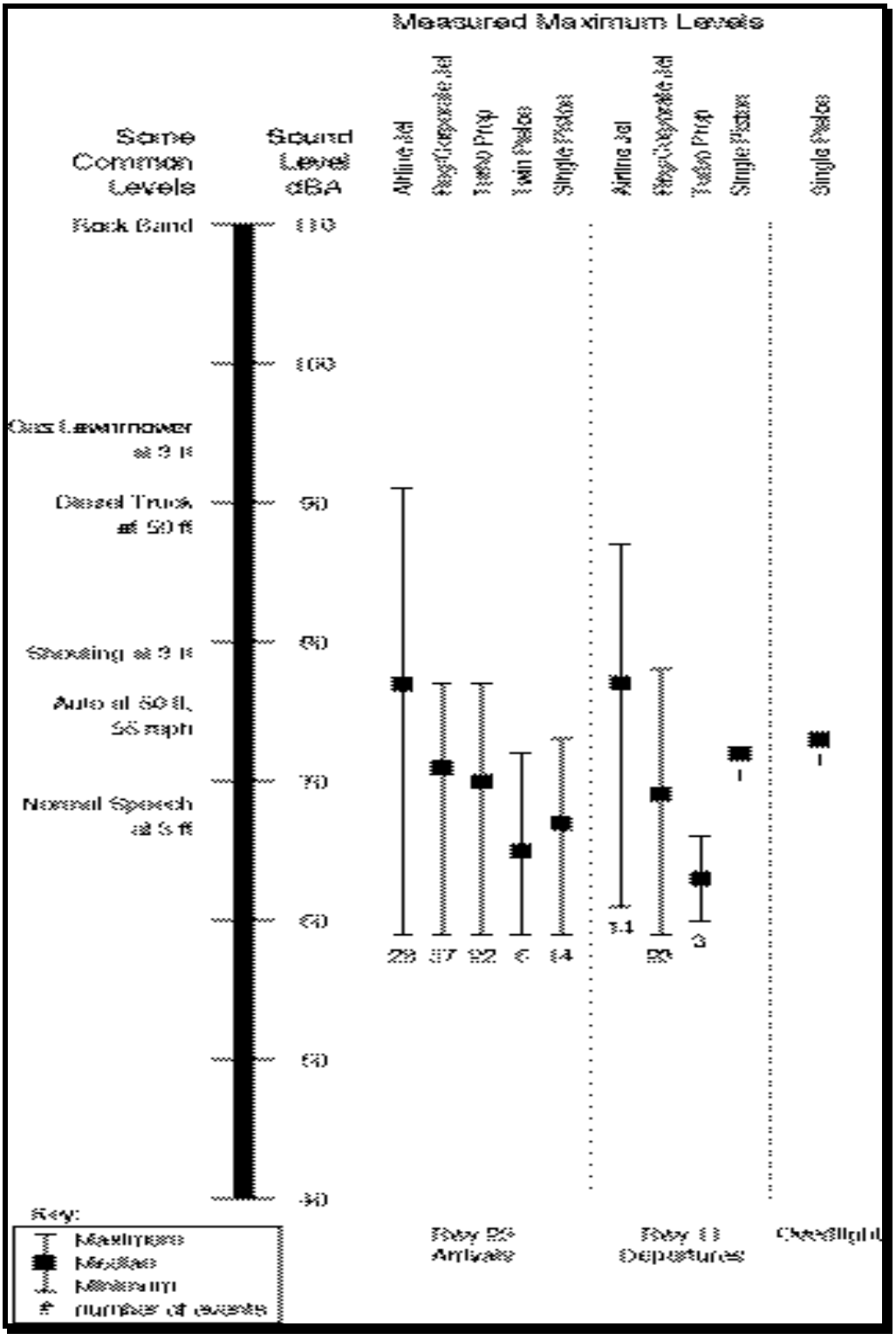
Table 7. Site 6 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
6:35 AM	Federal Express 1491	Boeing 727	Runway 29 Arrival	108	45 sec
10:09 PM	Federal Express 1291	Boeing 727	Runway 11 Departure	107	60 sec
6:02 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	105	44 sec
11:39 PM	US Airways 1730	Boeing 737-300	Runway 29 Arrival	100	37 sec
10:59 PM	US Airways 532	Boeing 737-400	Runway 29 Arrival	100	49 sec
10:00 PM	US Airways 759	Boeing 737-300	Runway 29 Arrival	98	33 sec
10:01 PM	US Airways 746	Boeing 737-400	Runway 29 Arrival	98	36 sec
10:04 PM	US Airways 759	Boeing 737-300	Runway 29 Arrival	98	34 sec
9:35 PM	Federal Express 1291	Boeing 727	Runway 11 Departure	95	76 sec
10:05 PM	Unknown 8640	Dornair 328	Runway 29 Arrival	95	45 sec
6:46 AM	Atlantic Coast Airlines 958	Canadair Regional Jet	Runway 29 Arrival	94	33 sec
10:11 PM	American Eagle Airlines 700	Embraer Regional Jet	Runway 29 Arrival	94	38 sec
5:47 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	94	45 sec
11:02 PM	Unknown 8640	Dornair 328	Runway 29 Arrival	93	32 sec
10:16 PM	Unknown 4181	Dornair 328	Runway 29 Arrival	93	25 sec
8:12 PM	Northwest Airlines 1850	McDonnell Douglas DC-9	Runway 29 Arrival	92	90 sec
5:17 PM	Airborne Express 118	McDonnell Douglas DC-9	Runway 29 Arrival	92	54 sec
2:19 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	92	65 sec
10:05 PM	Atlantic Coast Airlines 6142	Dornair 328 Jet	Runway 29 Arrival	92	35 sec
11:05 PM	American Eagle Airlines 035	Embraer Regional Jet	Runway 29 Arrival	92	34 sec

Figure 4 Site 6 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.4 Site 7: 28 Henry Street, South Portland

This site is located approximately three and three quarter miles to the east of Runway 11/29 and slightly south of the extended centerline in the Willard Beach neighborhood. The primary sources of aircraft noise events at this site were caused by straight-in arrivals to Runway 29 and departures off Runway 11. As was the case at Site 6, aircraft arriving to Runway 29 using the Harbor Visual Approach procedure were not audible at Site 7 during the hours it was attended. However, also as at Site 6, notably it was Federal Express' 727 takeoff from Runway 11 that caused the highest weighted single event level at this location too. Table 8 presents the loudest aircraft events at Site 7 during the measurement period.

Hourly L_{eq} values ranged from 32 dBA to 71 dBA. The lowest L_{eq} value of 32 dBA was recorded during the hours of 1, 2 and 3 am on May 29th, which corresponds to the low levels recorded at Site 6 on the same night. The high L_{eq} values recorded at this site were influenced by construction activity across the street during daylight hours. The average DNL for site 7 was 59 dB.

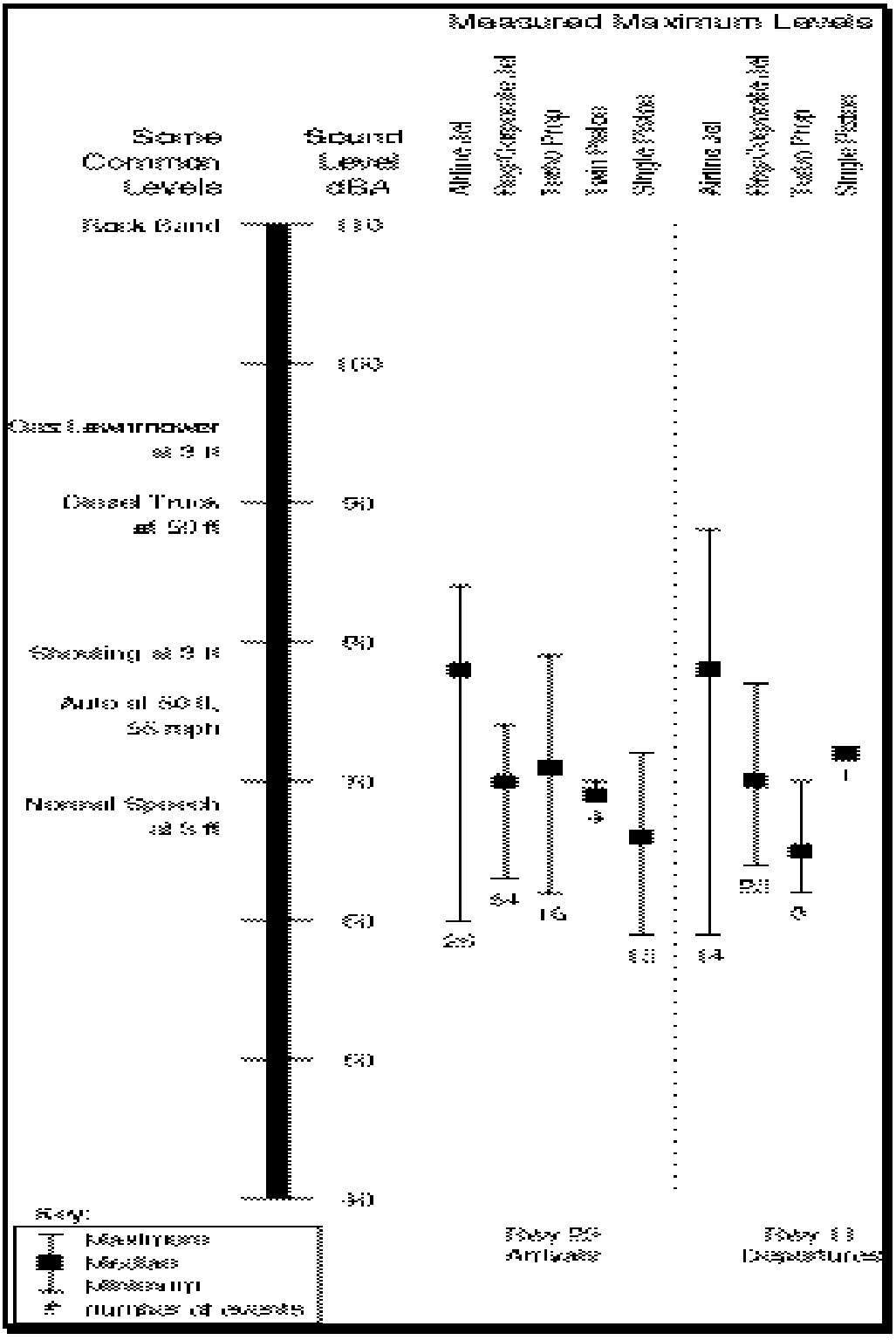
Table 8. Site 7 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
10:10 PM	Federal Express 1291	Boeing 727	Runway 11 Departure	107	48 sec
10:59 PM	US Airways 532	Boeing 737-400	Runway 29 Arrival	98	35 sec
11:38 PM	US Airways 1730	Boeing 737-300	Runway 29 Arrival	98	34 sec
10:01 PM	US Airways 746	Boeing 737-400	Runway 29 Arrival	97	32 sec
10:04 PM	US Airways 759	Boeing 737-300	Runway 29 Arrival	96	30 sec
10:00 PM	US Airways 759	Boeing 737-300	Runway 29 Arrival	96	34 sec
9:35 PM	Federal Express 1291	Boeing 727	Runway 11 Departure	96	70 sec
10:05 PM	Unknown 8640	Dornair 328	Runway 29 Arrival	95	33 sec
5:47 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	94	35 sec
6:49 PM	Northwest Airlines 1850	McDonnell Douglas DC-9-30	Runway 29 Arrival	93	48 sec
6:35 AM	Federal Express 1491	Boeing 727	Runway 29 Arrival	93	44 sec
11:02 PM	Unknown 8640	Dornair 328	Runway 29 Arrival	93	31 sec
2:19 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	93	40 sec
6:02 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	92	40 sec
11:44 PM	Atlantic Coast Airlines 6156	Dornair 328 Jet	Runway 29 Arrival	92	23 sec
10:10 PM	American Eagle Airlines 700	Embraer Regional Jet	Runway 29 Arrival	92	36 sec
10:05 PM	Atlantic Coast Airlines 6142	Dornair 328 Jet	Runway 29 Arrival	91	30 sec
10:16 PM	Unknown 4181	Dornair 328	Runway 29 Arrival	91	21 sec
11:04 PM	American Eagle Airlines 035	Embraer Regional Jet	Runway 29 Arrival	90	29 sec
9:05 PM	Delta Airlines 836	McDonnell Douglas MD80	Runway 29 Arrival	90	36 sec

Figure 5 Site 7 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.5 Site 9: 1169 Westbrook Street, Portland

Site 9 is located approximately 1,000 feet north of Runway 18/36 and is slightly west of the extended centerline. As a result, the bulk of recorded aircraft operations were small general aviation and commuter turboprop aircraft arriving to Runway 18 and departing on Runway 36. Some events at this site were caused by aircraft taxiing to or from the runway end. Table 9 presents the loudest aircraft events at Site 9 during the measurement period.

The hourly L_{eq} values, shown in Appendix B, measured at Site 9 ranged from 39 to 73 dBA. The average DNL for Site 9 for the measurement period was 61 dB.

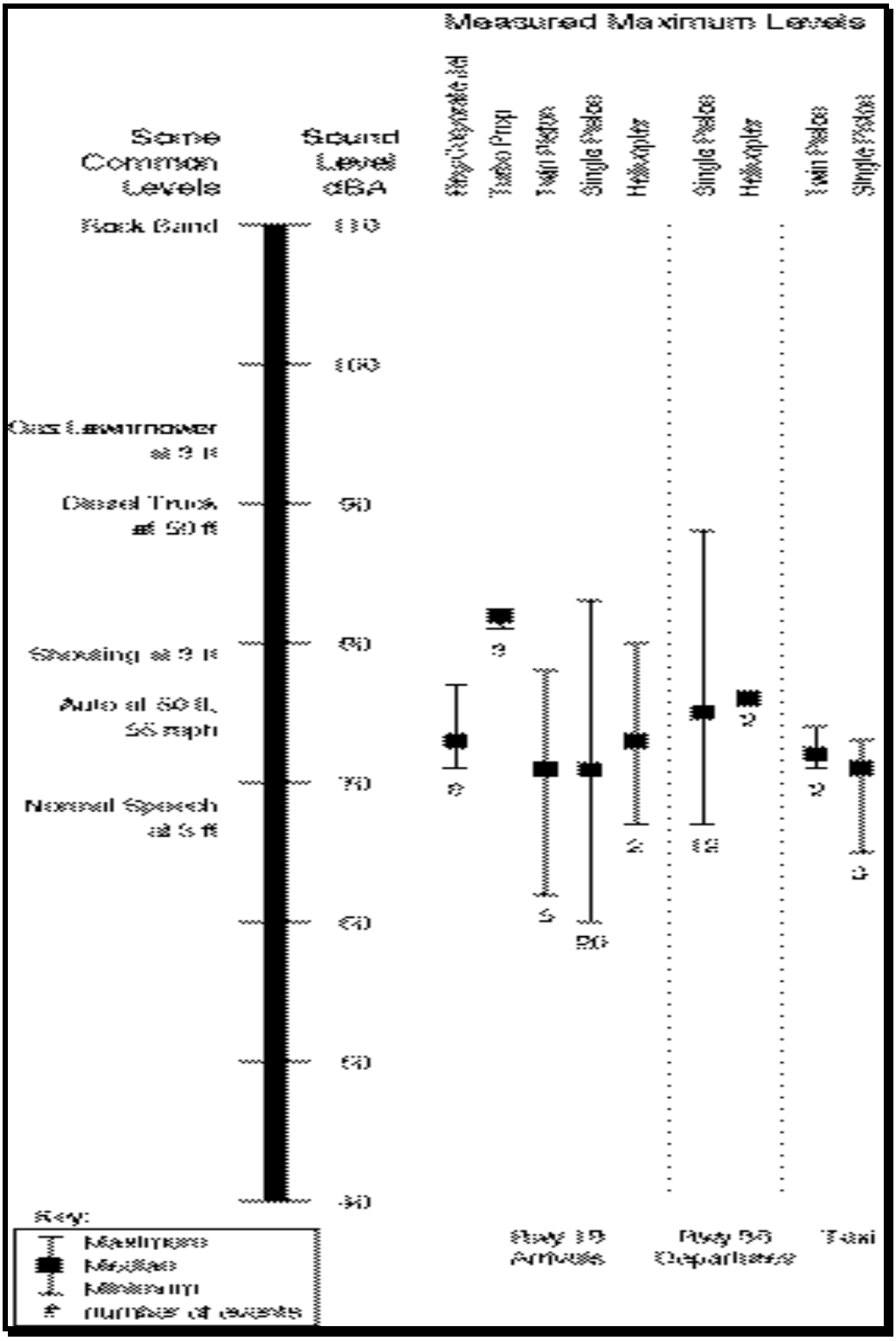
Table 9. Site 9 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
10:37 PM	Unknown 4181	Dornair 328	Runway 18 Arrival	97	14 sec
10:23 AM	General Aviation	Single Engine Propeller	Runway 18 Arrival	94	20 sec
10:43 PM	American Eagle 035	Embraer Regional Jet	Runway 18 Arrival	94	12 sec
8:04 AM	General Aviation	Single Engine Propeller	Runway 36 Departure	94	26 sec
5:37 AM	Unknown	Unknown	Runway 36 Departure	93	23 sec
11:20 PM	Atlantic Coast Airlines 488	Canadair Regional Jet	Runway 18 Arrival	93	12 sec
3:19 PM	American Eagle 773	Saab 340	Runway 18 Arrival	90	47 sec
10:35 PM	Atlantic Coast Airlines 6130	Dornair 328 Jet	Runway 18 Arrival	89	10 sec
12:31 PM	Unknown	Unknown	Runway 18 Arrival	89	48 sec
7:43 PM	General Aviation	Twin Engine Propeller	Runway 18 Arrival	89	26 sec
11:47 PM	General Aviation	Cessna Corporate Jet	Runway 18 Arrival	88	10 sec
11:54 AM	Unknown 4179	Dornair 328	Runway 18 Arrival	88	15 sec
11:18 PM	General Aviation	Twin Engine Turbo Prop	Runway 18 Arrival	87	10 sec
1:47 PM	Unknown	Helicopter	Runway 36 Departure	87	52 sec
7:45 PM	Wiggins 7408	Single Engine Propeller	Runway 18 Arrival	87	15 sec
7:43 AM	General Aviation	Single Engine Propeller	Runway 36 Departure	86	16 sec
7:36 AM	Wiggins 8408	Single Engine Propeller	Runway 36 Departure	85	11 sec
11:09 AM	Wiggins 8107	Single Engine Propeller	Runway 18 Arrival	85	12 sec
3:27 PM	General Aviation	Single Engine Propeller	Runway 18 Arrival	85	19 sec
9:47 AM	General Aviation	Single Engine Propeller	Runway 36 Departure	85	25 sec

Figure 6 Site 9 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.6 Site 10: 23 Fenway Street, Portland

Site 10 is located approximately 1,500 feet west of the approach end of Runway 18. This site was added to the list of suggested sites in order to attempt to collect data to support the over-water adjustment made to the INM, but was not attended by HMMH staff. The location of Site 10 made it difficult to positively match radar tracks to the measured events collected by the noise monitor. Due to the location of this site abeam Runway 18/36, aircraft noise events are primarily general aviation and commuter aircraft arriving to Runway 18 and departing Runway 36.

The hourly L_{eq} at this site ranged from 40 to 65 dBA. The average measured DNL for Site 10 during the measurement period was 58 dB.

3.1.5.7 Site 12: 138 Stroudwater Road, Portland

Site 12 is located approximately 3,000 feet north of Runway 18/36 and is on the extended centerline. Runway 18 arrivals and Runway 36 departures were the primary source of aircraft noise events recorded at this site. Corporate jet arrivals to Runway 18 created the loudest aircraft noise events at this location. Table 10 presents a list of the loudest aircraft events at Site 12 during the measurement period. Automobile and truck traffic on Westbrook Road and Congress Street contributed to the overall DNL.

The hourly L_{eq} varied between 37 and 68 dBA. The average DNL recorded for Site 12 during the measurement period was 57 dB.

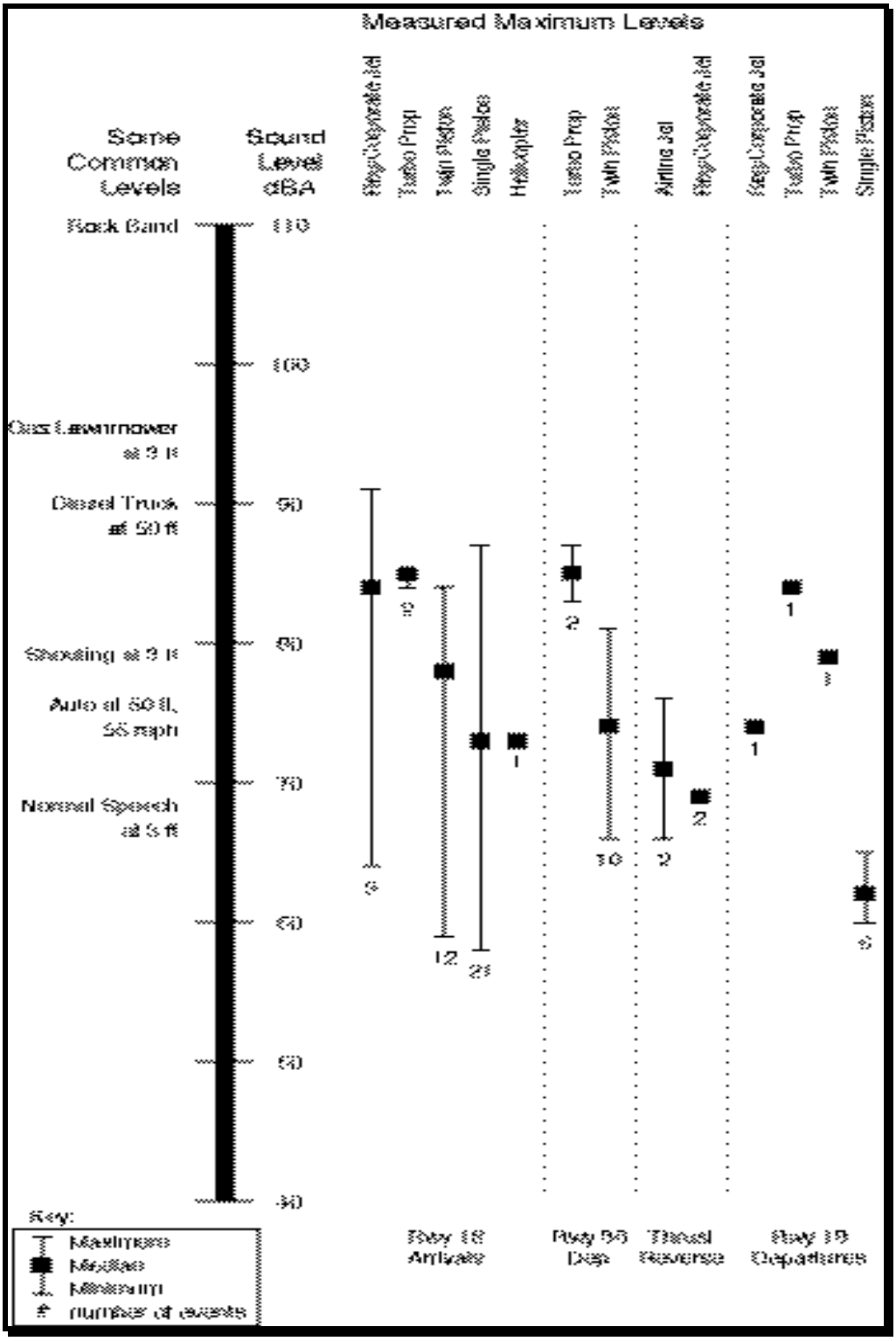
Table 10. Site 12 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
11:13 PM	Wiggins 7408	Single Engine Propeller	Runway 18 Arrival	101	31 sec
11:53 PM	Atlantic Coast Airlines 6130	Dornair 328 Jet	Runway 18 Arrival	99	18 sec
3:46 PM	Atlantic Coast Airlines 6128	Dornair 328 Jet	Runway 18 Arrival	98	96 sec
6:02 AM	Wiggins 8408	Single Engine Propeller	Runway 36 Departure	97	19 sec
3:33 PM	General Aviation	Twin Engine Propeller	Runway 36 Departure	94	35 sec
5:55 AM	General Aviation	Helicopter	Runway 36 Departure	93	35 sec
6:17 AM	Unknown	Unknown	Runway 36 Departure	93	20 sec
4:27 PM	General Aviation	Corporate Jet	Runway 18 Arrival	92	36 sec
4:23 PM	General Aviation	Twin Engine Turbo Prop	Runway 18 Arrival	92	56 sec
4:31 PM	Continental Express Airlines 3512	Embraer Regional Jet	Runway 18 Arrival	91	33 sec
4:34 PM	Atlantic Coast Airlines 630	Canadair Regional Jet	Runway 18 Arrival	91	55 sec
11:44 AM	Unknown 4179	Dornair 328	Runway 18 Arrival	91	23 sec
5:02 PM	General Aviation	Corporate Jet	Runway 18 Arrival	91	22 sec
7:32 PM	Wiggins 7408	Single Engine Propeller	Runway 18 Arrival	91	30 sec
4:45 PM	American Eagle Airlines 459	Embraer Regional Jet	Runway 18 Arrival	91	24 sec
7:22 PM	CommutAir 2621	Beechcraft 1900	Runway 18 Arrival	90	61 sec
7:27 PM	Wiggins 7408	Single Engine Propeller	Runway 18 Arrival	90	33 sec
2:45 PM	Colgan Air 5972	Saab 340	Runway 18 Arrival	90	64 sec
3:43 PM	CommutAir 2649	Beechcraft 1900	Runway 18 Arrival	90	30 sec
11:52 AM	Wiggins 8107	Single Engine Propeller	Runway 18 Arrival	90	38 sec

Figure 7 Site 12 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.8 Site 15: Maine Youth Center, South Portland

Site 15 is located at the Maine Youth Center approximately 2,500 feet southwest of Runway 18/36. Aircraft noise events varied, but included general aviation and commuter aircraft arriving to Runway 36 and departing from Runway 18 and sideline events from aircraft arriving and departing Runway 11/29. Almost no events were caused by overflights, making it difficult to positively match radar tracks with noise levels measured by the noise monitor. The heating, ventilation and air conditioning system was audible during most of the period this site was attended by HMMH staff. The hourly L_{eq} varied between 47 and 69 dBA. The average DNL recorded for Site 15 during the measurement period was 62 dB.

3.1.5.9 Site 18: 75 Vaughn Street, Portland

Site 18 is located on the Western Promenade, approximately one and one quarter miles east of Runway 11/29, one-quarter mile north of the extended centerline. It is in a built-up residential area with a significant amount of automobile traffic. Aircraft noise events measured at this site were primarily caused by arrivals to Runway 29 and departures off Runway 11. Automobiles, trucks and busses passing by caused many noise events measured at this site. Table 11 provides a list of the loudest aircraft events during the measurement period. The majority of aircraft arriving to Runway 29 using the Harbor Visual Approach were not audible at this site while HMMH staff attended it. The L_{eq} values ranged from a low of 39 dBA to a high of 71 dBA. The highest L_{eq} at this site occurred during the 11 o'clock hour on the morning of May 23rd, caused by lawn mowing in the vicinity of the noise monitor. The average DNL value recorded at Site 18 during the measurement period was 60 dB.

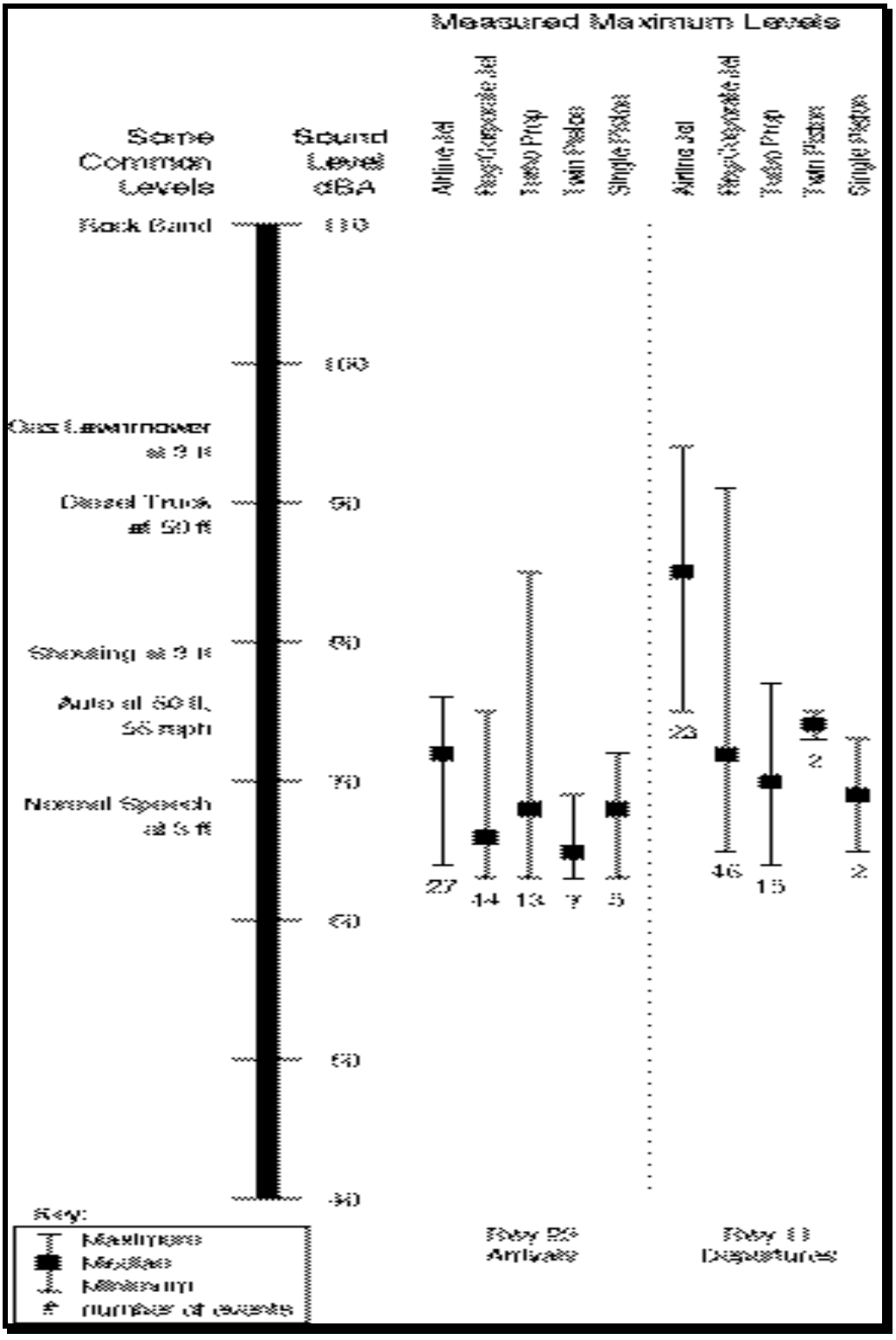
Table 11. Site 18 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
9:35 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	101	49 sec
4:14 PM	Northwest Airlines 1847	McDonnell Douglas DC-9-30	Runway 11 Departure	99	37 sec
9:35 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	98	36 sec
9:14 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	98	37 sec
2:02 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	98	38 sec
1:57 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	97	39 sec
5:37 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	97	30 sec
1:52 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	97	36 sec
5:34 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	96	42 sec
8:16 AM	Delta Airlines 1149	McDonnell Douglas MD80	Runway 11 Departure	95	45 sec
9:21 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	95	43 sec
6:06 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	94	42 sec
8:07 AM	Delta Airlines 1149	McDonnell Douglas MD80	Runway 11 Departure	94	47 sec
9:51 AM	Unknown	KC135	Runway 29 Arrival	94	24 sec
6:58 AM	Airborne Express 118	McDonnell Douglas DC-9-30	Runway 29 Arrival	93	40 sec
9:31 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	93	39 sec
8:12 PM	Ryan 9202	Boeing 737	Runway 11 Departure	92	52 sec
6:27 AM	Federal Express 2491	Boeing 727	Runway 29 Arrival	92	18 sec
10:54 PM	US Airways 532	Boeing 737-400	Runway 29 Arrival	91	20 sec
8:02 PM	Unknown 9407	Dornair 328	Runway 29 Arrival	91	18 sec

Figure 8 Site 18 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



3.1.5.10 Site 19: 55 Bowdoin Street, Portland

This site is located on the Western Promenade in Portland approximately one mile east of Runway 11/29 and one-quarter mile north of the extended centerline. Aircraft using the Harbor Visual Approach procedure to Runway 29 were not audible at this site during the hours it was attended. Large jets arriving to Runway 11 and departing off Runway 29 caused the loudest events at this site. Table 12 provides a list of the loudest aircraft events at this site during the measurement period. This site is located in a built-up residential area with a significant amount of automobile traffic, which contributed to the overall DNL value.

The hourly L_{eq} varied from 36 to 75 dBA. The average DNL value for the measurement period was 59 dB at site 19.

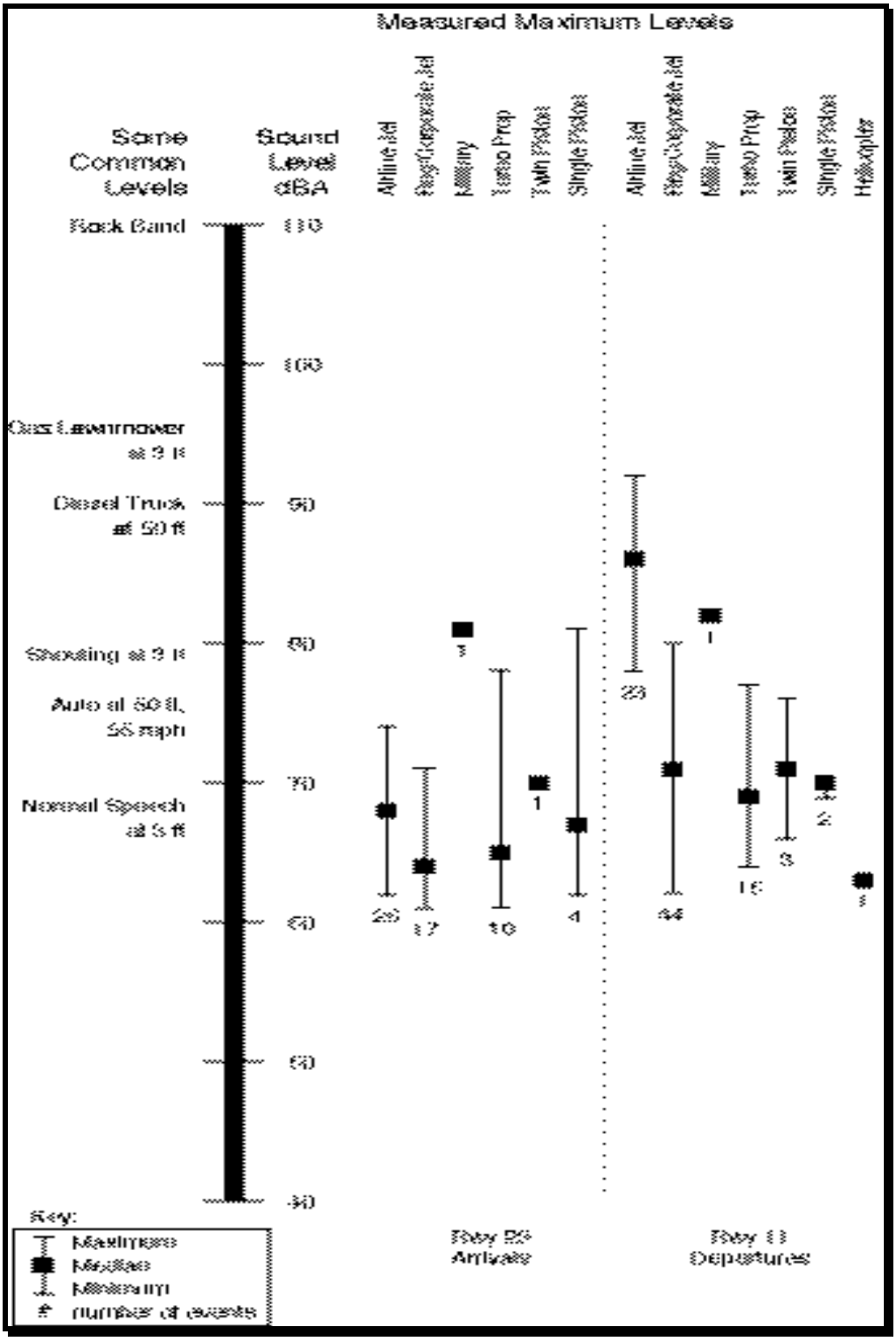
Table 12. Site 19 Loudest Aircraft Noise Events

Source: HMMH, 2002

Time	Operator	Aircraft Type	Operation	Weighted SEL (dBA)	Duration
9:35 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	101	51 sec
4:14 PM	Northwest Airlines 1847	McDonnell Douglas DC-9-30	Runway 11 Departure	99	35 sec
9:35 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	98	40 sec
9:14 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	98	36 sec
1:57 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	98	42 sec
2:02 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	98	39 sec
5:37 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	97	35 sec
1:52 PM	Delta Airlines 2247	McDonnell Douglas MD80	Runway 11 Departure	97	29 sec
5:34 PM	Delta Airlines 2108	McDonnell Douglas MD80	Runway 11 Departure	96	45 sec
8:16 AM	Delta Airlines 1149	McDonnell Douglas MD80	Runway 11 Departure	95	49 sec
9:21 AM	Delta Airlines 1081	McDonnell Douglas MD80	Runway 11 Departure	95	49 sec
9:31 AM	Northwest Airlines 1473	McDonnell Douglas DC-9-30	Runway 11 Departure	94	39 sec
8:12 PM	Ryan 9202	Boeing 737	Runway 11 Departure	93	49 sec
8:07 AM	Delta Airlines 1149	McDonnell Douglas MD80	Runway 11 Departure	93	47 sec
6:18 AM	Federal Express 1491	Boeing 727	Runway 29 Arrival	91	29 sec
6:06 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	90	34 sec
3:33 PM	US Airways 2163	Boeing 737-300	Runway 11 Departure	90	30 sec
2:25 PM	US Airways 1415	Boeing 737-300	Runway 11 Departure	90	32 sec
6:14 PM	US Airways 1479	Boeing 737-300	Runway 11 Departure	90	25 sec
5:56 AM	Federal Express 1961	Boeing 727	Runway 29 Arrival	90	29 sec

Figure 9 Site 19 Maximum A-Weighted Sound Levels

Source: HMMH, 2002



Clearly, throughout this reporting of measured levels, the most significant noise events are those caused by Federal Express' (and to a lesser extent, Airborne Express') 727s, but also by older hushkitted DC9-30s, and MD-80s flown by Northwest and Delta Airlines, respectively. To the extent these aircraft remain in PWM's fleet, they are likely targets for mitigation measures.

3.2 INM-Predicted Noise Exposure

While measured levels add a degree of credibility to the understanding of an existing noise environment, computer-generated levels are more appropriate for understanding how noise differs around the airport or how it is apt to change in the future under alternative operational scenarios. In addition, Part 150 requires that the noise environment be described in terms of annual average DNL contours, an impossibility with measurements alone. Thus, calculations of DNL and single event noise levels at PWM were also developed using an FAA computer model known as the Integrated Noise Model (INM), version 6.0c. It requires operational inputs in the following categories:

- Geographical coordinates reflecting runway locations and other physical features of the airport;
- Number and mix of aircraft operations by aircraft type;
- Number and type of operations during daytime or at night (10:00 p.m. to 7:00 a.m.);
- Frequency of runway use by different groups of aircraft;
- Flight paths flown to and from the runways; and
- Frequency of flights following the various flight paths.

3.2.1 Airport Physical Parameters

PWM is located approximately three miles west of downtown Portland and is contained within the jurisdictional boundaries of the City of Portland. The Jetport has two main runways, each end of which is designated by a different number that, with the addition of a trailing "0," reflects the magnetic heading of the runway to the nearest 10º, as seen be the pilot. Thus, the main runway, 11/29, has the designation "11" at the west end of the pavement looking eastward, indicating that it is aligned on a magnetic heading of approximately 110º, while the opposite end of the same piece of pavement has the designation "29" indicating its orientation on a heading of 290º. The operational length of the pavement is 6,800 feet. The second, shorter, "crosswind" runway, 18/36, is oriented on magnetic headings of 180º and 360º and is 5,001 feet long and 150 feet wide. The published airport elevation is 74 feet above mean sea level, and the annual average temperature is 58.7° F, both of which affect sound propagation and are used by the INM to adjust the rate at which sound decreases with increasing distance from the aircraft.

Figure 10 presents the existing airport property line, runway layout, taxiways, parking aprons, and other physical features of the Jetport. The INM includes an internal database of the airport layout, including runway coordinates, orientation, start-of-takeoff roll points, runway end elevations, landing thresholds, approach angles, and other data, all of which are taken into account in the noise modeling. There are no displaced thresholds on any runway end, meaning that aircraft taking off from PWM begin their takeoff roll essentially at the end of each runway while landings typically arrive over the end of each runway at an altitude of about 50 feet and touch down approximately 1,000 feet down the runway. Runways 29 and 36 have a "visual approach slope indicator" (VASI) set at 3º that helps pilots of smaller aircraft approach the runways at a desirable angle. Runway 18 has a VASI set at a slightly steeper 3.25º to increase clearance over the higher terrain north of the Jetport. The runway end elevations are as follows: Runway 11, 73.6 feet, Runway 29, 42.0 feet, Runway 18 44.6 feet, and Runway 36, 46.6 feet.

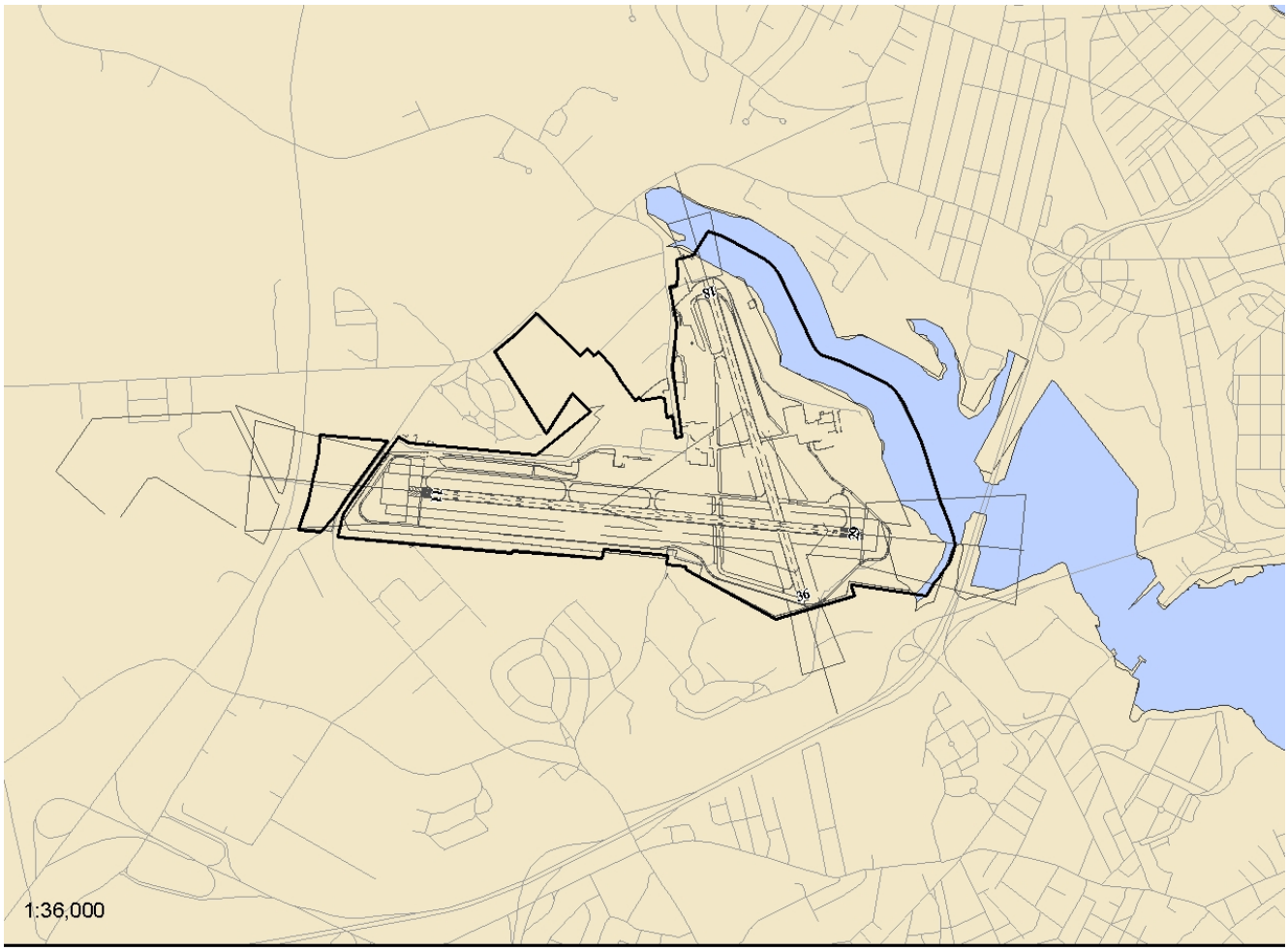


Figure 10. PWM Airport Layout Plan

3.2.2 Aircraft Operations for 2002

Part 150 and its table of noise/land use compatibility guidelines require the calculation of "yearly DNL" values; that is, the daily noise exposure (in DNL) averaged over a year – usually a calendar year. The INM produces these values of exposure utilizing an "average annual day" of airport operations.

Because this study was initiated in early 2002, it would logically have used the prior calendar year of activity to produce the average annual day's operations. However, the declining economy combined with the devastating aftereffects of September 11, 2001 on the aviation industry worldwide would suggest that some adjustment should be made to 2001 traffic if it is to properly represent a baseline condition for analyzing noise mitigation measures. The Noise Advisory Committee strongly concurred.

In actuality, PWM did not fare as poorly as many airports. Figure 11 shows a plot of the average daily traffic counts month-by-month for the years 1999, 2000, and 2001. Operations clearly dropped in September 2001; however, they showed signs of a recovery as early as the following month, and PWM ended the year with approximately 112,000 operations, up nearly 6,000 operations over the prior year, though some 13,000 operations less than the strong levels of 1999.

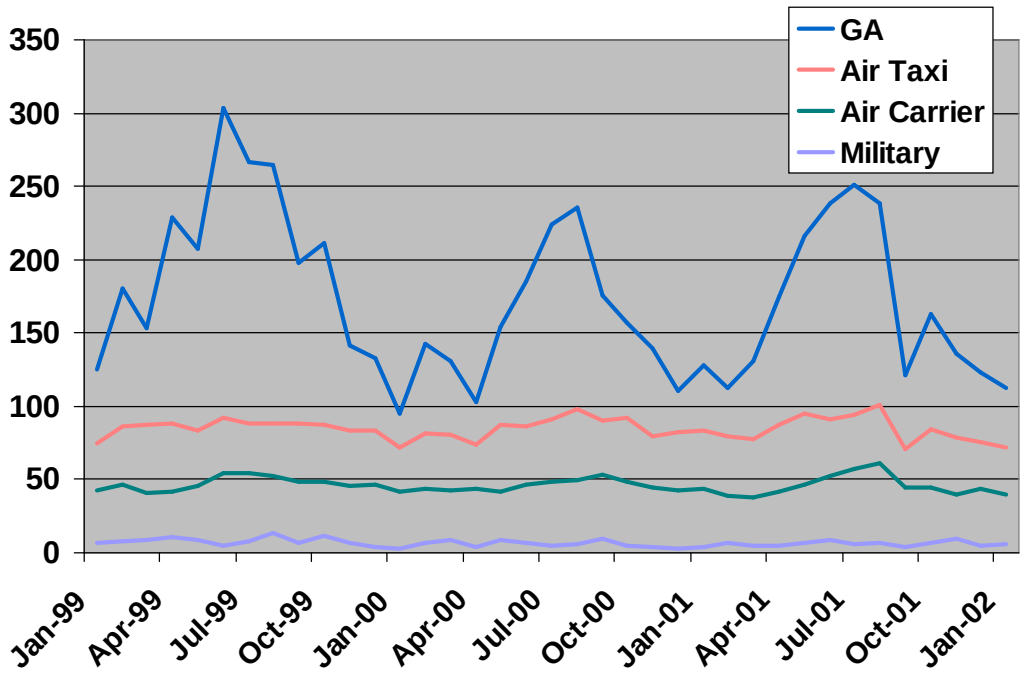


Figure 11. Average Daily Traffic by Aircraft Group by Month, January 1999 through January 2002

Source: SH&E Inc. -- FAA Air Traffic Activity Data System

Figure 12 on the following page shows another breakdown of average daily traffic counts illustrating the significant change in Jetport operations that occurred in the aftermath of September 11th – a major decline in general aviation traffic as the decreased activity levels continued into early 2002. The shift in fleet mix again supports the need to consider adjustments to 2001 operations so that they better reflect "existing conditions" rather than the aberration, which both the study team and the Noise Advisory Committee believed was temporary and unrepresentative of normal activity at the Jetport. HMMH's subcontractor, SH&E, provided the team with adjusted operations levels, utilizing not only historic operations data but also demographic information, passenger enplanements, fleet projections and other material (summarized in a technical report and included in this document as Appendix B) to project what the study team and the NAC believed would be more representative of 2002 – in effect a short-range forecast of existing operations. That projection of existing activity for a more normal baseline period is shown by aircraft group in the far right column of Figure 12. Annual average daily operations were estimated to total 314. Of these, approximately 56 percent were general aviation operations, 27 percent air taxis, 16 percent air carrier and cargo operations, and less than ½ percent military operations.

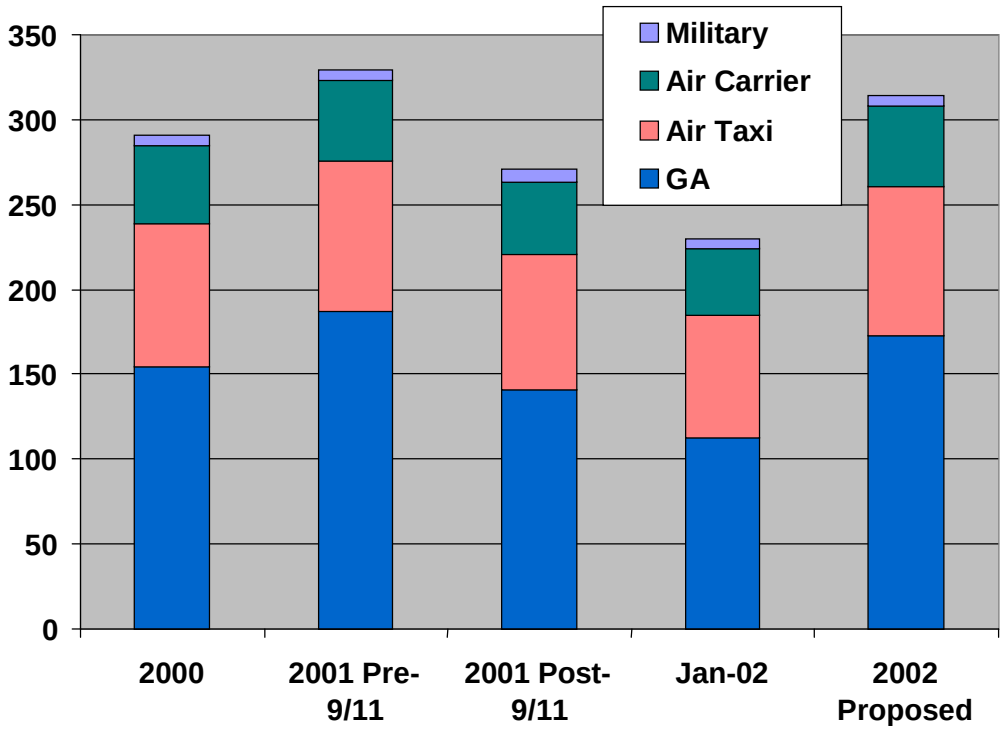


Figure 12. Average Daily Operations by Type of Operator Before and After 9/11/01

Source: SH&E Inc. -- FAA Air Traffic Activity Data System

Figure 13 shows another effect of the declining economy and the events of September 11th – the nearly immediate grounding of most of the older, inefficient, and loud recertified (or "hushkitted") Stage 3 airplanes remaining in the U.S. fleet, in combination with the replacement of many turboprop aircraft by quieter, more efficient small Regional Jets (RJs). Hushkitted aircraft in early 2002 represented about half of their pre-9/11 activity levels, while Regional Jet operations increased from approximately 27 percent of scheduled activity before September 11th to nearly 45 percent in the early months of 2002. This mix was forecast to continue through 2002, which when combined with the expected return to pre-9/11 operations levels means that hushkitted aircraft are projected to decrease from about 8 operations per day in 2001 to an average of about 4 operations per day in 2002, while RJs are projected to increase from about 33 operations per day to about 50 per day over the same period. As most members of the Noise Advisory Group acknowledged, the noise benefits of the conversion to RJs have been welcomed.

Still further subdivision of these operations into a mix of specific aircraft and engine types is required for actual noise modeling, and for this purpose, additional data sources were tapped. The *Official Airline Guide* (OAG) provided the types of aircraft operated by scheduled passenger service carriers – air taxi operators as well as major air carriers. *J.P. Fleets* was used to estimate the number of aircraft having different engine types within a given operator's fleet. In addition, FAA Air Traffic Control Tower (ATCT) staff from Portland Tower provided HMMH with multiple samples of radar data from the FAA's ARTS 2E radar system, totaling 30 days of activity during March, May, and June, 2002. The radar data consisted of records for each flight arriving to or departing from PWM, and include, with few exceptions, the date, time and type of aircraft, and the flight path it followed (from which runway use

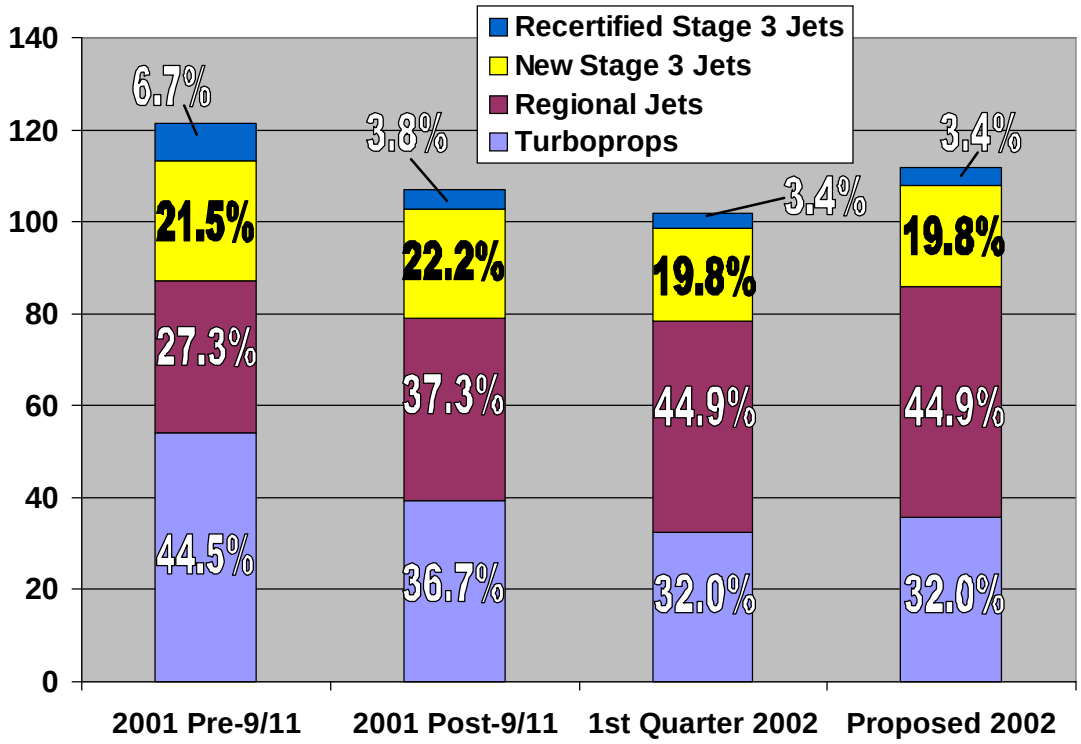


Figure 13. Average Daily Commercial Operations by Types of Aircraft Before and After 9/11/01

Source: SH&E, Inc.

could also be inferred; see Section 3.2.3). The radar data were used to determine the aircraft fleet mix for general aviation and military operations, and also were used to determine the daytime and nighttime activity levels for each aircraft type, remembering that nighttime for purposes of noise exposure calculations is from 10:00 p.m. to 7:00 a.m. the next morning. Table 13 presents the full detailed breakdown of average daily operations for the year 2002.

Table 13. Modeled Average Daily Aircraft Operations for 2002

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Touch and Go's		Total
		Day	Night	Day	Night	Day	Night	
Large Jet	727EM1	0.00	0.01	0.01	0.00	0.00	0.00	0.03
	727EM2	0.14	0.92	0.85	0.21	0.00	0.00	2.12
	737300	1.48	0.76	1.66	0.58	0.00	0.00	4.49
	7373B2	1.93	0.99	2.16	0.76	0.00	0.00	5.83
	737400	0.97	0.44	0.57	0.85	0.00	0.00	2.83
	737N9	0.08	0.00	0.08	0.00	0.00	0.00	0.15
	DC93LW	1.05	0.34	1.39	0.00	0.00	0.00	2.78
	DC95HW	0.88	0.21	1.09	0.00	0.00	0.00	2.18
	F10065	0.07	0.00	0.07	0.00	0.00	0.00	0.13
	KC135	0.31	0.00	0.31	0.00	0.00	0.00	0.61
	MD88	3.29	1.10	4.38	0.00	0.00	0.00	8.76
Large Jet Subtotal		10.18	4.78	12.55	2.40	0.00	0.00	29.91
Regional Jet/Corporate Jet	BAE146	0.00	1.10	1.10	0.00	0.00	0.00	2.19
	CIT3	0.66	0.00	0.44	0.22	0.00	0.00	1.33
	CL600	12.09	4.38	12.11	4.37	0.00	0.00	32.95
	CNA500	0.47	0.09	0.45	0.11	0.00	0.00	1.12
	CNA750	0.10	0.00	0.10	0.00	0.00	0.00	0.20
	EMB135	4.62	0.27	2.69	2.20	0.00	0.00	9.78
	EMB145	1.18	0.03	1.18	0.03	0.00	0.00	2.42
	EMB14L	0.63	1.23	1.66	0.19	0.00	0.00	3.71
	FAL20	0.10	0.00	0.10	0.00	0.00	0.00	0.20
	FAL90(1)	0.92	0.00	0.79	0.13	0.00	0.00	1.84
	GIIB	0.10	0.00	0.10	0.00	0.00	0.00	0.20
	GIV	0.17	0.09	0.13	0.13	0.00	0.00	0.51
	GV	0.20	0.00	0.20	0.00	0.00	0.00	0.41
	IA1125	0.15	0.00	0.15	0.00	0.00	0.00	0.31
	LEAR25	1.07	0.00	0.80	0.27	0.00	0.00	2.14
	LEAR35	5.62	0.20	5.08	0.74	0.00	0.00	11.64
	MU3001	3.72	0.17	3.48	0.40	0.00	0.00	7.76
Regional/Corporate Jet Subtotal		31.82	7.55	30.56	8.80	0.00	0.00	78.73
Turboprop	ATR42	2.34	0.54	2.42	0.46	0.00	0.00	5.75
	BEC190	6.54	0.00	6.54	0.00	0.00	0.00	13.07
	C130E	0.26	0.00	0.26	0.00	0.00	0.00	0.51
	CNA441	2.04	0.36	1.92	0.48	0.00	0.00	4.80
	DHC6	2.25	0.20	2.34	0.11	0.00	0.00	4.90
	DHC8	6.62	0.18	5.46	1.33	0.00	0.00	13.59
	DO328	0.70	0.00	0.70	0.00	0.00	0.00	1.40
	L118	0.92	0.00	0.92	0.00	0.00	0.00	1.84
	SD330	0.10	0.00	0.10	0.00	0.00	0.00	0.20
	SF340	4.94	0.94	4.68	1.21	0.00	0.00	11.77
Turboprop Subtotal		26.71	2.21	25.34	3.58	0.00	0.00	57.83
Piston	BEC58P	6.52	0.15	6.58	0.08	8.58	0.15	22.06
	CNA172	16.07	0.29	15.66	0.70	20.77	0.64	54.13
	CNA206	3.81	0.14	3.59	0.36	4.84	0.33	13.07
	GASEPF	9.51	0.79	6.57	3.74	10.53	2.97	34.11
	GASEPV	6.17	0.00	5.88	0.29	7.89	0.19	20.43
Piston Subtotal		42.08	1.37	38.28	5.17	52.61	4.28	143.79
Helicopters	B206L	1.61	0.23	1.69	0.15	0.00	0.00	3.68
Total		112.40	16.13	108.42	20.11	52.61	4.28	313.95

(1) Modeled at FAA direction as LEAR35+1.8 dB

3.2.3 Runway Utilization and Flight Track Geometry

In addition to details on aircraft types, the radar data provide information on how frequently each runway end is used for arrival and departure, and whether the use of runways is different from daytime to nighttime.

Table 14 presents the runway utilizations obtained from the radar, listing the percentages separately by aircraft groups and showing that larger aircraft always favor use of the longer Runway 11/29.

It was discussed during Noise Advisory Committee meetings that for part of the time covered by the radar sample (the months of May and June), resurfacing of Runway 11/29 was taking place during the nighttime hours from 10:30 p.m. to 6:00 a.m., so that aircraft landing during those hours were required to use the shorter crosswind Runway 18/36 more frequently than normal. This suggests that the nighttime use of 18/36 could be overestimated in the data sample summarized below; however, the Tower is normally closed late at night because of the small amount of traffic occurring during those hours, on top of which Jetport staff indicated that operators of some of the larger aircraft shifted their schedules away from the construction times in order to have continued access to the longer runway, which they preferred. Thus, the overestimate of use of 18/36 at night is believed to be quite small, and in the absence of more reliable data, has been disregarded for purposes of modeling average DNL values.

Table 14. Modeled Runway Use

Aircraft Category	Runway	Arrivals		Departures	
		Day	Night	Day	Night
Large Jet	11	43%	44%	37%	15%
	29	57%	55%	63%	83%
	18	0%	0%	0%	2%
	36	0%	1%	0%	0%
Regional/Corporate Jet	11	40%	44%	39%	9%
	29	54%	45%	56%	88%
	18	4%	7%	4%	1%
	36	2%	4%	1%	3%
Turboprop	11	39%	31%	34%	3%
	29	49%	46%	53%	80%
	18	8%	19%	12%	11%
	36	4%	4%	1%	6%
Piston	11	17%	12%	8%	5%
	29	39%	53%	40%	48%
	18	33%	24%	37%	29%
	36	11%	12%	15%	19%

In addition to runway usage, radar data provide an ideal source of information for identifying where aircraft fly and how often they utilize different flight corridors in the vicinity of the Jetport. Figure 14 and Figure 15, which follow, show the actual arrival and departure paths flown by aircraft in and out of PWM during the approximate three-week sample provided by the Air Traffic Control Tower for use in this analysis. Figure 14 depicts the flight paths of jet aircraft; Figure 15 depicts the less uniform flight paths of propeller aircraft. The broad dispersion of propeller aircraft occurs because a large majority of that traffic is not under radar control, flying instead under "Visual Flight Rules," which are more flexible than "Instrument Flight Rules" and, within limits, allow pilots to go where they want.

From these data sets, prototypical flight tracks were developed for noise modeling. Known as "backbones," these tracks follow the central tendency of more dispersed paths flown by aircraft along each major flight corridor. Additional tracks are created to either side of the backbones to account for the dispersion within each corridor, and traffic is distributed normally onto each track to reflect the spreading of noise along the corridor. Figure 16 and Figure 17 depict all of the modeled flight tracks used to estimate existing exposure, Figure 16 showing departure tracks, Figure 17 showing arrivals. Each track is labeled with a name including the runway number, followed by "J" or "P" for jet or propeller, "D" or "A" for departure or arrival, and a numerical identifier. Touch-and-go tracks are labeled with the runway number, "TG" and "R" or "L" for right-hand or left-hand traffic patterns. Appendix C presents the flight track use percentages that were modeled by aircraft group.

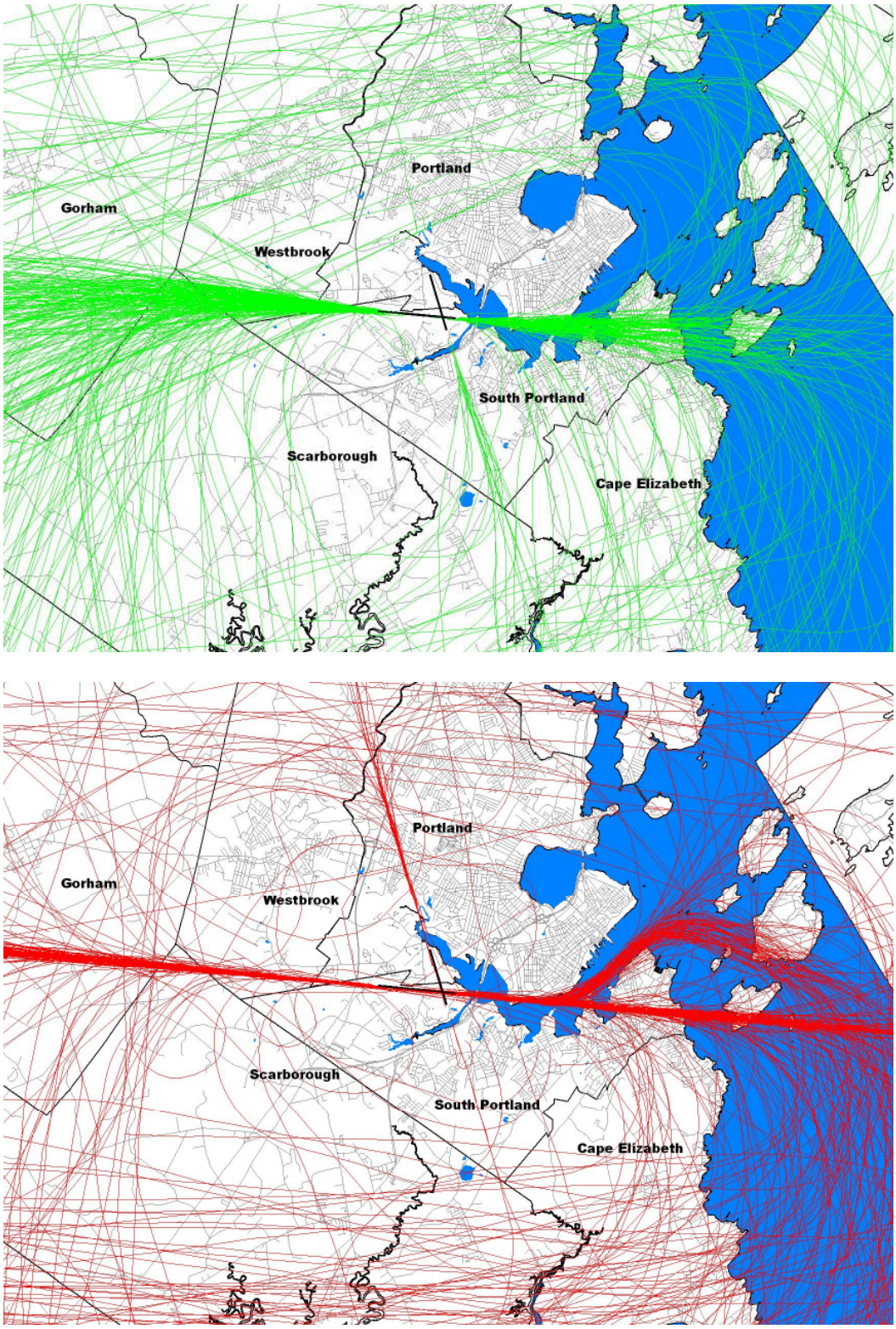


Figure 14. Sample of Radar Plots for Jet Departures (top) and Arrivals (bottom) at PWM

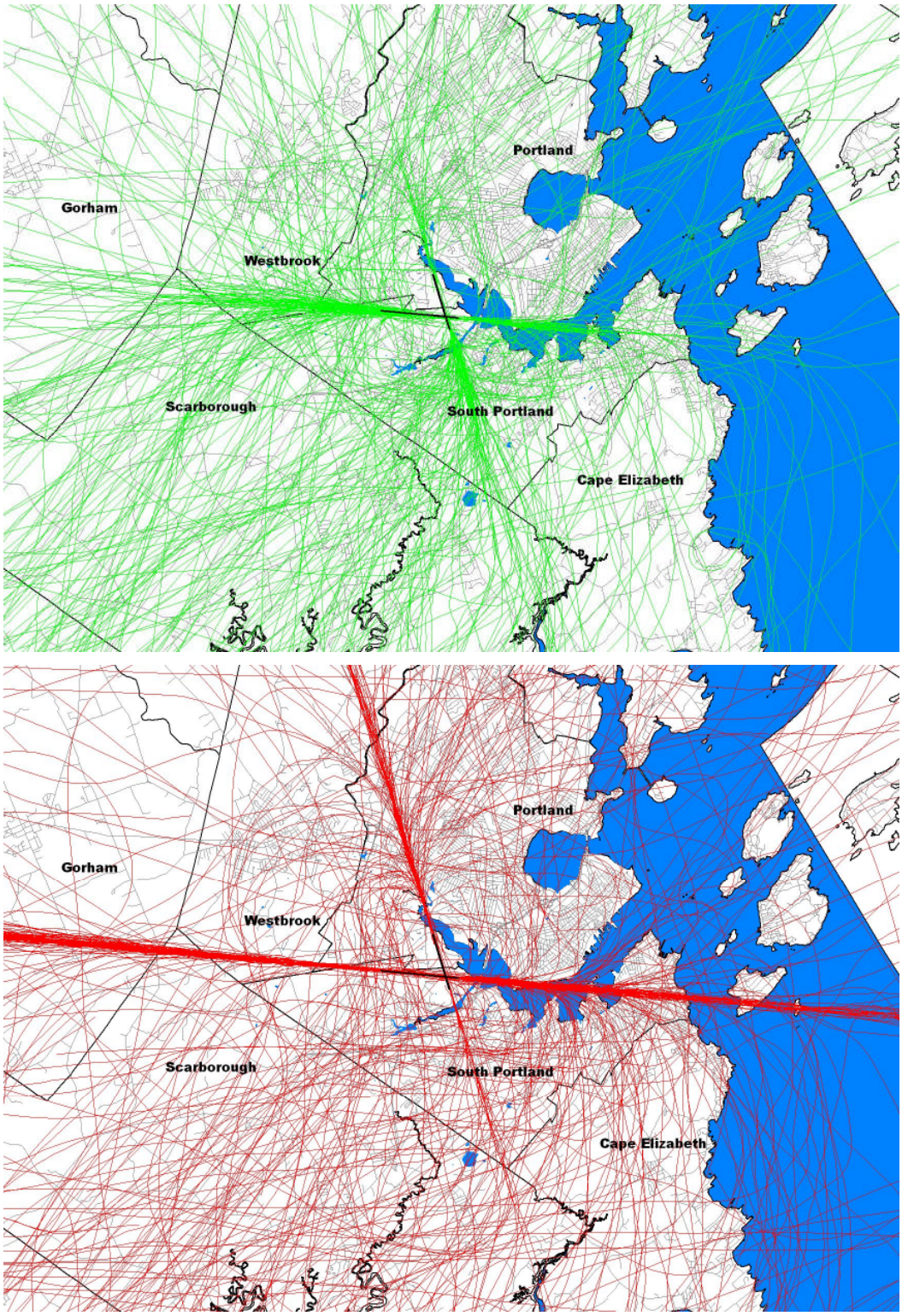


Figure 15. Sample of Radar Plots for Prop Departures (top) and Arrivals (bottom) at PWM

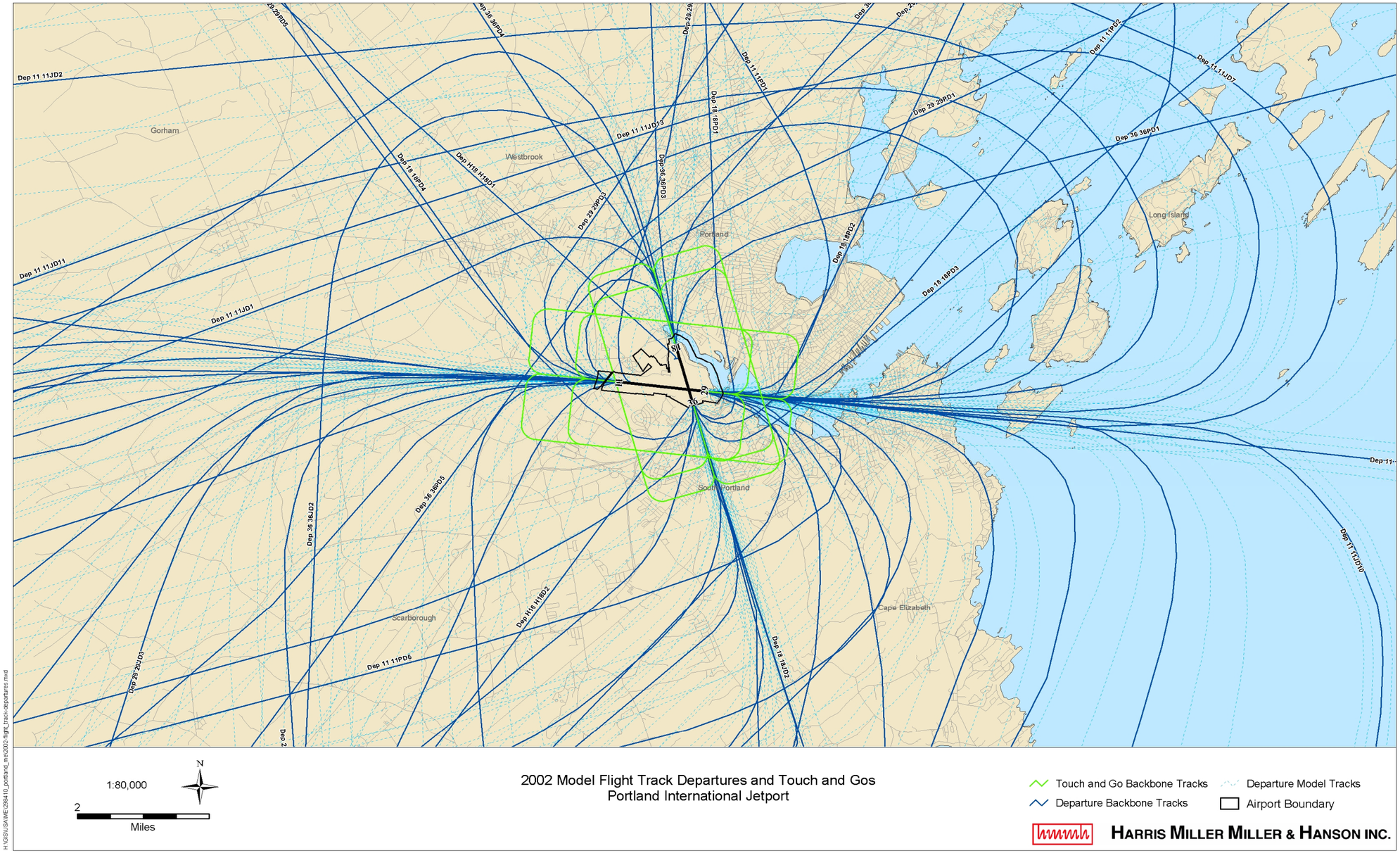


Figure 16. Modeled Backbone (dark) and Dispersed (light) Flight Tracks for Departures and Touch-and-Go's at PWM

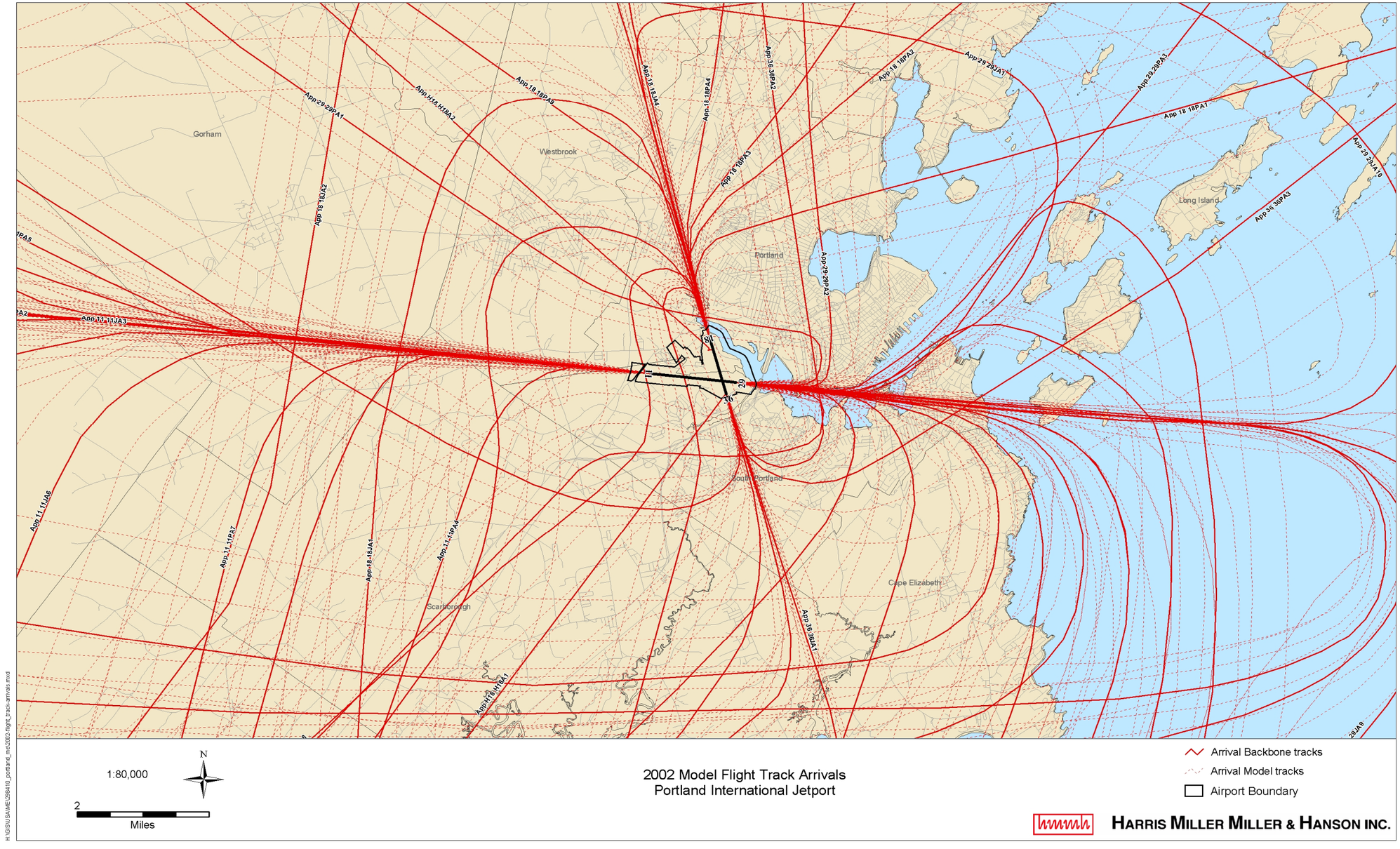


Figure 17. Modeled Backbone (dark) and Dispersed (light) Tracks for Arrivals at PWM

3.3 Effects of Existing Noise Compatibility Program on Current Noise Levels

In 1987, The City of Portland sponsored its first Part 150 Noise Compatibility Program for Portland International Jetport and proceeded to develop a series of 18 noise mitigation measures, which it submitted to the FAA for review in November 1989. On March 27, 1990, the FAA determined that the Noise Exposure Map was in compliance with the requirements of Part 150, and initiated the follow-on 180-day review period for the Noise Compatibility Program. The NCP was approved on September 21, 1990. Copies of the approving letters from FAA appear in this document in Appendix E.

The 1990 NCP included a number of operational measures as well as administrative and land use measures, the effectiveness of which can clearly affect the existing noise environment. This section of Chapter 3 assesses the influence of each of the approved measures, using quantifiable data where feasible to judge the benefits of each.

3.3.1 Noise Barrier at the Approach End of Runway 18 -- Approved

Preliminary design of the proposed 15- to 20-foot barrier was approved by FAA with the expectation that it would reduce noise of individual taxi operations as well as departure noise caused of aircraft taking off on Runway 18. The benefit was expected to be as much as 12 to 16 dB for several homes near the intersection of Westbrook Road and Yellowbird in Stroudwater. However, community concerns for the visual impact of the structure eventually required sitting the barrier in a less optimum position, reducing its effectiveness by 3 to 4 dB. While still beneficial, it has no significant effect on noise from aircraft in flight or on resulting DNL contours.

Figure 18. Noise Barrier at North End of Runway 18

3.3.2 Hush House on East End of Airport Property -- Approved

The original Part 150 anticipated the need for a hush house so that Bar Harbor Airlines could conduct maintenance run-ups near its hangar. Bar Harbor no longer operates at PWM so the need for the hush house has disappeared. The City has no plans to construct the facility at this time.

3.3.3 *Preferential Use of Runway 29* – Approved

The approved measure identifies Runway 29 as the preferred runway for noise abatement for morning departures and Runway 11 as preferred for late night arrivals. Portland Tower incorporated the measure into its standard operating procedures, PWM 7110.4 CHG 1, dated 7/31/01, with wording as follows:

> *(a) Runway 11/29 is preferable to runway 18/36.*
> *(b) Runway 18/36 is noise sensitive.*
> *(c) When the wind is less than ten knots, early morning departures should use runway 29, and late night arrivals should use runway 11.*
> *(d) Use if runway 11/29 is subject to the following conditions:*
> *i. Runway surface conditions are equal to or better than those of runway 18/36.*
> *ii. A crosswind greater than fifteen knots does not exist.*
> *iii. No tailwind exists, except as described in (c) above.*
> *(e) If the pilot of a turbojet or four engine turboprop aircraft requests another runway, honor the request to the extent that air traffic and other conditions permit, and advise the pilot that the runway requested is noise sensitive.*

To evaluate the effectiveness of the measure, HMMH analyzed the radar data from May and June 2002, disaggregating arrivals and departures by runway and by hour of the day to check for preferred runway use. If the procedure were being utilized effectively, one would expect to see heavier use of 29 for early morning departures, followed later in the day by heavier use of Runway 11 for arrivals. Figure 19 shows the results of the analysis. The top half of the figure clearly confirms that from 4:00 a.m. to 9:00 a.m., almost all departures used the preferred runway, after which there is a more balanced distribution onto both 11 and 29. Similarly, although involving many fewer operations, the bottom half of the figure shows that late night arrivals from midnight to 1:00 a.m. and 4:00 to 5:00 a.m. are all landing 11.

In total, the 1990 NCP anticipated that with the preferred runway use, larger jet traffic would utilize Runway 29 60% of the time, and Runway 11 40%. In fact, Table 14 indicates that present usage is almost exactly in those proportions. The measure appears to have been implemented exceptionally well.

3.3.4 Preferential Arrival Route -- Approved

Under this measure, Air Traffic Control is expected to give vectors (assigned headings) so that aircraft approach Runway 29 from the north and make greater use of the airspace over Portland Harbor. The preferred arrival corridor in this case is to follow the published Harbor Visual Approach Procedure (HARBOR VISUAL RWY 29), illustrated in Figure 20. Though only usable during VFR weather conditions, the procedure is flown by nearly half of the aircraft landing on Runway 29, as reflected in the radar data sample of jet arrival paths seen in the lower half of Figure 14. Given the current limitations of the procedure, it appears to be reasonably effective at keeping aircraft over the Fore River, but the present Noise Advisory Committee prefers to see even more traffic using it, or a new, more refined measure for use in instrument conditions. New measures will attempt to achieve this.

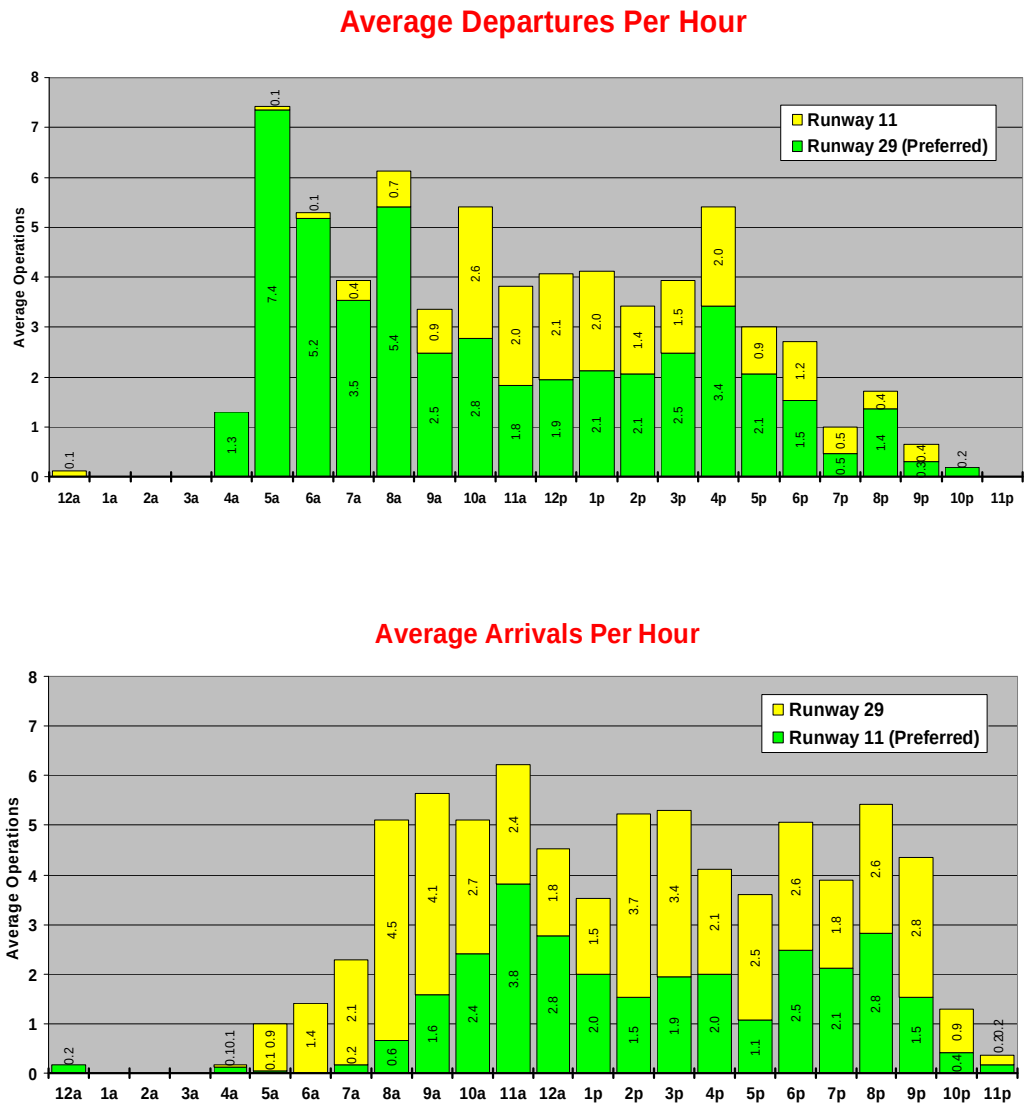


Figure 19. Departure and Arrival Use of Preferred Runways by Time of Day

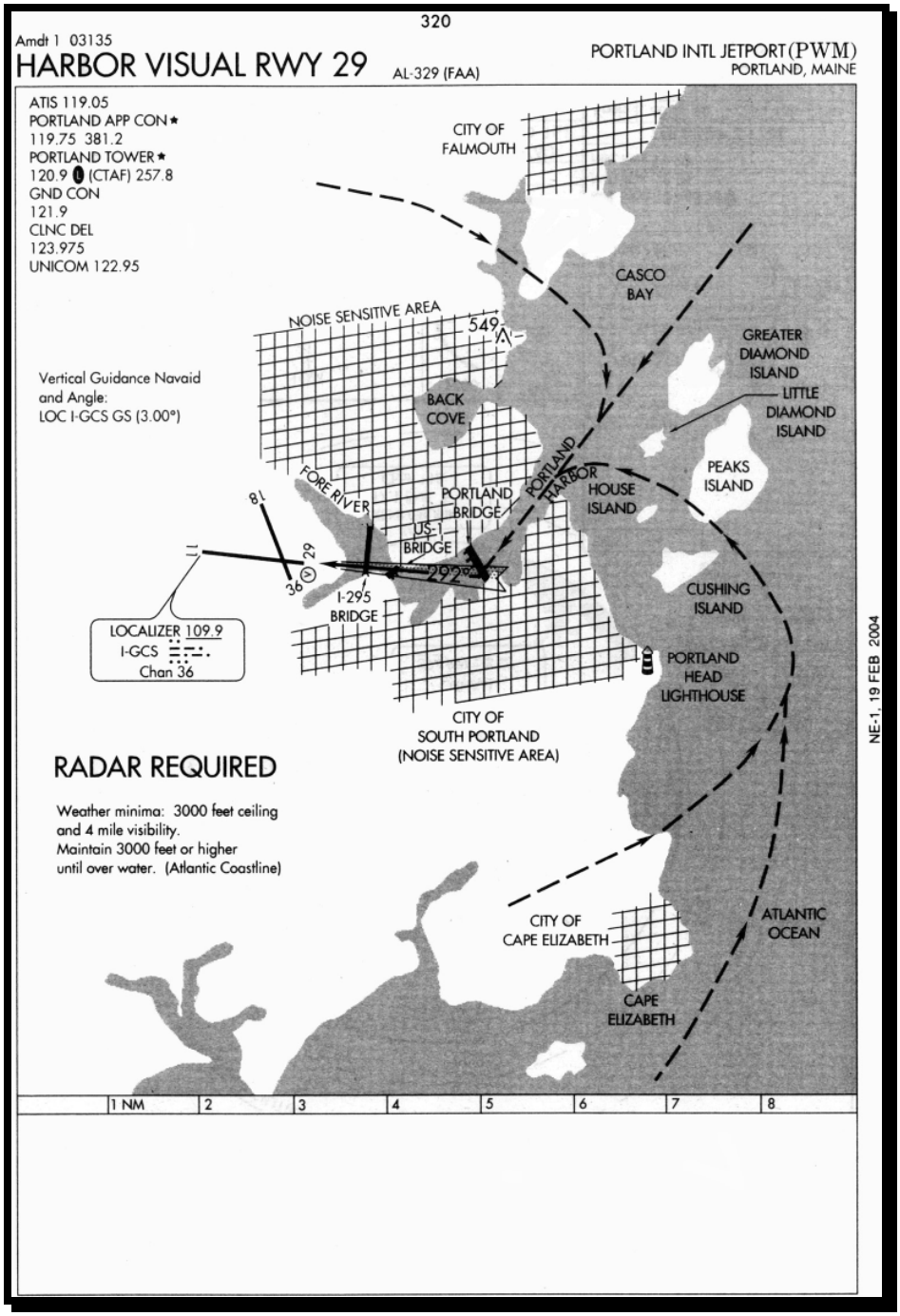


Figure 20. HARBOR VISUAL RWY 29 Approach Procedure

3.3.5 *Runway 11 Preferential Departure Routes* – Approved

This measure identifies three routes – (1) a right turnout as soon as possible; (2) left turns to overfly the Fore River, and (3) straight out on runway heading until reaching 3,000 feet. The measure is characterized more generally as fanning. Radar traces of departures off of Runway 11, seen in the top half of Figure 14, show most traffic heading straight out, but there also exists significant dispersion among those aircraft making right turns after takeoff, and only a very few operations make left turns. In fact, none of the latter group appears to follow the Fore River, despite the fact that an existing Standard Instrument Departure, the CASCO DEPARTURE, exists for use as a noise abatement procedure. Taken in combination, the three routes appear more representative of arbitrary departure headings rather than three well-defined corridors.

During the course of the NAC meetings for this Update, essentially all current departure tracks off of Runway 11 were identified as problematic. Measures proposed in this Update focus on elimination of early right turns and increasing the number of aircraft departing up the Fore River.

3.3.6 *FAA Advisory Circular (AC) 91-53 Noise Abatement Departure Profiles* – Approved

The study team was unable to identify how many operators utilize the AC 91-53 Departure Profile, so the effectiveness of the measure is unknown. Nevertheless, it is beneficial as a mitigation measure and the present Update study will continue to recommend its use.

3.3.7 *Monitor Proposals for New Scheduled Operations Between 11:30 p.m. and 6:15 a.m.* – Approved in part

The measure was approved to the extent that it established an administrative procedure for review of proposed airline service; however, the FAA disapproved the measure to the extent that it appeared to grant the Noise Abatement Committee the right to delay access to PWM through extended negotiations. Based on discussions during the present Part 150 Update, it appears the measure was never implemented effectively; for example, members of the NAC complained to Airport Management regarding lease negotiations that were carried out without Committee knowledge. The NAC expressed interest in having improved communications on this issue.

3.3.8 *Noise Abatement Committee Review of Implementation* – Approved

The previous Part 150 Advisory Committee was authorized to continue in operation as a Noise Abatement Committee to review compliance with approved measures. The Committee still exists and served a valuable role debating new measures in this Part 150 Update. Many of the members have been serving in that capacity since the time of the original Part 150 study and believe it is important for the NAC to continue.

3.3.9 *Quantitative Review of Changes in Noise Exposure* – Approved

EXP is a tool to track changes in noise exposure without going through a major noise-modeling exercise each year. Airport Management is to compute the metric to determine whether the NCP should be reevaluated and new noise contours prepared, but the metric has never been computed. Instead, the Jetport has made the effort to update more detailed noise contours every five years – 1987 as part of the original Part 150, 1993 as part of a Master Plan Study, 1998/1999 as part of an Environmental Assessment for the runway extension, and 2002 as part of the updated Part 150.

3.3.10 *Recomputation of Contours with Changes in Airport Layout or Operation* – Approved

The measure requires revising the NEM and reevaluating the NCP if a major change in airfield layout or operations is proposed. Neither of these events has occurred since the original Part 150 Study was completed in 1990, but the interim studies identified in Section 3.3.9 are similar in intent.

3.3.11 Minimum Time Interval Between Preparation of New Noise Contours -- Approved

New noise contours must be updated at least every five years. Although the current Part 150 Update follows the original study by more than 10 years, interim contours *have* been developed, as indicated in Section 3.3.9.

3.3.12 *Land Acquisition and Relocation* – Approved

A mobile home park consisting of 20 homes within the original 70 DNL contour was approved for purchase and relocation. However, the subsequent 1993 Master Plan Study found 57 residents exposed to long-term DNL levels above 65 dB, most located outside the City's jurisdiction, and concluded that homes in Maine were heavily insulated for weather anyway. Acquisition was never accomplished and a decrease in noise contour area makes the mobile home park no longer eligible.

3.3.13 *Soundproofing*—Approved

187 residential units and 4 non-residential units exposed to noise between DNL levels of 65 and 70 dB were identified for sound insulation pending structural and acoustic surveys. The Jetport has chosen *not* to pursue implementation.

3.3.14 Easement Acquisition Associated with Sound proofing – Approved

In areas eligible for sound insulation, avigation easements were recommended and approved. No action was taken to pursue implementation in connection with noise, but some easements have been acquired in connection with the runway extension.

3.3.15 *Airport Zoning Overlay District* – Approved

Noise-sensitive land uses would be restricted and required to meet specified construction standards. No action has been taken by affected jurisdictions.

3.3.16 *Easement Acquisition as Part of Proposed New Development* – Approved

The measure is intended to restrict land uses to those compatible with specified noise exposure levels. The easement would ensure the Jetport's right to overflight, cause noise, and prohibit obstructions to airspace. No action has been taken to pursue implementation for purposes of noise mitigation.

3.3.17 *Real Estate Disclosure* – Approved

Real estate disclosure was approved for inclusion in revisions to zoning ordinances. No action has been taken by any surrounding community to pursue implementation for purposes of noise mitigation.

3.3.18 *Undeveloped Land Acquisition* – Approved

This measure authorizes the Jetport to eliminate long-term compatibility issues associated with development in areas subject to DNL levels of 80 dB through voluntary purchase. DNL levels of 80 dB no longer exist off airport property. Jetport has closed on 75 acres for new general aviation apron.

In sum, of the 18 measures that comprise the Jetport's current Noise Compatibility Program, three have a significant effect on current exposure levels: the preferential runway use program, the Harbor Visual Approach Procedure, and the fanned departure headings used off of Runway 11. The combined effects of all three of these measures are included within the operations data that comprise the inputs to the INM.Annual average DNL values produced by the operations identified in the previous sections of this chapter have been computed using version 6.0c of the INM. The exposure levels are shown later in as a set of contours in 5-decibel increments ranging in value from 55 dB to 75 dB. A DNL of 55 dB is the EPA's level of community noise exposure identified as requisite to protect public health and welfare with a 5-decibel margin of safety; it is a level typical of a suburban residential neighborhood. A DNL value of 60 dB protects health and welfare without the margin of safety and is typical of an urban residential neighborhood. Levels of 65, 70, and 75 dB are key land use compatibility guidelines identified earlier in Table 3.

3.4 Sound Propagation Factors Unique to PWM

One final factor affecting noise exposure in certain communities around Portland International Jetport is how the sound from aircraft propagates into surrounding neighborhoods. With reference to Figure 21 below, INM 6.0c is very good at predicting noise from aircraft in flight (as along sound propagation path 1), but it does less well at predicting noise from aircraft on or near the ground (along propagation path 2), especially if the propagation is across water or up a hill (as along propagation path 3).

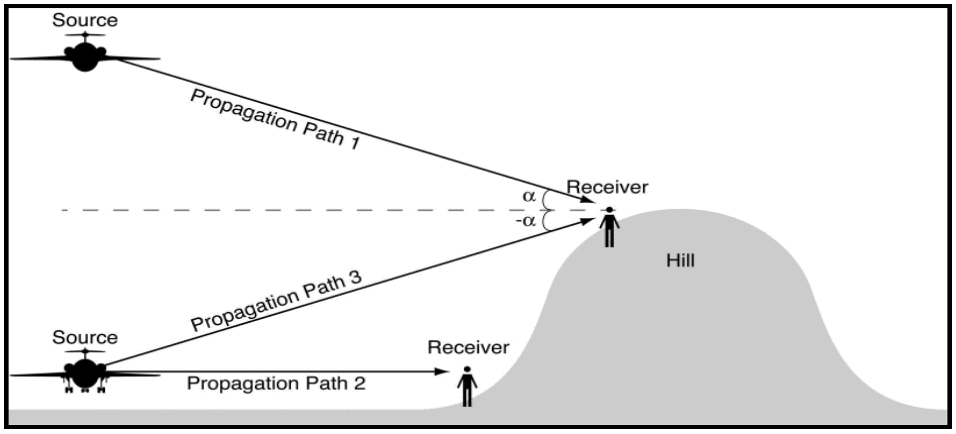


Figure 21. Typical Sound Propagation Paths near Airports

The model oversimplifies these latter two propagation possibilities by assuming that the sound travels over a smooth, grass-covered surface extending uniformly from the source to each individual homeowner in the community – a large horizontal surface from the aircraft to the person at the base of the hill along propagation path 2, or over a large sloped surface between the aircraft and the person at the top of the hill along propagation path 3. In both cases, the model ignores the possibility that there may be intervening

buildings, hilly terrain, or other structures that partially shield the noise coming from aircraft on or near the runway. In those situations, noise would be *less* than the INM would predict. Conversely, the model ignores the possible presence of acoustically "hard" surfaces (such as water) that reflect sound, and it ignores terrain that rises steeply and causes little or no interference with sound. In those situations, noise levels would be *more* than the INM would predict. In fact, a July 2000 study of terrain effects on aircraft noise in East Boston near Logan Airport showed that measured SELs from aircraft at their start of takeoff from one of Logan's main runways were 8 to 10 decibels *higher* at the top of a steep 150-foot high hill than were measurements of the same aircraft recorded at the bottom of the hill. And as expected, *no* differences existed from the top to the bottom of the hill for aircraft in flight. The report attributed the difference for aircraft on the ground to a reduction in ground effect as the elevation of the terrain increased.[3] Massport, as operator of Logan Airport, received FAA approval to adjust its annual noise contours to accommodate this previously unrecognized phenomenon within the INM and has continued to adjust its contours for "hill effects" each year since.

With terrain features around PWM similar to those at Logan, the Part 150 Noise Working Group requested a comparable evaluation of terrain effects, particularly along the Western Promenade ("Prom"), to determine whether adjustments should be made to the contours in this study. The photograph in Figure 22 illustrates the concern in this neighborhood that the INM's normal ground-to-ground propagation algorithms may not be applicable when considering the contribution of noise from aircraft beginning their takeoff on Runway 29 at the left side of the picture then rolling down the runway away from the camera towards the center of the photo as they lift off and begin their climb. With Runway 29 used for takeoff almost 60 percent of the time, the potential for underestimating exposure in this area is high.

Figure 22. View from Western Prom Looking Westward towards Runway 29

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[3] Miller, R.L., and Reindel, E.M., "Terrain Effects on Aircraft Noise in East Boston", for the Massachusetts Port Authority; July 2000

No measurement program similar to the one for Massport was undertaken in this Part 150 Update to justify terrain adjustments in *any* area around PWM; however, the New England Region of the FAA, who had reviewed the earlier study at Logan, agreed that if the consultant team believed terrain adjustments were appropriate for PWM, the Region would consider the application of similar adjustment techniques without a costly supplemental study.

To determine the appropriateness of adjusting contours for other-than-standard ground-to-ground sound propagation, HMMH produced a cross-section of the terrain from the rear of an aircraft at start-of-takeoff from the east end of Runway 29 towards homes along the Western Prom. Figure 23 compares that cross-section with the terrain in East Boston where the formal measurement program had proven the need for adjustment. The expanse of intervening water at each airport is shown as having "0" elevation.

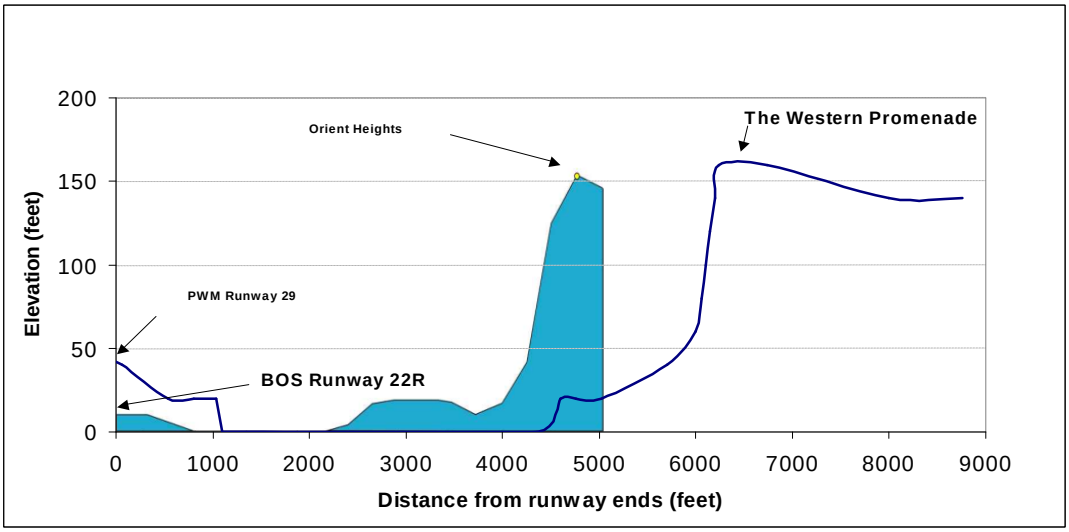


Figure 23. A Comparison of Terrain Cross-Sections at Logan and at PWM

The elevation angle from an aircraft at start of takeoff to the top of each respective hill is actually about 0.5 degrees less for the Western Prom than it is for Orient Heights; however, there is more than a half-mile of water between the runway and the Western Prom compared to less than 1,500 feet of water between the runway and Orient Heights. The water's surface cause's sound to propagate more easily over long distances rather than be partially absorbed by intervening soft ground as is assumed by the INM. The combination of these factors (terrain elevation and expanse of water) suggests sound produced by aircraft taking off on Runway 29 (*away* from the Western Prom) is apt to propagate as if the aircraft were in the air as opposed to on the ground – the same conclusion found in the Logan study.

Other areas around PWM do not share the same degree of similarity to Orient Heights. For example, north of PWM the Fore River narrows and there is only a slight terrain difference between start of takeoff for Runway 18 and homes along Fenway Street south of Congress Street. The Logan study showed that small elevation changes and small expanses of water resulted in no measurable effect on noise levels in the community. The INM's ground-to-ground propagation assumptions were reasonable.

Based on these observations, HMMH believes the areas most likely to experience reduced ground effect as sound propagates into the community are northeast, east, and slightly southeast of the Jetport, the greatest effect generally being on a bearing of about 065 degrees from the east end of Runway 29. In

anticipation of FAA acceptance of this limited finding, HMMH applied corrective adjustments by negating the effects of the standard ground-to-ground attenuation algorithms for a collection of grid points in these areas, then combined the adjusted and unadjusted grid points back into a single file used to plot the revised noise contours. The process mirrors the adjustments made on the Logan study. A comparison of the unadjusted and adjusted contour sets is shown in. From that, it is easy to see that the over-water adjustment accounts for a maximum increase in exposure on the order of 3 dB to the east of the Jetport, but slims to about a 1 dB increase just west of the I-295 bridge, then quickly melds into the no change at all west of the intersections of 11/29 and 18/36.

Also shown in are population "centroids" – points defined by the U.S. Census Bureau representing a concentration of people within a census block, each centroid having all the demographic characteristics of the population living within the block; e.g., number of residents, number of dwelling units, income levels, etc. Centroids included within a DNL noise contour are used to estimate the numbers of people living within various contour intervals. Table 16 later in this Chapter presents the numbers of residents living within each 5-decibel increment of exposure from DNL 75 down to DNL 55.

3.5 Comparisons to 2003 Operations and Noise

Because this NEM is being filed for review with FAA in 2004 using 2002 as a baseline period to assess the benefits of noise mitigation, Part 150 requires that operations be examined for a more recent past period to determine whether the findings of this NEM Update are still applicable. As a rough approximation of the similarity of the two periods, Part 150 permits use of the older period if the number of operations has not changed by more than 15 percent.

To support 2002 as the baseline period, PWM staff provided counts of enplanements (passengers getting on scheduled and chartered flights) and deplanements (passengers getting off) for each of the two most recent calendar years as an indicator of change in commercial activity. For 2002, enplanements numbered 630,837, decreasing by only 1,752 in 2003, a 0.3 percent difference. Deplanements were 620,331 in 2002 and increased by 4,017 in 2003, a 0.6 percent difference. By this measure, commercial activity remained essentially unchanged over the two-year period.

A better indicator of actual operations levels are the FAA ATCT traffic counts that are kept daily by air traffic controllers. These are compiled in monthly reports and summarized annually on an FAA web site (www.apo.data.faa.gov/atads/towers). PWM counts for 2002 totaled 102,630 and in 2003 totaled 88,143, a decrease in activity of 14.1%, most of it attributable to declining general aviation operations. Commercial air carrier and air taxi operations declined from 45,086 in 2002 to 42,658, a decrease of only 5.4%. Given that these aircraft account for many of the higher noise levels at PWM, the overall exposure in terms of average daily DNL is likely to have changed by less than ½ dB from one year to the next.

Traffic in the first three months of 2004 continues to decline, again primarily in the general aviation sector. Overall counts for January, February and March 2004 were 17,565, down from 22,005 for the first three months of 2002, a decrease of 20.2% over the two-year period. However, air carrier and air taxi flights during the same three-month periods were 9,916, down from 10,552, only a 6.0% decline over the two years. If this trend were to continue for the remainder of 2004, the estimated change in the average daily DNL from 2002 is still estimated to be no more than ½ dB from 2002 to 2004.

In summary, the changes in commercial traffic over the past two years, while downward, have been modest with little change in the mix of aircraft types serving the Jetport. The greater changes have been among general aviation operators who have seen more significant declines in traffic, primarily in small

propeller-driven aircraft, which have the least effect on noise. The 2002 baseline period for this study is thus still considered a reasonable estimate of existing exposure levels.

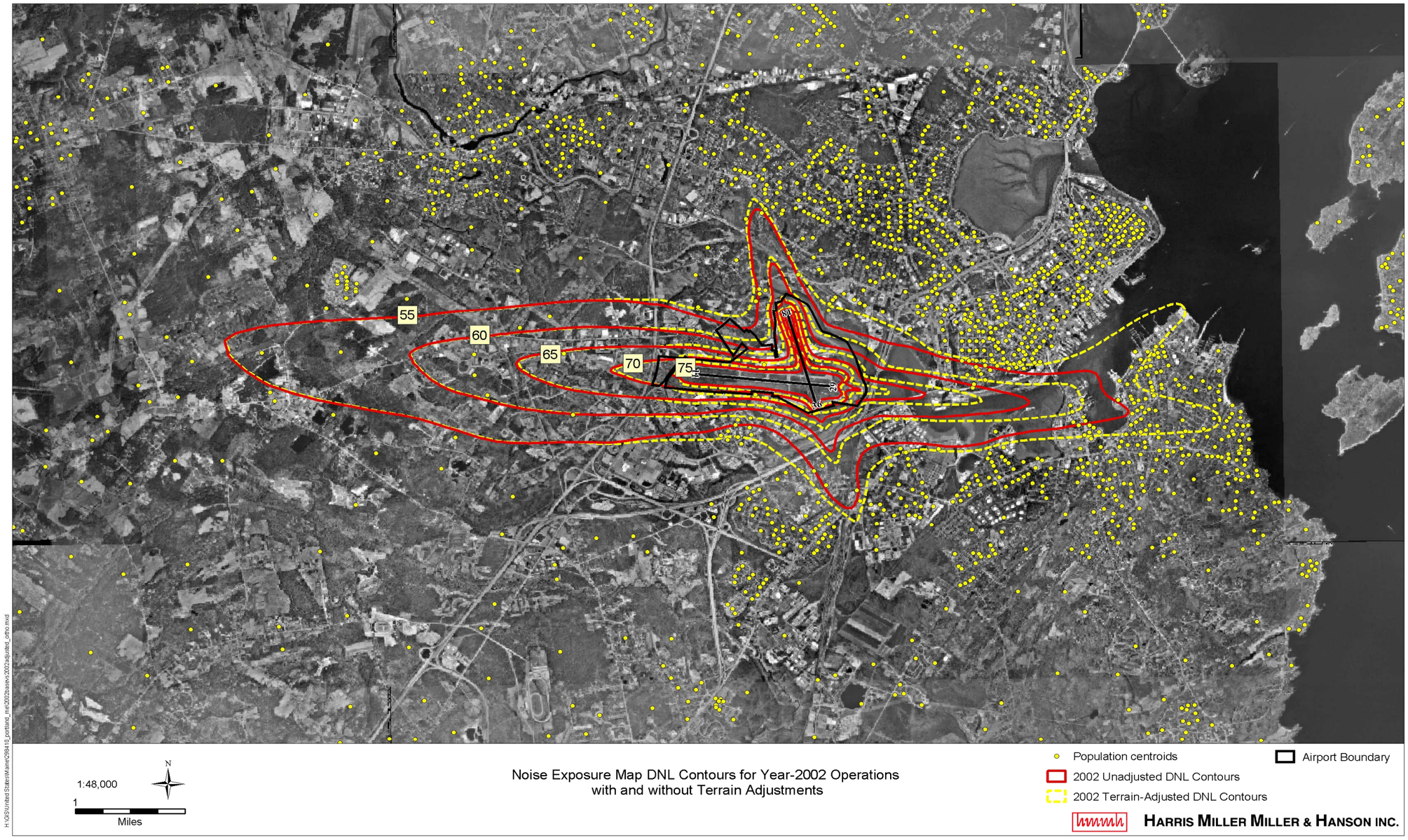


Figure 24. Noise Exposure Map DNL Contours for Year-2002 Operations with and without Terrain Adjustments

3.6 Comparison of Existing Exposure with 1986/1987 Levels

Though Part 150 has no requirement to make comparisons between the original study and the present Update, it may at least be of interest to observe just how much the noise exposure has changed over that time frame. Figure 25 provides a comparison of the two study periods. For consistency with the older DNL contour analysis, neither of these cases includes the terrain adjustment, and contours are only shown down to values of 60 dB.

It is still clear from looking at the two contour sets that noise has decreased on the order of 7 to 10 decibels off the ends of Runways 11 and 29, but mixed results exist off of Runway 18/36. To the south, exposure has decreased 2 to 3 dB, while to the north exposure has increased by about 4 dB. The decrease in noise east and west of the main runway is the result of the elimination of FAR Part 36 Stage 2, air carrier jets that were commonplace during the earlier period 1986/1987. Stage 2 jets over 75,000 pounds were required by Federal regulation to be phased out of service by January 1, 2000, and these older, noisier jets were either replaced with newer aircraft manufactured to meet more stringent Stage 3 noise standards, or they were retrofitted with new or hushkitted engines to comply with the Stage 3 limits. There are now 18 fewer operations per day in these old and noisy aircraft, replaced instead by smaller and much quieter RJs. Reduced operations by Boeing727 aircraft alone account for almost a 5 dB reduction in exposure off the main runways. This is clearly a significant improvement. However, because relatively few of these older Stage 2 or re-certified Stage 3 aircraft ever used the shorter crosswind runway, 18/36, the changes that have occurred off of it are likely caused by differences in runway use between the earlier and the current study.

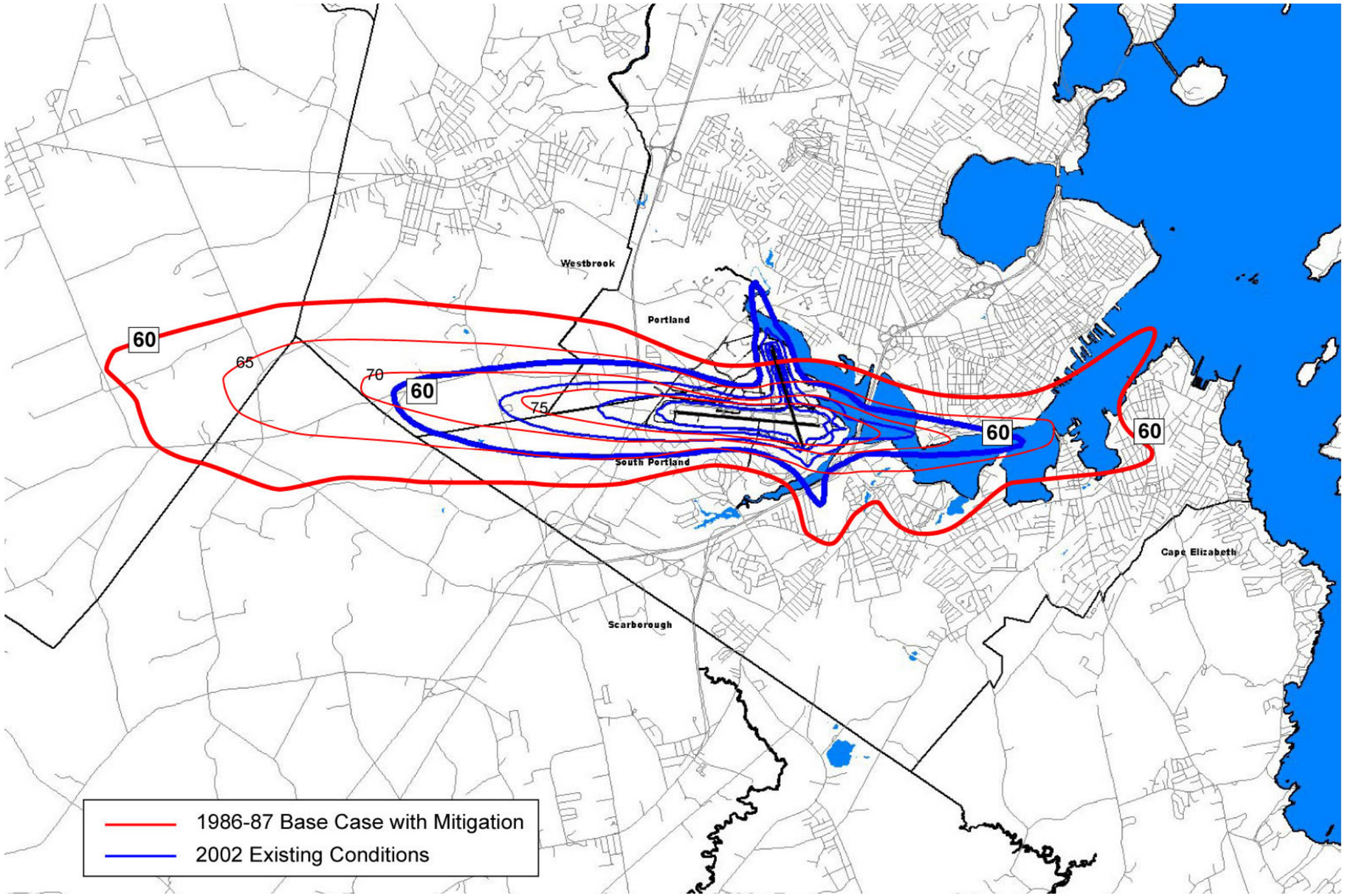


Figure 25. Comparison of DNL Contours for 2002 to those from 1986/87 Part 150 Study

4 FORECAST OPERATIONS AND NOISE LEVELS FOR 2007

HMMH's subcontractor SH&E conducted a five-year forecast for the PWM Part 150 Update, the purpose being to provide a forward-looking estimate of how noise is apt to change at the Jetport with and without additional noise mitigation measures, especially any that entail land use measures. The firm's report is presented in full in Appendix E. A brief summary of their findings is reported here.

In preparing the forecast, SH&E analyzed trends in aviation at both a local and a national level, recognizing that the events of 9/11 had, and continue to have, a significant bearing on the entire aviation industry. Four segments of the fleet were analyzed independently to arrive at as refined an estimate as possible under the strained economic conditions: (1) commercial air carrier and air taxi operations, (2) cargo operations, (3) charter activity, and (4) general aviation.

Factors affecting the forecast of scheduled operations included local population growth, income growth, historical enplanements, shifts in passenger preferences towards regional jet operators, load factors, prior point-to-point service by jets and turboprops, and new aircraft orders by carriers serving Portland. Cargo activity was determined to remain relatively unchanged, and general aviation operations were estimated to grow at a slower than national average rate.

The culmination of these individual estimates is the comprehensive listing of 120,830 annual operations for 2007, disaggregated by aircraft type and summarized in Exhibit 22 of Appendix E. As with existing operations, for calculations of annual average DNL noise exposure levels, these annual numbers are divided by 365 to determine the number of operations per day. They are listed in Table 15 below.

Since no major airport layout changes are anticipated in this study, the runway utilization rates, flight track geometry, and flight track utilization rates are assumed to remain the same as modeled for the existing 2002 conditions.

Future noise exposure levels predicted to occur as a result of this forecast activity are shown in Figure 26 and are compared to the 2002 exposure levels shown earlier in Figure 24. Again, DNL contours are shown in 5-decibel increments from 55 to 75 dB and include the adjustment for over-water sound propagation and terrain effects in the same areas north and east of the Jetport as adjusted in the 2002 scenario. The increased traffic volume in 2007 results in very minor increases in noise exposure off of each runway end, except along the lobe extending northeastward out the Fore River where the forecast case is slightly less than the 2002 scenario. However, in no area is the noise expected to change by more than a few tenths of a decibel, which is considered to be insignificant.

Figure 26 represents the future baseline Noise Exposure Map against which proposed noise compatibility measures will be judged for effectiveness and degree of improvement.

Table 15 2007 Modeled Average Daily Aircraft Operations

Source: SH&E, 2002

Aircraft Category	INM Aircraft Type	Arrivals		Departures		Touch and Go's		Total
		Day	Night	Day	Night	Day	Night	
Large Jet	737300	1.37	0.63	1.69	0.31	0.00	0.00	4.00
	737400	0.03	0.00	0.03	0.00	0.00	0.00	0.07
	737700	0.62	0.27	0.76	0.13	0.00	0.00	1.78
	727EM2	0.16	1.27	1.25	0.18	0.00	0.00	2.86
	7373B2	1.37	0.63	1.69	0.31	0.00	0.00	4.00
	A320	1.96	0.89	2.41	0.45	0.00	0.00	5.71
	DC93LW	0.05	0.38	0.37	0.06	0.00	0.00	0.86
	DC95HW	0.03	0.25	0.25	0.04	0.00	0.00	0.57
	KC135	0.31	0.00	0.31	0.00	0.00	0.00	0.61
	MD88	2.00	0.89	2.44	0.45	0.00	0.00	5.78
Large Jet Subtotal		7.90	5.22	11.19	1.93	0.00	0.00	26.24
Regional/Corporate Jet	CIT3	0.74	0.03	0.66	0.11	0.00	0.00	1.55
	CL600	2.02	0.51	1.89	0.64	0.00	0.00	5.07
	CL601	16.12	5.28	15.33	6.07	0.00	0.00	42.80
	CNA500	0.63	0.02	0.56	0.09	0.00	0.00	1.31
	CNA750	0.11	0.00	0.10	0.02	0.00	0.00	0.24
	EMB135	5.27	1.73	5.01	1.99	0.00	0.00	14.00
	EMB145	8.74	2.86	8.31	3.29	0.00	0.00	23.20
	FAL20	0.11	0.00	0.10	0.02	0.00	0.00	0.24
	FAL90(1)	1.03	0.04	0.92	0.15	0.00	0.00	2.14
	GIIB	0.11	0.00	0.10	0.02	0.00	0.00	0.24
	GIV	0.29	0.01	0.26	0.04	0.00	0.00	0.59
	GV	0.23	0.01	0.20	0.03	0.00	0.00	0.48
	IA1125	0.17	0.01	0.15	0.02	0.00	0.00	0.36
	LEAR25	1.20	0.05	1.07	0.17	0.00	0.00	2.50
	LEAR35	6.52	0.26	5.83	0.95	0.00	0.00	13.56
	MU3001	4.35	0.17	3.89	0.63	0.00	0.00	9.04
Regional/Corporate Jet Subtotal		47.67	10.99	44.41	14.25	0.00	0.00	117.31
Turboprop	BEC190	3.67	0.33	3.63	0.37	0.00	0.00	8.00
	C130E	0.26	0.00	0.26	0.00	0.00	0.00	0.51
	CNA441	2.28	0.16	2.02	0.43	0.00	0.00	4.90
	DHC6	2.33	0.17	2.06	0.44	0.00	0.00	5.00
	DHC8	4.71	0.34	4.16	0.89	0.00	0.00	10.11
	DO328	0.92	0.08	0.91	0.09	0.00	0.00	2.00
	L188	0.87	0.06	0.77	0.17	0.00	0.00	1.88
	SD330	0.10	0.01	0.09	0.02	0.00	0.00	0.21
	SF340	1.83	0.17	1.81	0.19	0.00	0.00	4.00
Turboprop Subtotal		16.97	1.32	15.69	2.61	0.00	0.00	36.60
Piston	BEC58P	6.65	0.18	6.20	0.64	8.79	0.15	22.62
	CNA172	16.32	0.45	15.20	1.57	21.30	0.66	55.49
	CNA206	3.94	0.11	3.67	0.38	4.97	0.34	13.40
	GASEPF	9.98	0.49	8.37	2.09	10.79	3.04	34.76
	GASEPV	6.16	0.17	5.74	0.59	8.09	0.20	20.94
Piston Subtotal		43.05	1.39	39.18	5.27	53.94	4.39	147.21
Helicopter	B206L	1.61	0.23	1.69	0.15	0.00	0.00	3.68
Total		117.20	19.16	112.15	24.20	53.94	4.39	331.04

(1) Modeled at FAA direction as LEAR35+1.8 dB

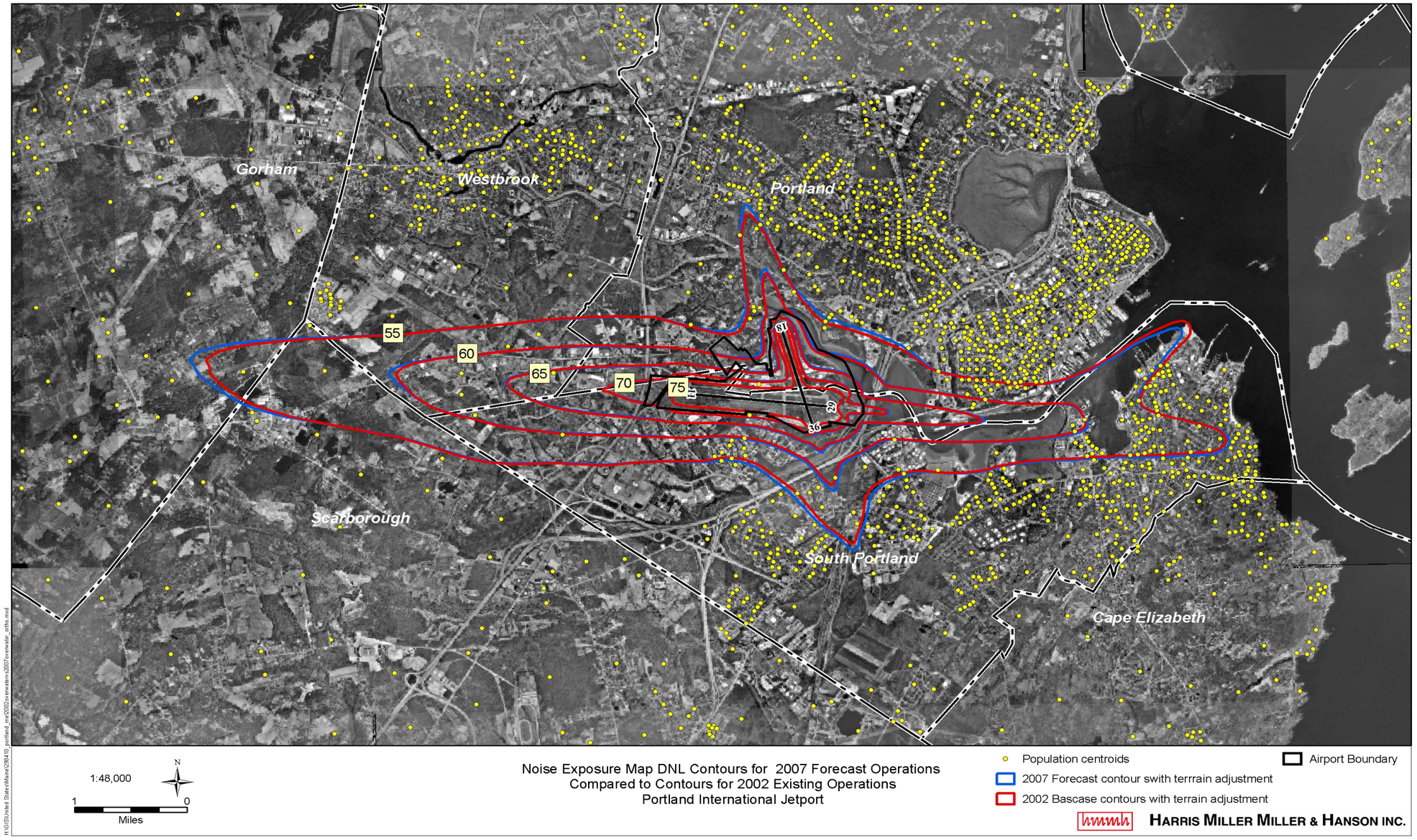


Figure 26. Noise Exposure Map DNL Contours for 2007 Forecast Operations Compared to Contours for 2002 Existing Operations

5 EXISTING LAND USE AND POPULATION COUNTS

Land uses within the study area include undeveloped, commercial/industrial, and residential land use, and are shown in Figure 27. Primary land uses north of the Jetport include commercial/industrial, low-intensity residential, and undeveloped land. To the west, land uses include undeveloped land, urban/recreation grasses, and low-intensity residential. Southwest of the Jetport is mostly commercial and industrial development, especially along the I-95 corridor. Low-intensity residential and undeveloped land is located directly to the south. High-intensity residential can be found a little further out and southeast of PWM, mainly along the I-295 corridor. The area immediately east of the airport mainly consists of the Fore River, followed by high- and low-intensity residential use atop the Western Promenade. Still further to the east, across the Fore River is an additional mix of high- and low-intensity residential use in South Portland and Cape Elizabeth.

Sources of land use data are limited for this study. With the exception of Westbrook, land use data are not available from local municipalities. Thus, the Study Team used National Land Cover Data (NLCD) from the U.S. Geological Survey (March, 2000). The NLCD is of limited value due to the way the land use categories are defined. For example, residential land use normally is not shown as part of airport property but because of the way NLCD defines developable land, Low Intensity Residential is shown on Figure 27 as part of the airport property. Table 16 defines the NLCD residential land cover classes used in Figure 27.

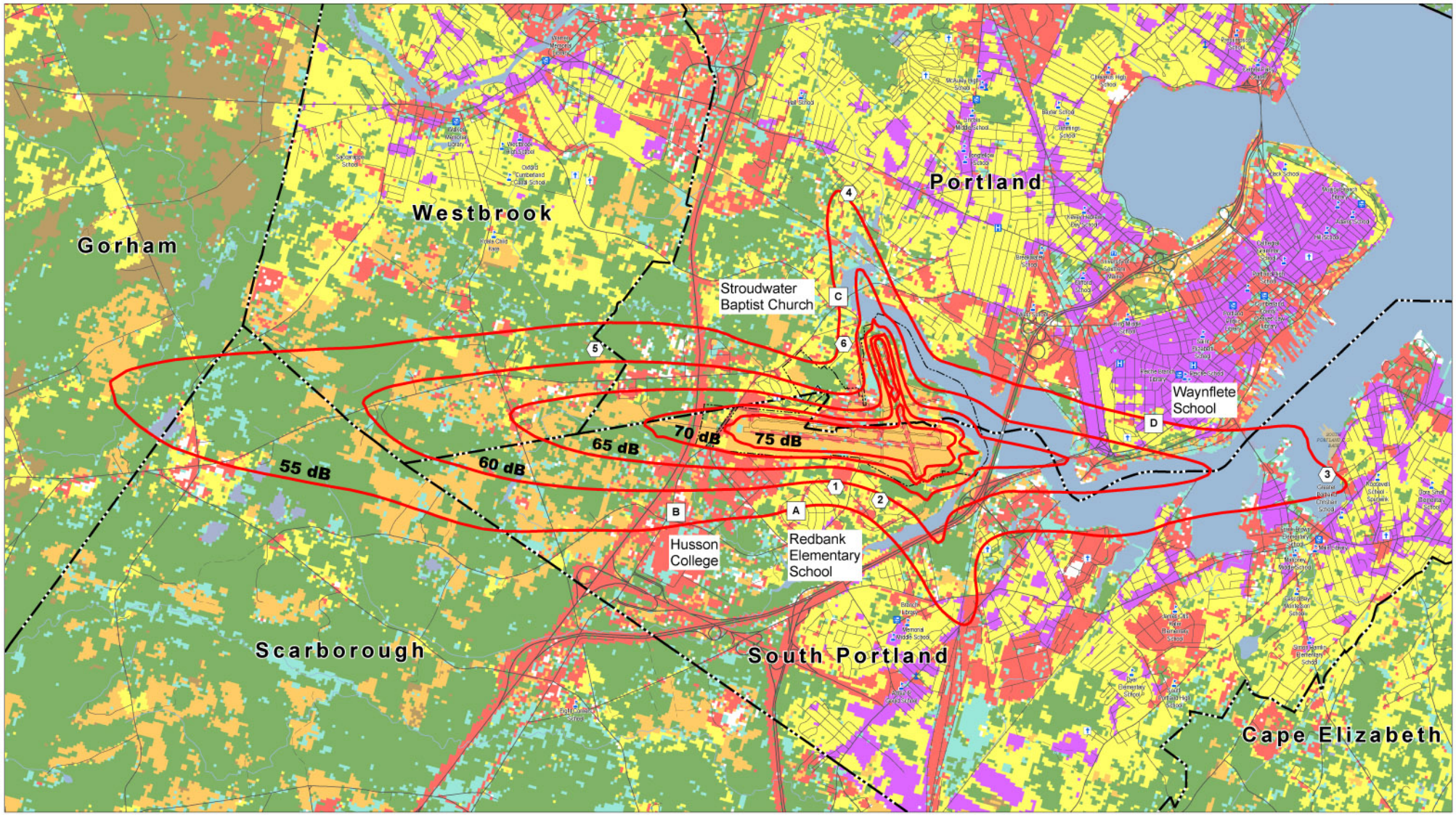
Table 16. NLCD Residential Land Use Cover Class Definitions

Class	Definition
Low Intensity Residential	Includes areas with a mixture of constructed materials (e.g. asphalt, concrete, buildings, etc.) and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20-70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas.
High Intensity Residential	Includes highly developed areas where people reside in high numbers. Examples include apartment complexes and row houses. Vegetation accounts for less than 20 percent of the cover. Constructed materials account for 80 – 100 percent of the cover.

Source: USGS website, 2003

5.1 Existing Noise-Sensitive Receptors

Existing noise sensitive receptors and their locations within the study area are shown in Table 17. The locations of these receptors are also shown on Figure 27. The receptors include three schools and one place of worship, though none of the four sites is exposed to a DNL greater than 60 dB. No hospitals or nursing homes are located within the study area. The sources used to identify the location of these existing sensitive receptors were the *Maine Atlas and Gazetteer*, feature datasets from the Maine Office of Geographic Information Systems (GIS), and from the Internet: MapQuest's *Yellow Pages and Medicare – Nursing Home Compare*. The receptors listed in these sources included schools, libraries, hospitals, nursing homes, places of worship, and cemeteries.



Portland ME (PWM) Part 150 Study

Figure 27. Existing Land Use Map

April 18, 2003

Data Sources: National Land Cover Data, U.S. Geological Survey (USGS), Updated March, 2000
Maine Office of GIS (MEGIS), Feature Datasets

2002 Airport Noise Contours

Planned Residential Developments in the Study Area (see Table 4)

Sensitive Receptors in the Study Area (see Table 2)

School
University / College
Library
Hospital
Place of Worship
Cemetery

Low Intensity Residential *
High Intensity Residential *
Commercial/Industrial/Trans.
Urban / Recreational Grasses
Undeveloped / Vegetated
Agriculture
Water
Wetlands
Manufacturing

* See Table 1 for definitions of these land use categories

Harris Miller Miller & Hanson, Inc.
Vanasse Hangen Brustlin, Inc.

0 0.25 0.5 1 1.5 Miles

Table 17. Noise-Sensitive Receptors in the Study Area

ID	Name	Address
A	Redbank Elementary School	29 Macarthur Circle N, South Portland
B	Husson College – Continuing Education Center	220 Maine Mall Road, South Portland
C	Stroudwater Baptist Church	1729 Congress Street, Portland
D	Waynflete School	360 Spring Street, Portland

5.2 Future Land Use

This section describes the areas zoned for residential use and future residential developments that are located within the study area. The data limitations that were encountered in creating a future zoning map are discussed as well.

5.2.1 Zoning

Zoning within the study area includes a combination of rural/undeveloped land, commercial/industrial/ business land, and residential land. The majority of residentially-zoned land in the study area is within the 55 dB DNL noise contour. Only Portland and South Portland have limited areas of land zoned for residential use within the 65 dB DNL noise contour. Although South Portland has land zoned as Rural Residential within the 70 and 75 dB DNL noise contours, the majority of this area is airport property.

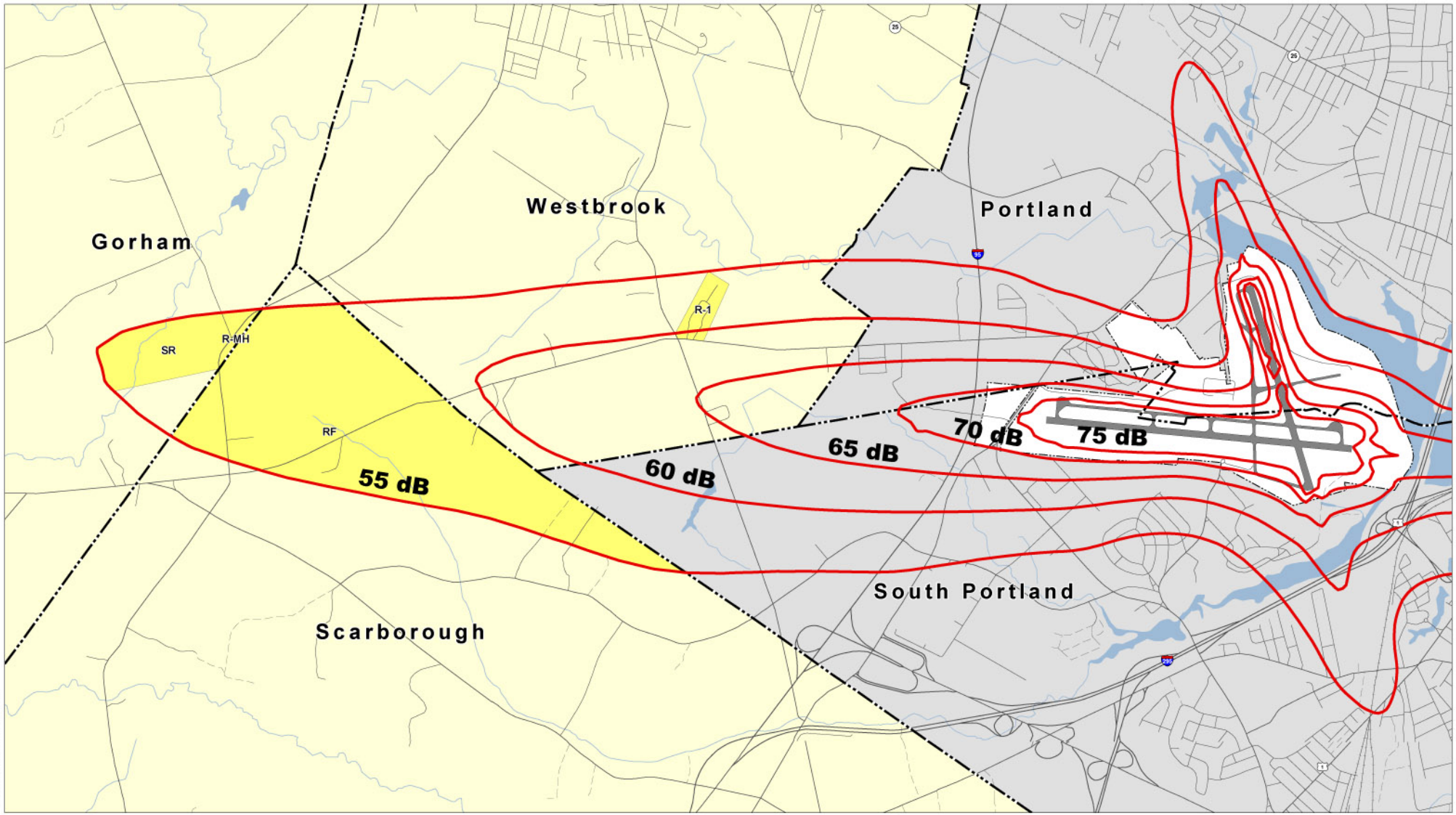
Definitions for the zoning classifications vary by municipality. The definitions for the zoning classifications that allow residential development by municipality are shown in Table 19. Zoning code information for each municipality was obtained from their respective Web sites. Existing zoning information was obtained from each of the municipalities in the study area in the form of paper zoning maps and discussions with local planners. The noise contours were transferred onto each of the municipalities' zoning maps to develop the information shown in Figures 28, 29, and 30.

5.2.2 Planned Residential Developments

Six residential development sites are planned or under construction in the study area. All of these sites are located within the 55 dB DNL noise contour. The planned residential developments are listed in Table 4 and their locations are shown on Figure 27. Information about these sites was obtained from discussions with planners in each municipality.

Table 18. Planned Residential Development Sites in the Study Area

ID	Site	Noise Contour	Municipality
1	Proposed 120-unit apartment development	55 to 60 dB DNL	South Portland
2	Maine Youth Center expansion		South Portland
3	136 apartments opening May 2003		South Portland
4	Residential development under construction		Portland
5	Proposed Spring Harbor Hospital		Westbrook
6	Proposed residential development		Portland



Portland ME (PWM) Part 150 Study

Residential Zoning in Gorham, Westbrook and Scarborough, ME

Figure 2

April 18, 2003

2002 Airport Noise Contours

Residential Zones *

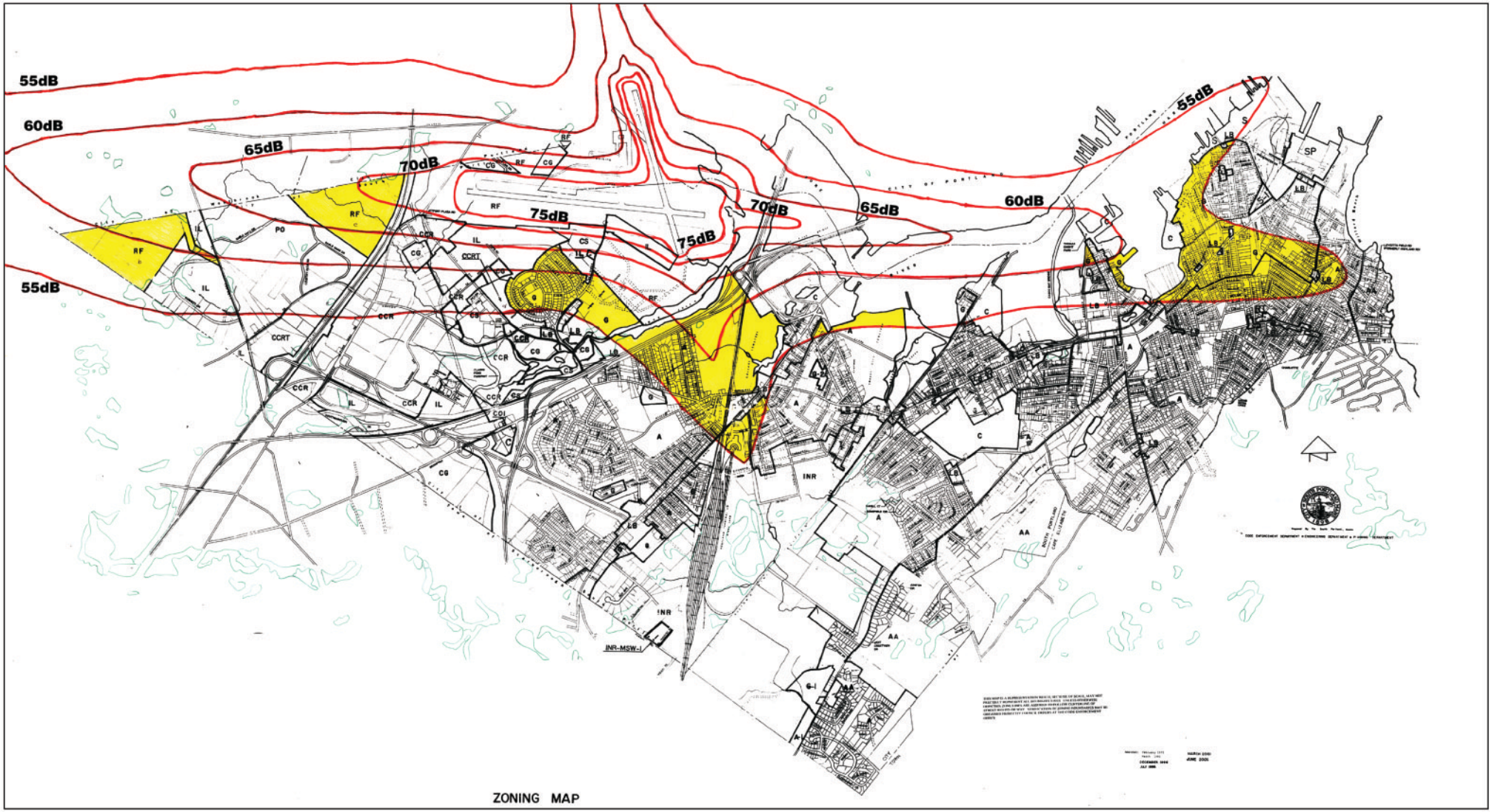
R-1	Residential Growth Area
RF	Rural Residence & Farming
R-MH	Rural Manufactured Housing
SR	Suburban Residential

* Zones are defined in Table 3

Harris Miller Miller & Hanson, Inc.

Vanasse Hangen Brustlin, Inc.

0 0.25 0.5 0.75 1 Miles



Portland ME (PWM) Part 150 Study

South Portland Zoning Map

Figure 3

April 11, 2003

DISTRICT KEY

G-I	CONDITIONAL RESIDENTIAL
CCRT	TRANSITIONAL CENTRAL & REGIONAL COMMERCIAL
RF	RURAL RESIDENTIAL
AA	RESIDENTIAL
A	RESIDENTIAL
B	RESIDENTIAL
LB	LIMITED BUSINESS
C	COMMERCIAL
I	INDUSTRIAL
PO	PROFESSIONAL OFFICE
IL	LIMIT INDUSTRIAL
CCR	CENTRAL & REGIONAL COMMERCIAL
CG	GENERAL COMMERCIAL
CS	SUBURBAN COMMERCIAL
INR	NON-RESIDENTIAL INDUSTRIAL
A-1	CONDITIONAL RESIDENTIAL
A-2	CONTRACT RESIDENTIAL (120 RIDGEWOOD AVENUE)
INR-MSW-I	CONDITIONAL NON-RESIDENTIAL INDUSTRIAL MUNICIPAL SOLID WASTE TRANSFER DISTRICT & INDUSTRY PDI
COI	CONDITIONAL OFFICE (31 BROADWAY)
RT	TRANSITIONAL RESIDENTIAL
SP	SPRING POINT
S-I	CONDITIONAL SHIPYARD (30 MARCELLA ST)
S	SHIPYARD

RESIDENTIAL ZONING IN STUDY AREA

SCALE IN FEET

0 500 1000 2000 3000 4000 5000

greater portland council of governments

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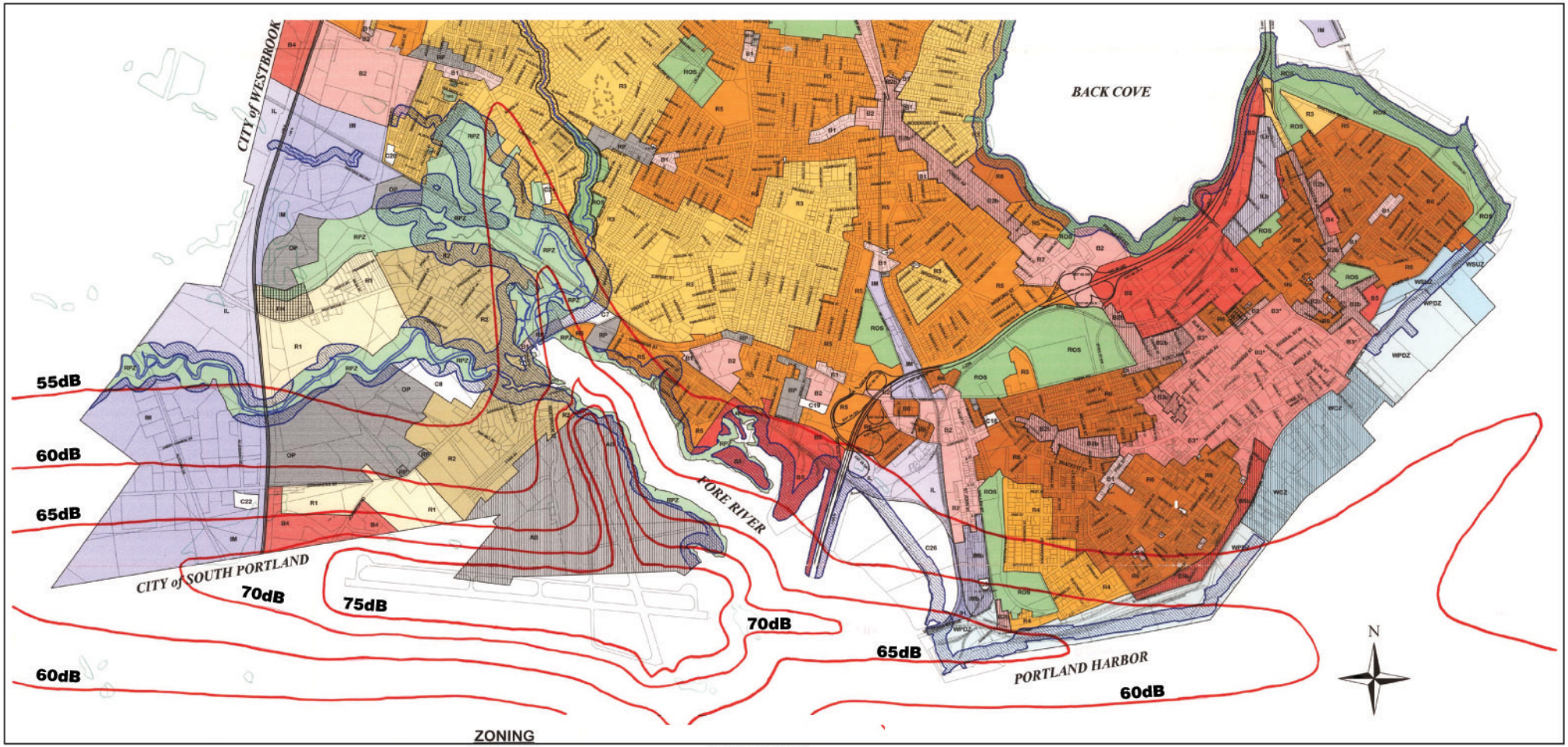


ZONING

RESIDENTIAL
R1 R2 R3 R4 R5 R5a R6

RESIDENTIAL PROFESSIONAL
RP

NEIGHBORHOOD BUSINESS
B1 B1b

COMMUNITY BUSINESS
B2 B2b

DOWNTOWN BUSINESS
B3* B3c

COMMERCIAL CORRIDOR BUSINESS
B4

URBAN COMMERCIAL BUSINESS
B5 B5b

* Refer to Zoning Supplementary Maps for special zoning provisions that may apply within the zone.

AIRPORT BUSINESS
AB

OFFICE PARK
OP

INDUSTRIAL - LOW IMPACT
IL ILb

INDUSTRIAL - MODERATE IMPACT
IM IMb

INDUSTRIAL - HIGH IMPACT
IH

WATERFRONT
WPDZ WCZ WSUZ

RECREATION OPEN SPACE
ROS

RESOURCE PROTECTION ZONE
RPZ

500 0 500 1000 1500 2000 2500 Feet

Portland ME (PWM) Part 150 Study

Portland Zoning Map

Figure 4

April 11, 2003

Harris Miller Miller & Hanson, Inc.

Vanasse Hangen Brustlin, Inc.

Table 19. Residential Zoning Definitions by Municipality

Municipality	Zoning Classification	Zoning Definition
South Portland	Rural Residential	Maximum net residential density – 1 dwelling unit/2 net residential acres Permitted uses: single-family homes, farming, churches, schools, parks, cemeteries, recreation, etc.
Portland	R-1, R-2	Lower density residential, single-family homes on individual lots in outlying areas of the city. R-1 – minimum lot size – 15,000 square feet R-2 – minimum lot size – 10,000 square feet
	R-3	Medium density residential development, single-family homes on individual lots and planned residential unit developments. Minimum lot size – 6,500 square feet
	R-4	Western Promenade, mix of single family, multi-family, and low-rise multi-family dwellings and other compatible development at mediums densities. Minimum lot size – 6,000 square feet
	R-5	Medium-density residential development, single-family and low-intensity multifamily on individual lots. Minimum lot size – 6,000 square feet
	R-6	On the peninsula for housing primarily multifamily dwellings at a high density. Minimum lot size – 4,500 square feet
Westbrook	Residential Growth Area 1 (R1)	Established residential areas within and surrounding the urban core. Maximum-8 units/acre.
Scarborough	Rural Residence & Farming (RF)	Maximum net residential density – 1 dwelling unit/net residential 2 acres. Permitted uses: farming, single-family homes, residential recreational facility, hospitals, family care homes, golf course, places of worship, etc.
Gorham	Manufactured Housing Park Overlay District	A parcel of land under unified ownership approved by the municipality for the placement of 3 or more manufactured homes Minimum lot size for lots served by public sewer-6,500 square feet Minimum lot size for lots served by individual subsurface waste disposal system-20,000 square feet
	Suburban Residential District (SR)	New low-density residential growth area Minimum lot size – 60,000 square feet

Existing zoning information was obtained from each of the municipalities in the study area in the form of paper zoning maps and discussions with local planners. The noise contours were transferred onto each of the municipalities' zoning maps to develop the information shown in Figures 28, 29, and 30.

5.2.3 Planned Residential Developments

Six residential development sites are planned or under construction in the study area. All of these sites are located within the 55 dB DNL noise contour. The planned residential developments are listed in Table 4 and their locations are shown on Figure 27. Information about these sites was obtained from discussions with planners in each municipality.

Table 20. Planned Residential Development Sites in the Study Area

ID	Site	Noise Contour	Municipality
1	Proposed 120-unit apartment development	55 to 60 dB DNL	South Portland
2	Maine Youth Center expansion		South Portland
3	136 apartments opening May 2003		South Portland
4	Residential development under construction		Portland
5	Proposed Spring Harbor Hospital		Westbrook
6	Proposed residential development		Portland

5.3 Population Within DNL Contour Increments

Using U.S. Census Bureau data from the 2000 census and the population centroids shown on earlier figures, the estimated number of people within the 2002 and 2007 baseline contours are summarized below. Note that the over-water and terrain adjustment adds approximately 130 people into the 65 to 70 dB increment, and approximately 20 people into the 60 to 65 dB increment, but has its largest effect at DNL values of 55 to 60 dB.

Table 21. Estimated Number of People Residing within Various DNL Contour Increments

Portland International Jetport
Population Counts within DNL Increments

	DNL 55-60	DNL 60-65	DNL 65-70	DNL above 70	**Total**
2002 Baseline, no terrain adjustment	1,659	105	1,432	0	3,196
2002 Baseline, w/ terrain adjustment	5,702	125	1,555	0	7,382
2007 Forecast w/ terrain adjustment	5,699	788	40	1,515	8,042

6 ANALYSES AND RECOMMENDATIONS FOR NOISE ABATEMENT ELEMENTS OF THE NCP

The primary means of identifying candidate measures for consideration as part of PWM's new Noise Compatibility Program was through the Noise Advisory Committee. Various issues had been identified by community members of the Committee before the Update study had even begun -- issues such as the exceptionally loud operations by Federal Express in its re-certified 727s, early turns after takeoff from Runway 11, inadequate use of the Harbor Visual Approach procedure, and others.

Noise measurements, especially of individual loud events, and analyses of radar data during the early stages of the Update confirmed many of the problems and provided much of the supporting evidence from which potential solutions could be developed. The list below was developed by the Committee and used to help focus attention on the most significant of the issues.

Table 22. NAC's Prioritized List of Most Serious Noise Issues

Group	Problem	Number of Votes
Air Traffic Control/Procedures	Low Flights Over Neighborhoods	6
Controllable by Operator/Airlines	Federal Express Flights	6
Controllable by Operator/Airlines	Times of Arrivals and Departures (10pm-7am)	6
Controllable by Operator/Airlines	Old Equipment	5
Air Traffic Control/Procedures	Lack of Formal Noise Abatement Program	4
Air Traffic Control/Procedures	Flights Over Islands and Cape Elizabeth	3
Air Traffic Control/Procedures	Short Cuts on Harbor Visual Approach and Departures by Problem Aircraft	3
Air Traffic Control/Procedures	Compliance with Procedures	2
Communication/Education	Lack of Consequences	2
Controllable by Operator/Airlines	Military Operations	2
Air Traffic Control/Procedures	Aircraft Profiles (Routes and Altitudes)	1
Air Traffic Control/Procedures	Inadequate Fanning	1
Air Traffic Control/Procedures	Lack of Use of Harbor Visual Approach During Hours of Darkness	1
Air Traffic Control/Procedures	Safety	1
Communication/Education	Lack of Public Understanding	1
Communication/Education	Management Attitude	1
Controllable by Operator/Airlines	Stakeholder Ambivalence	1
Land Use	Lack of Control of Airport and Residential Development	1
Political and Economic Issues	Lights on 295	1
Political and Economic Issues	Trying to do too many things at Airport (GA, Passenger, Cargo)	1
Air Traffic Control/Procedures	Lack of Use of Preferential Runway	
Communication/Education	Evaluation of Complaints	
Controllable by Operator/Airlines	Delayed Arrivals	
Controllable by Operator/Airlines	Runups -- PreFlight and Maintenance	
Controllable by Operator/Airlines	Seasonal Use of Airport	
Controllable by Operator/Airlines	Use of Thrust Reverse	
Controllable by Operator/Airlines	Vibration	
Land Use	Building Codes	
Land Use	Downtown Airport (location)	
Land Use	On Airport Trucking Facility	
Land Use	Zoning	
Miscellaneous	Health Issues	
Miscellaneous	Lack of Criteria to Judge Effectiveness	
Miscellaneous	Noise Impacts from Unique Topography	
Miscellaneous	Weather	
Political and Economic Issues	Funding for Solutions	
Political and Economic Issues	Impact on Property Values	
Political and Economic Issues	Lack of Contract Review	
Political and Economic Issues	Lack of Political Control	

6.1 New FMS/RNAV Flight Procedures

At the time that noise abatement flight procedures were first being investigated for their application at PWM, noise analyses showed there was a potential benefit to be gained from specification of new instrument approach and departure procedures that could be utilized by aircraft equipped with Flight Management Systems (FMS) based on Radio Navigation (RNAV) and Global Positioning Satellite (GPS) technologies. Though not expected to be a complete panacea for overflights of noise-sensitive areas in Portland or South Portland along the Fore River, the new systems would potentially allow more aircraft to fly Standard Instrument Departure procedures (SIDs) and Standard Terminal Arrival procedures (STARS) employing greater maneuverability close to the runway and under poor weather conditions than have been able to in the past. Specifically, a new instrument approach procedure could supplement and eventually replace the HARBOR VISUAL RWY 29, a Visual Flight Rule procedure, which can only be used when the cloud ceiling is greater than 3,000 feet and visibility is greater than four miles. Aircraft following the HARBOR VISUAL essentially fly down the center of the Fore River and make a last minute turn onto final approach to Runway 29 approximately over the Casco Bay Bridge. A published instrument approach allowing the same degree of maneuverability in poorer weather conditions could potentially reduce the number of straight-in ILS and GPS approaches over Willard Beach, Ferry Village, and other close-in areas of South Portland. A similar procedure in reverse for departures from Runway 11 would also help reduce the number of straight-out departures over the same areas.

As these instrument procedure options were being investigated for PWM, the FAA imposed a moratorium on all new RNAV procedures due to the occurrence of several unsafe mishaps at other airports. The ban on RNAV arrival procedures was eventually lifted in July 2003, but in doing so, the FAA required the final GPS fix on most new RNAV procedures to be no closer than 10 nautical miles from the airport, making the technology much less useful for noise mitigation purposes. A similar restriction was expected when the moratorium on departure procedures was to be lifted. As a result, plans for RNAV(GPS) arrival and departure procedures as elements of this Noise Compatibility Program Update were placed on hold and in the draft of this document were recommended for consideration in PWM's next Part 150 Update.

Between publication of the draft and final versions of this Part 150 Update, however, FAA's Director of System Operations and Safety issued a memo lifting the moratorium on all RNAV procedures and calling for the renewed implementation of RNAV SIDs and STARS. FAA Orders 7100.9D and 8260.44A specify the design criteria to be used in developing the procedures, including that their purpose is to improve safety; the procedures are not to be designed solely for noise abatement, but they can be used to enhance it.

With the fortuitous timing of the lifted ban, new GPS-based RNAV procedures now *are* being recommended for inclusion in this Part 150 Update based on the same analysis of noise level improvements applicable to related, but less precise measures discussed below. The recommendation supplements these other measures, which collectively address improved guidance and increased use of arrival and departure routes to and from PWM that optimize overflight of the Fore River. The specific RNAV recommendation is included in Section 6.2 below.

6.2 Increase Departures from Runway 11 and Arrivals to Runway 29 over the Fore River

Strong evidence exists to show that jet (as well as prop) aircraft make early southbound turns after takeoff and fly directly over heavily populated areas of South Portland, Cape Elizabeth, and beyond. Figure 31 shows a significant portion of the jet departures from Runway 11 making the southbound turn, and a further check of aircraft altitudes through a gate parallel to and approximately ½-mile south of the extended centerline to the runway (the lower box in Figure 31) shows that a large share of the turning jets are starting to traverse the area at altitudes of 800 to 2,000 feet above field elevation.

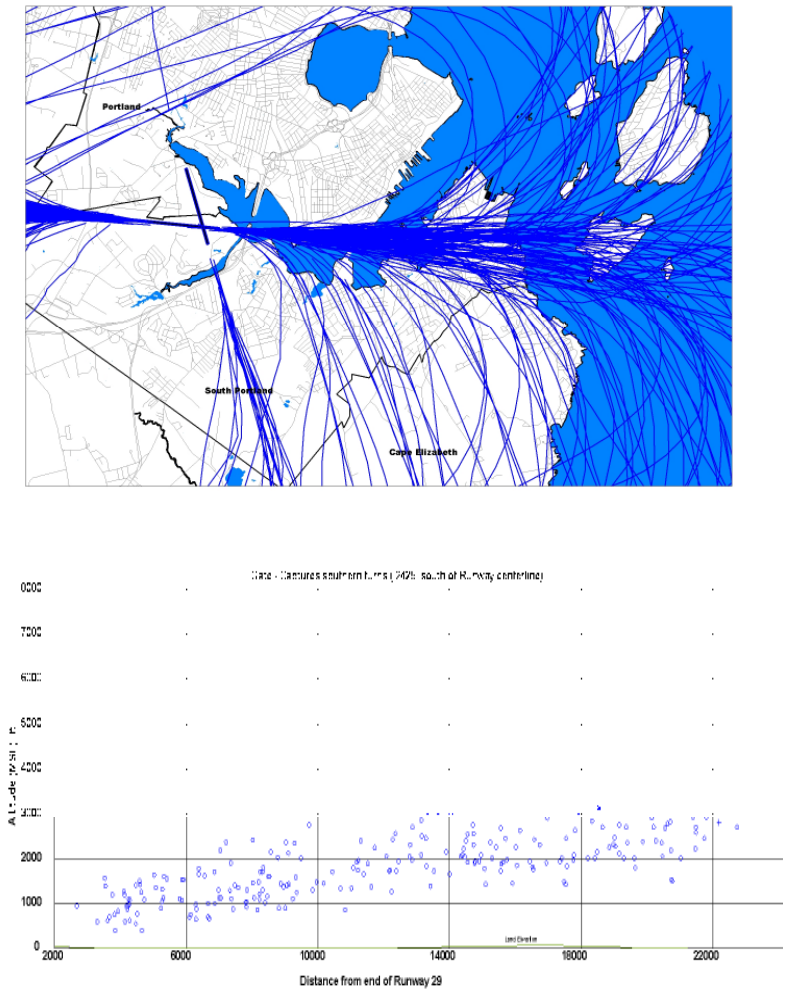


Figure 31. Example of Early Right Turns After Takeoff from Runway 11

Recognizing that moving these aircraft to a straight-out corridor will simply shift the noise burden to the Western Promenade and to the Ferry Village/Willard Beach sections of South Portland (see Table 23 and

Figure 32) -- areas which are already exposed to straight-out departures from Runway 11 as well as straight-in instrument approaches to Runway 29 -- the real goal of any new abatement measure addressing early southbound turns *must* be to utilize a departure routing out the Fore River. If defined precisely enough, the new procedure can also help reduce early left turns that cross over or near the Western Prom.

Table 23. Changes in DNL and Maximum SEL Due to Reduction of Early Right Turns from Runway 11

COMPARISON OF DNL AND SEL NOISE METRICS FOR DIFFERENT MITIGATION MEASURES							
		DNL for 2007			Maximum SEL for 2007		
Area	Site No.	Baseline	No Early Turns to East	Change in DNL	Baseline	No Early Turns to East	Change in SEL
Westbrook	33	57.2	57.2	0.0	102.0	102.0	0.0
Stroudwater	12	60.0	60.0	0.0	105.2	105.2	0.0
Western Promenade	18	57.5	58.1	0.6	104.6	105.2	0.6
Ferry Village	27	55.4	55.6	0.2	100.2	100.6	0.4
Peaks Island	36	46.5	47.1	0.6	92.0	92.9	0.9
Fort Williams Park	37	44.1	40.7	-3.4	91.1	88.1	-3.0
Cape Elizabeth	29	46.3	43.6	-2.7	93.7	90.9	-2.8
Courtland Court	38	65.9	65.9	0.0	111.6	111.6	0.0

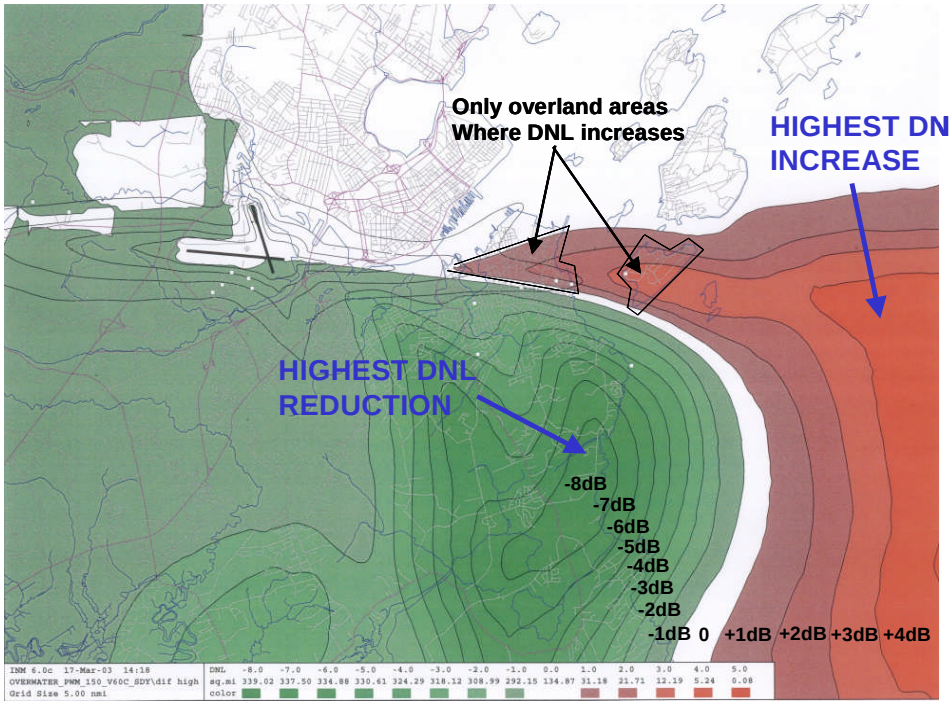


Figure 32. Changes in DNL Caused by Extending Early Right Turns Straight Out On Runway Heading

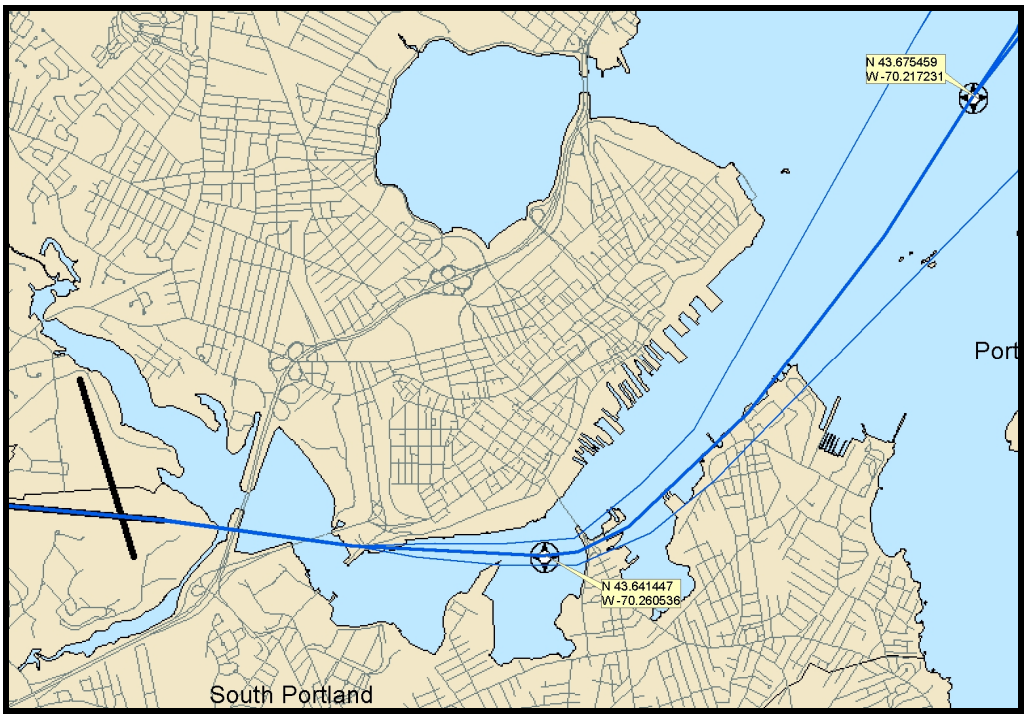
With those combined goals in mind, the following measures are recommended, all of which are important to maximize the desired benefits:

(1) *Portland Tower should begin assigning the current CASCO DEPARTURE to as many aircraft departing Runway 11 as possible. If feasible, air traffic controllers should instruct aircraft assigned the CASCO SID to fly the 060 degree heading until reaching at least 3,000 feet MSL.*. The CASCO DEPARTURE is an existing noise abatement departure procedure designed to guide aircraft out the mouth of the Fore River, and it ought to be usable immediately. Because it is an existing published procedure, no Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required for implementation.

(2) *If, in ATC's judgment, significant traffic delays will result from consecutive aircraft assigned to the CASCO DEPARTURE, Portland Tower should* ***at a minimum*** *assign the CASCO SID to* ***every re-certified Stage 3 aircraft and every Stage 2 aircraft*** (now mostly corporate jets) *that departs on Runway 11. If feasible, air traffic controllers should instruct all re-certified Stage 3 aircraft and all Stage 2 aircraft to fly the 060 degree heading until reaching at least 3,000 feet MSL.*

(3) *Jetport staff should publish a* ***voluntary*** *noise abatement departure procedure that utilizes GPS technology and allows properly-instrumented aircraft to navigate more precisely along the same desired corridor as the CASCO DEPARTURE.* Proposed waypoints are illustrated in Figure 33

along with proposed text of the procedure. Waypoint names are arbitrary. Because the procedure is voluntary, no additional EA or EIS is needed for implementation.



Voluntary Noise Abatement Departure Procedure for Runway 11
Portland International Jetport (PWM), Maine

For all GPS-equipped turbojet and turboprop aircraft departing Runway 11:
Fly runway heading. Cross flyover waypoint FORAY (N 43.641447,W -70.260536), thence, direct to flyover waypoint FORBEE (N43.675459, W –70.217231). Cross FORBEE at or above 3,000 feet MSL. Expect vectors to filed route. Expect further clearance to requested altitude.
Pilots of turbojet and turboprop aircraft without GPS capability should request clearance to fly the CASCO DEPARTURE.

Figure 33. Voluntary Noise Abatement Departure Procedure for Runway 11

(4) *If and when a flight track monitoring system is acquired by the Jetport (see later recommendation in Section 6.9), it should be used to evaluate the CASCO DEPARTURE as well as the Voluntary Noise Abetment Departure Procedure to determine whether they are accomplishing their intended purpose of keepingthe majority of aircraft over the Fore River. In particular, the Jetport should analyze each measure to (a) determine whether it is necessary to*

extend or shorten the I-PWM 1.3 DME or FORAY turn points so that aircraft are not cutting early over the Western Promenade or are not drifting east into South Portland; and (b) determine whether aircraft are staying on the 060 degree heading sufficiently long to avoid overflying noise-sensitive parts of either Portland or South Portland at low altitude.

(5) *Once an optimum turning point and distance are identified, Jetport staff should modify the latitudes and longitudes of the GPS fixes in the voluntary procedure (***Figure 33** *above), if necessary, and also initiate a request to FAA Air Traffic Division to design and, if determined feasible, implement a Type B RNAV SID that serves as an instrument overlay to the voluntary procedure. To be designed to Order 8260.44A or its latest update, the SID should direct aircraft to an initial flyby point off the departure end of Runway 11 followed by a left turn to approximately 060 degrees to a second fix, not less than I-PWM 3.2 DME (or to an equivalent distance off the Kennebunk VORTAC) before turning west- or southbound. Note that, if the flight track analysis suggests the initial waypoint should be located less than 2½ nautical miles from the departure end of the runway, the SID would also require an annotation indicatinga higher than standard climb gradinet may be required to reach it.* A simplified depiction of the suggested new RNAV SID with its fictitious name, CASCO XXX DEPARTURE (RNAV), is shown in Figure 34, with the assumption that the named GPS coordinates identified in the voluntary noise abatement departure procedure adequately guide aircraft out the Fore River. If FAA were to approve this new procedure, Portland Tower should be able to issue the new CASCO XXX DEPARTURE clearance to GPS-equipped aircraft during its hours of operation, and Boston Center should be able to issue the same clearance during late-night hours after the Tower is closed, something it cannot do now.

Here again no further environmental analyses are needed for implementation. Though the CASCO XXX SID would represent a new published procedure affecting aircraft at altitudes less than 3,000 feet AGL, RNAV overlays of existing procedures (in this case the existing CASCO DEPARTURE) do not trigger a need for an additional EA or EIS under the National Environmental Policy Act nor under any applicable FAA Orders.

(6) *To further maximize use of the Fore River departure routes, Jetport staff should meet with Federal Expresss, Airborne Express, and any other known users of re-certified (hushkitted) or other loud, noise-critical Stage 3 aircraft (such as the MD-80 series), as well as any users of Stage 2 aircraft, to demand their support in requesting and accepting the existing CASCO SID clearance (or the future CASCO XXX RNAV SID, if it is eventually approved by FAA) out to the full extent of the specified altitude or range, or alternatively, to fly the voluntary noise abatement departure procedure.*

(7) *To increase overflights of the Fore River on arrival,beyond that afforded by the HARBOR VISUAL RWY 29 (as shown previously in Figure 14), it is also recommended that FAA Air Traffic Division initiate design of a GPS-based RNAV STAR to Runway 29 that serves as an instrument overlay to the HARBOR VISUAL. Desired GPS locations for waypoints should essentially match those of the proposed CASCO XXX SID, altered as needed to meet the design criteria of FAA Orders 7100.9D and 8260.44A or their updates. If approved by FAA, both Portland Tower and Boston Center should issue clearances to fly the new procedure when feasible and especially at night during periods when Runway 29 cannot be used for arrival (See Section 6.5).*

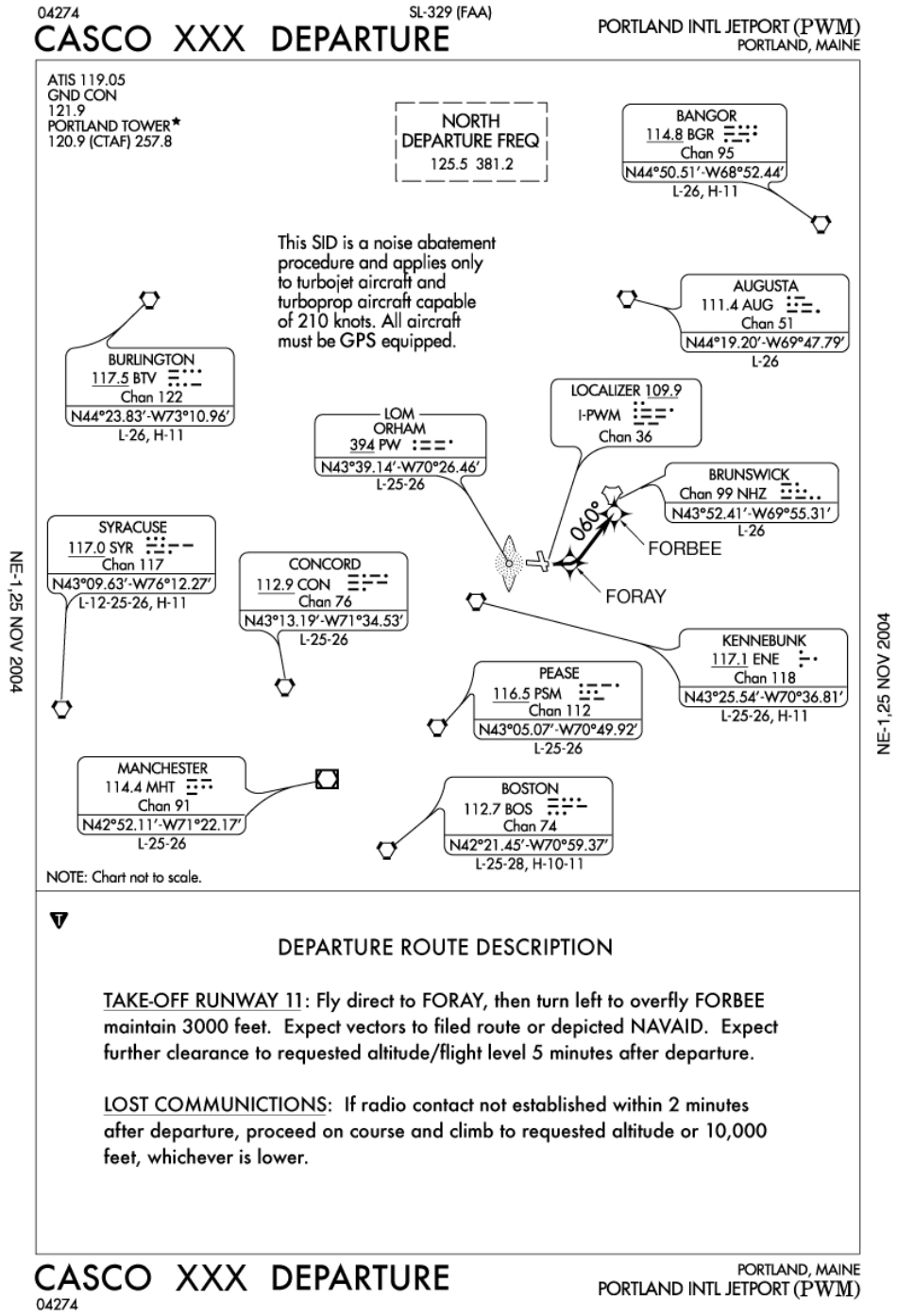


Figure 34. Fictitious CASCO XXX RNAV Departure SID

6.3 Reduce Early Left Turns After Takeoff from Runway 29

As seen earlier in Figure 14 and isolated below in Figure 35, a mirrored issue exists with early left turns off of Runway 29. Although fewer people live west of the Jetport, west flow traffic occurs approximately 60 percent of the time and thus causes higher exposure levels than those to the east, making Westbrook residents among the more heavily affected by PWM noise. Furthermore, no published noise abatement flight procedure exists as a remedy.

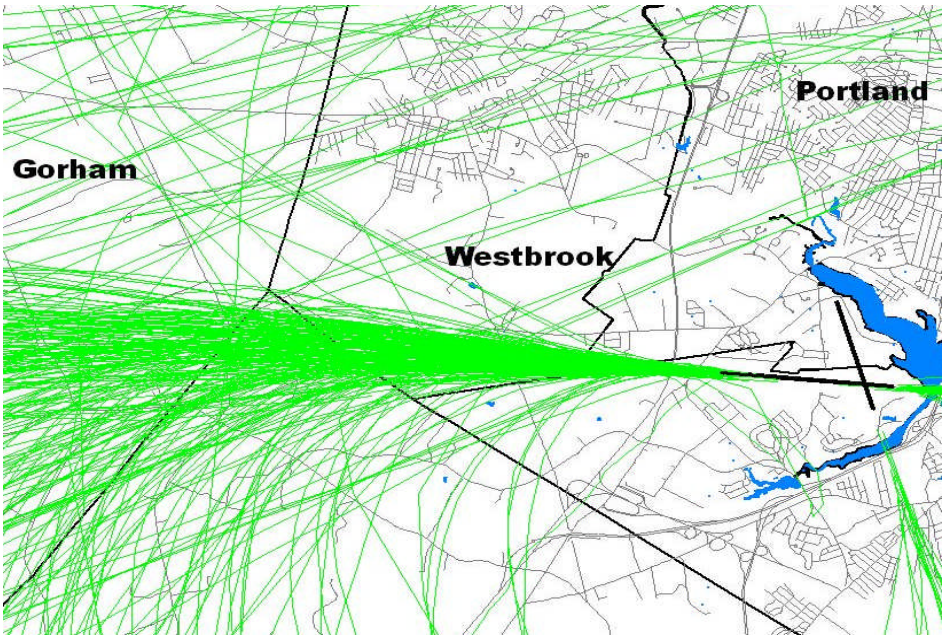


Figure 35. Early Left Turns from Runway 29

(8) *To address the west side of the Jetport, the following voluntary measure is recommended in order to keep aircraft on a straight-out departure heading until approximately 5 nautical miles from takeoff. Jetport staff should publish a voluntary noise abatement departure procedure that utilizes GPS technology and allows properly-instrumented aircraft to fly runway heading until reaching flyover waypoint FORCEE (N43.651707, W-70.413823) or 3,000 feet MSL, whichever comes first.* FORCEE in on the Gorham town line, just south of the intersection between Westbrook and Scarborough. Proposed text of the procedure is given below.

Voluntary Noise Abatement Departure Procedure for Runway 29
Portland International Jetport (PWM), Maine

For all GPS-equipped turbojet and turboprop aircraft departing Runway 29:
Fly runway heading until crossing flyover waypoint FORCEE (N 43.651707, W -70.413823), or reaching 3,000 feet MSL, whichever comes first. Expect vectors to filed route. Expect further clearance to requested altitude.
Pilots of turbojet and turboprop aircraft without GPS capability should fly runway heading to I-PWM 4.9DME or 3,000 feet MSL, whichever comes first.

6.4 Federal Express

Noise measurements, modeling, and complaints consistently point to Federal Express' nighttime operations of its recertified Stage 3 727s as the most identifiable contributor to the noise environment at PWM. Departures from Runway 11 between 10:00 p.m. and 11:00 p.m. produced SELs over 105 dBA at Sites 6 and 7, and generally a few dB less for arrivals. Aircraft typically arrive around 5:00 to 6:30 in the morning and again from 7:00 to 8:00 at night. They depart around 8:00 to 10:00 in the evening and again around 6:00 in the morning. The flights are often the slowest climbing and loudest of commercial operators as indicated in Figure 36.

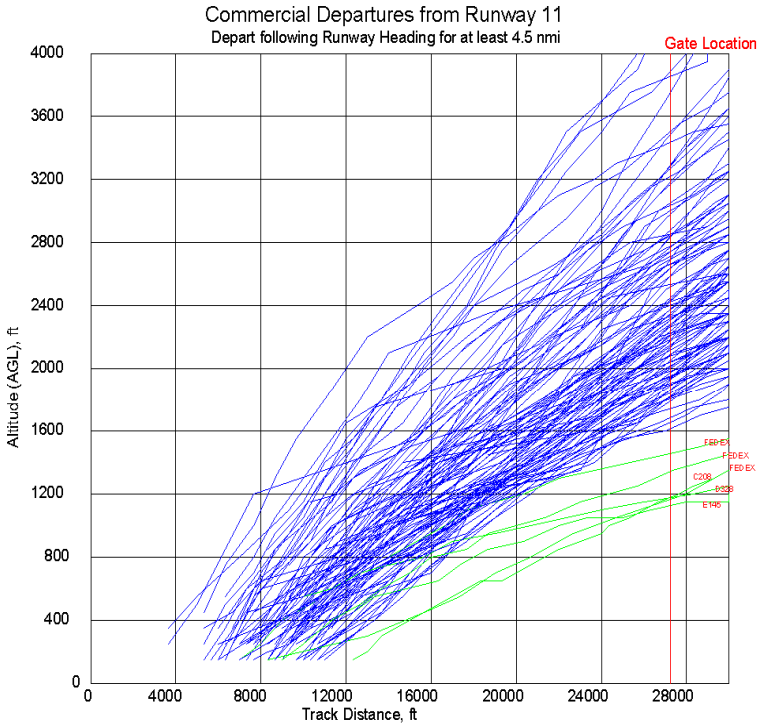


Figure 36. Climb Profiles for Straight-Out Departures of Commercial Jets

Analyses of two unlikely mitigation measures – shifting times of operation into daytime hours and converting from 727s to larger A-310s – each showed a modest improvement, both in DNL as well as maximum SEL, but Federal Express indicated that their flight schedules and insufficient cargo volumes in and out of Portland dictated use of the smaller though louder 727s. The company did, however, state its readiness to work with the Jetport and air traffic control to increase its utilization of the CASCO SID.

(9) Given that runway assignment and assignment of departure procedures are likely to be the primary measures available to address the noise of the Federal Express aircraft, it is

recommended that Jetport staff, Federal Express, and Portland Tower work together to accomplish the following, in order of importance:

a. Maximize the number of 727 operations using Runway 29 for departure. Aircraft should remain on runway heading until reaching I-PWM 6.2 DME or 3,000 feet, whichever comes first.

b. If Runway 29 is unavailable for takeoff, maximize the use of Runway 11 for landing.

c. If departures from Runway 11 are necessary, every effort should be made to assign the existing CASCO DEPARTURE (or the RNAV update if it is approved) to all 727 operations and the procedure flown out the mouth of the Fore River until the aircraft has passed 3,000 feet. If the CASCO SID (or the RNAV update) cannot be issued and followed to 3,000 feet, it is desirable to have the pilot follow the voluntary noise abatement departure procedure for Runway 11.

d. *Except in emergencies, or in cases where Runway 11/29 is closed for repair, snow-removal, or other maintenance, or when the tailwind component for an operation will exceed the operating limit of the aircraft, no 727 operation should use Runway 18 or 36 for landing or for takeoff. The need for expedited ground time is not an acceptable reason to use 18/36.*

Assuming that Portland Tower is able to increase its assignment of the CASCO SID, and that additional aircraft begin to follow new voluntary noise abatement procedures at both ends of the main runway, noise exposure is likely to improve slightly in a number of areas east and west of the Jetport. The changes are illustrated in the contour comparison in Figure 37, maximum improvements appearing to be on the order of 1 decibel, not large but worthy. Not shown are the larger improvements in DNL that may be as much as 2 to 4 dB and are apt to be noticed in areas of South Portland south of Highland Avenue and on into Cape Elizabeth. The benefit derives from fewer overflights by aircraft making early southbound turns shortly after takeoff, though these improvements are at DNL levels less than 55 dB.

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Noise Exposure Map 2007 DNL Contours
Showing Benefits of Reduced Early Turns
Portland International Jetport

2007 Forecast Contours
2007 New Turns Contours
Airport Boundary

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6.5 Preferential Runway Use

None of the measures discussed above addresses noise exposure off of Runway 18/36, nor do departure turns off of 18/36 show benefit due to a lack of compatible land use or open water over which to concentrate flights. What does have benefit, however, is the increased preferred use of Runway 11/29 over 18/36, *provided the shift can be accomplished by the loudest of the aircraft using the crosswind on a regular basis*. As now, Runway 29 is still preferred for departures and Runway 11 still preferred for arrivals. Also, as earlier analysis indicated, it appears that total overall usage of 11 and 29 is well balanced; thus, the modifications discussed here are not intended to greatly alter use of the main runway. Nevertheless, some significant benefits are feasible off of 18/36 with relatively small effect on 11/29.

To accomplish the shift in usage and achieve meaningful noise reduction for residents of Stroudwater and areas south of Interstate 295, two factors must be addressed. Portland Tower's current standard operating procedure, PWM 7110.4 CHG 1, specifies weather criteria for use of preferred runways that are more stringent than allowed by FAA under Order 8400.9, entitled "National Safety and Operational Criteria for Runway Use Programs". That Order from FAA Headquarters allows turbojet aircraft to operate on a preferred runway under a variety of less stringent weather criteria, including the following:

a. For clear and dry runways, the crosswind component for the selected runway must not be greater than 20 knots. [PWM 7110.4 limits the crosswind to 15 knots].

b. Except when anemometers are installed near the touchdown zone, the tailwind component must not be greater than 5 knots. [PWM 7110.4 limits the tailwind to 0 knots, except when the wind is less than 10 knots, then early morning departures should use Runway 29 and late night arrivals should use Runway 11].

(10) It is recommended that Portland Tower consider changing its criteria to be consistent with FAA's national criteria, making 11/29 usable as the preferred runway more often.

(11) In addition, to achieve substantial benefit off of 18/36 from preferential use of 11/29, a variety of aircraft types will need to request and/or be issued clearance to use the main runway instead of the crosswind. Besides the Federal Express 727s, the aircraft of greatest significance include:

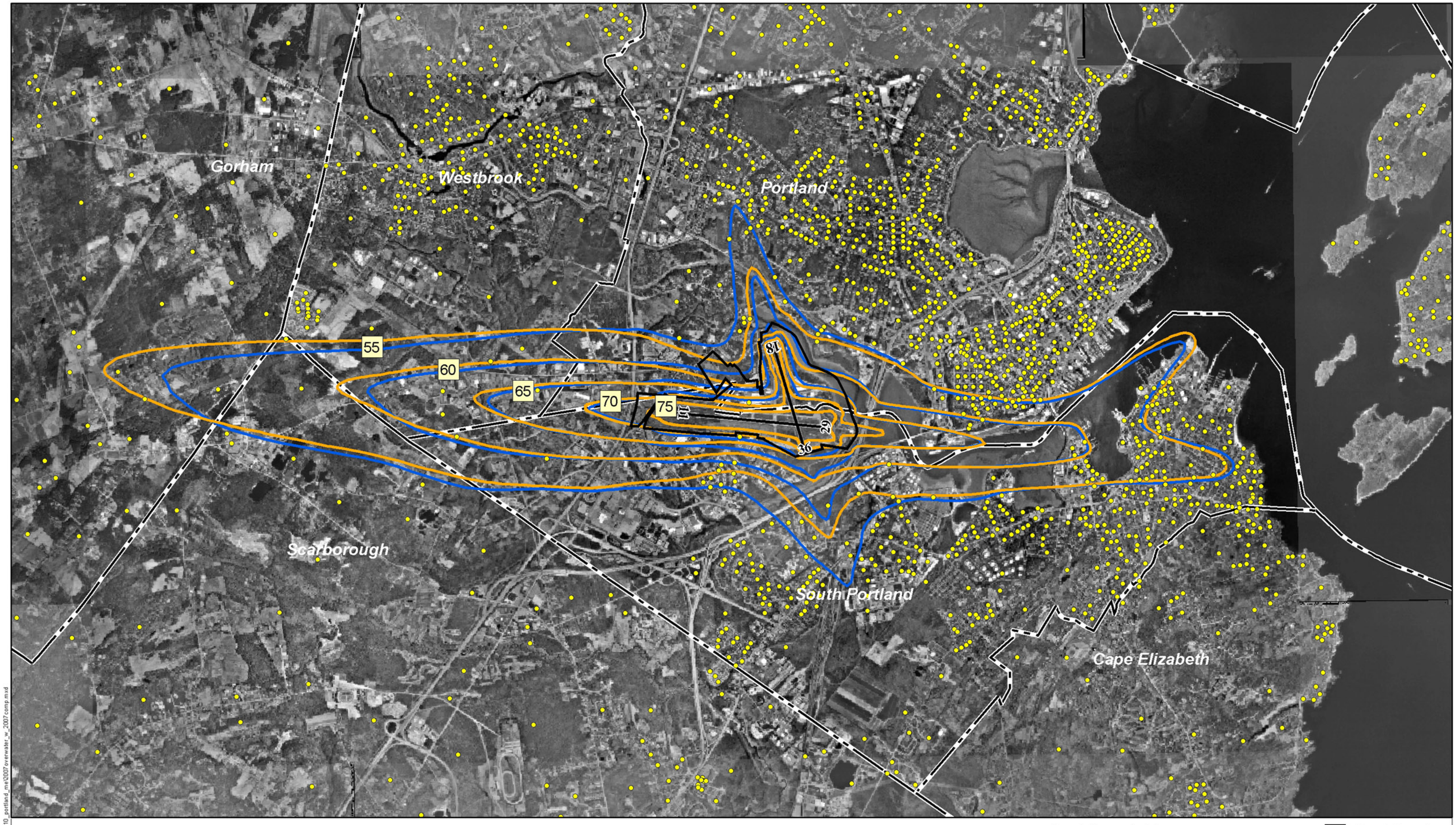
- *All old LearJets, regardless of engine treatment or flap management*
- *All G-IIs and G-IIIs, regardless of hushkit configurations*
- *All DC-9s and B-737-200s*
- *All MD-80 and –87 series aircraft*
- *MD-90s*
- *Embraer 145s*
- *All Canadair 600s and 601s*
- *All Falcon 900s*
- *All Westwind 1124s and 1125s*
- *All nighttime operations*

A desire for expedited taxi times should not constitute sufficient reason to use the crosswind runway. Effective implementation of the new program with its emphasis on loud aircraft types will best be accomplished with assistance from Jetport staff. Publicity measures should include informational meetings, brochures, airfield signs, posters in flight planning or operations rooms, and follow-up with operators when pilots are found to be lax or ignore the program.

6.6 Combined Benefits of Operational Measures

If the noise abatement departure turns, the increased use of the CASCO SID (especially by Federal Express and other operators of noise-critical aircraft), and the preferential runway use program are implemented together, the estimated benefit in terms of overall noise exposure is shown in Figure 38. Moving clockwise around the airfield:

- The largest potential improvement is likely to be in Stroudwater where exposure can be expected to improve on the order of 3 to 4 dB, primarily the result of fewer of the loudest aircraft types using the runway. This outcome will not be fully achievable if the older and larger corporate and air carrier jets continue to use the runway as before.
- Noise exposure along the Western Promenade and further east along Danforth and West Commercial St. does not change measurably in these scenarios. In fact, it is difficult to find any means of reducing noise in this area along the river given that it is, by any other standard, a desirable location to have aircraft fly. On the contrary, the Jetport and the NAC will have to remain attentive to this section of Portland to be sure that the increased use of the Fore River flight corridor does not result in shortcuts across the south end of the Promenade or a favoring of one side of the river over the other.
- What **will be** a potentially noticeable improvement to this area are the reductions in occasional late night overflights of aircraft taking off after the Tower is closed then turning early over the City prior to radio and radar contact with Boston Center. One of the primary efforts needed in making any of these Fore River departures work better is the extension of the northeast leg out to the mouth of the river. Neither the CASCO SID in its present form nor the voluntary noise abatement procedure that supplements it are likely to completely solve this issue without modification, but the Tower, the Center, the Jetport and the late-night operators are fully capable of addressing it.
- On the east side of the river, the small changes in the noise contours are not likely to be noticeable one way or the other, though it is always useful when exposure is seen to improve, even if only very slightly, as it does in the Ferry Village/Loveitt's Field area under the long straight-in flight corridor.
- South of the extended runway centerline in South Portland and Cape Elizabeth there is no apparent benefit to the procedural changes modeled, though they do exist and should be noticeable at DNL levels less than 55 dB. The key continues to be whether Portland Tower, the Center, and the users can work together to help address the early turns after takeoffs
- South of Runway 18/36, exposure has the potential of improving approximately the same degree as in Stroudwater – some 3 to 4 dB, due to a reduction of louder aircraft using the crosswind, **if** the program is managed well. The Maine Youth Center to the side of the runway centerline will benefit to a lesser degree from the change, though the new facility is adequately air conditioned and is not likely to be seriously affected by the noise as it is even now. Some apartment units in Redbank Village may also note minor improvements in noise.
- Only to the west of the Jetport is there expected to be a slight increase in exposure, generally on the order to ½ to 1 dB and caused by increased departures on the preferred runway and the concentration of more aircraft on the straight-out departure route to avoid early southbound turns. Minor improvements in Scarborough occur as a result of that.



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Noise Compatibility Program DNL Contours for 2007
Compared to 2007 NEM
Portland International Jetport

- Population centroids
- 2007 Forecast contours with terrrain adjustment
- 2007 Composite contours with terrain adjustment
- Airport Boundary

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6.7 Population Affected By the NCP Update

Estimated counts of the number of people affected by the proposed operational measures are included in Table 24 below. The net improvement referred to in the last line represents the difference between the 2007 forecast with the existing program in place and the 2007 scenario with the new operational elements, where in each case the contours have been adjusted for the terrain and over-water propagation effects described earlier in this document.

One of the more obvious effects of the new measures is that the estimated 186 people within the DNL 70 to 75 dB range are now expected to be back within the 65 to 70 dB range. Those and the other 40 individuals exposed to noise above 65 dB live in two primary areas – in Westbrook on or near Thomas Drive, in the vicinity of Courtland Court, Powers Road, or Pope Avenue, just southwest of the intersection or Runways 11/29 and 18/36, as shown in Figure 38. A third group of individuals resides on the north side of Runway 11/29, identified by the population centroid near the airport hotel (also shown in Figure 38. Most of the individuals benefiting from improvements at the lower exposure levels live north and south of Runway 18/36 in Stroudwater and South Portland.

Table 24. Estimated Number of People Affected by the New NCP

Portland International Jetport Population Counts within DNL Increments					
	DNL 55-60	DNL 60-65	DNL 65-70	DNL above 70	**Total**
Baseline Conditions:					
2002 Baseline, no terrain adjustment	1,659	105	103	0	1,867
2002 Baseline, terrain adjusted	5,702	125	226	0	6,053
2007 Forecast, terrain adjusted	5,699	788	40	186	6,713
With Abatement Measures:					
2007 with New NCP, terrain adjusted	5,414	395	226	0	6,035
Net Improvement:	-285	-393	186	-186	-678

The balance of this Chapter addresses additional measures recommended for inclusion in the full NCP.

6.8 Land Use Measures

During meetings set up with members of the Planning Departments of Portland, South Portland, and Westbrook, the study team's land use consultant, Vanhasse Hangen Brustlin Inc. discussed possible land use remediation and preventative tools for consideration by the individual jurisdictions to address noise issues around the airport. Remediation measures included sound insulation, purchase of development rights, redevelopment, and avigation easements. Preventative measures included compatible use zoning, transfer of development rights, fair disclosure rights subdivision regulation changes, and airport noise overlay districts. Normally these are considered possible means of addressing serious noise issues at airports, but they are typically employed where the noise exceeds DNL values of 65 to 70 dB. There was

little interest in employing any of the measures in the jurisdictions visited. In addition, the same measures were discussed at a meeting of the Noise Advisory Committee in March 2003. However, the NAC expressed no interest in such measures either.

Finally, although 226 residents remain exposed to DNL values of 65 to 70 dB, many are believed to be renters in the Courtland Court apartment complex and in transient lodging immediately south of and overlooking the Jetport as shown earlier in Figure 38. The rise in terrain in this area renders noise barriers of any reasonable height to be infeasible as a noise mitigation measure. Thus, the Portland International Jetport's Management does not intend to initiate any land use solutions for these individuals.

(12) Despite the general lack of interest in land use measures, it remains an important obligation of any airport to be involved with local land use decisions that can encroach on its operation or in other ways affect its development. Thus, this Update recommends that Jetport Management coordinate efforts with the City of Portland, the City of South Portland, and the communities of Westbrook, Scarborough, and Stroudwater to reduce incompatible land use development through measures such as encouraging noise notifications on subdivision plans, encouraging building code revisions, and other similar low-level efforts to help assure that Portland International Jetport minimizes its future impacts on its neighbors.

6.9 Administrative Measures

The following additional measures **are** being recommended for inclusion within the Update. All have been proposed to and discussed with the NAC at one or more meetings.

6.9.1 New Flight Track Monitoring System

It became apparent during early phases of this Update that while the FAA Air Traffic Control Tower was extremely helpful in giving the study team access to samples of radar data for analysis, there were also many times during the study when additional access to data would have been helpful, and there are specific future needs for such data to help in the refinement of the operational measures recommended as part of this Update.

Many airports both larger and smaller than PWM have such systems and value them as essential and effective tools, not only in diagnosing noise issues, but as public relations tools. New versions of these systems are web-based and some airports have provided limited public access to certain summary data and monthly or quarterly reports. Depending on available Information Technology (IT) support staff available to the City of Portland, the system can be maintained in the airport offices or can be accessed through secure links to vendor servers. The latter approach eliminates the need for on-site server maintenance, data back-ups, disk management, and on-site installation of software upgrades.

Typically such systems create numerous automated reports. A typical example in the context of this Update might be a morning report that identifies (by airline or operator, aircraft type, time, etc.) every departure that took off from Runway 11 in the previous 24 hours, which ones deviated out of the Fore River flight corridor, the altitude at which they crossed land, and so on. Jetport management would have immediately-available data with which to confront the problem. Similarly, flight track plots over high quality mapping data or orthophotos would allow detailed analysis of DME and distance fixes for refinement of the CASCO SID. In sum, such a system will make the operational measures recommended earlier be very much easier to investigate and enforce.

There are four or five primary vendors of such systems. Listed alphabetically, they are: BAE Systems, Bridgenet Consulting, Bruel & Kjaer, Lochard Inc., and Rannoch.Inc.

The approximate initial cost of a system such as described here is likely to be on the order of $100,000 to $200,000, depending on factors such as the type of link to the FAA radar, whether separate links must be made to Boston Center, whether web access is required, level of support, need for additional computers, and so on.

(13) It is strongly recommended that the City establish a budget for such a flight track monitoring system, invite vendors to the Jetport to give a demonstration, and initiate a Request for Proposals for the delivery, installation, training, and support of a new flight track monitoring system.

6.9.2 Initiate Periodic Calculations of EXP(osure) metric

EXP is a simple spreadsheet means of tracking noise exposure using flight operations as the sole basis for the estimate. EXP utilizes pre-canned calculations of SELs from the FAA's Integrated Noise Model to represent each aircraft type, and using nothing more than the average daily operations by aircraft type, provides a single number noise value that is proportional to DNL. Computing the value each year, quarter, or month provides a key indicator on how total noise is changing over time, independent of how the operations change.

Such a metric is used by many smaller airports and some larger ones as a substitute for much more complex annual contour reports, and can easily be incorporated into a standard report produced automatically by the new flight track monitoring system. There is no urgency to begin calculations of the metric; if the track monitoring system is to be procured, calculations of EXP could easily be delayed so that it gets installed as part of the procurement.

(14) It is recommended that PWM initiate the tracking of the EXP noise metric to better understand the potential changes in exposure that will be associated with actions such as operations by a new tenant, introduction of commercial flights by a new entrant, changes in nighttime operations, shifts in noise due to major runway resurfacing or construction projects, and so on. It is also recommended that periodic reports be issued to the public, either through the Jetport's web page, a news letter, or meetings of the NAC.

6.9.3 Establish Engine Run-Up Procedures

PWM has previously established a location for engine run-ups at the west end of Taxiway Alpha near the hold-short line for Runway 11. Though run-ups were not identified as a major issue during the course of this Update, the Jetport intends to establish additional controls over the conduct of maintenance activity.

(15) To that end, the following practices are recommended:

- *Any operator wishing to conduct an engine run-up at greater than 70 percent power for more that 5 minutes must receive prior permission from Jetport Operations staff.*
- *Run-ups for which permission must be granted, must be carried out on the holding apron at the west end of Taxiway Alpha near the hold-short point for Runway 11.*
- *Run-ups shall be conducted on a magnetic headings of 110º or as close to that heading as feasible.*

- *When a run-up is complete, the operator shall report back to Jetport Operations, giving the start and end times of the run-up, the heading(s), the maximum power setting used during the period, and the purpose of the run-up.*

- *Jetport Operations staff shall maintain a monthly log of each run-up and shall provide a copy of each to the Assistant Airport Manager to assist in answering any noise complaints.*

6.9.4 Continue to Work with Federal Express and Others to Encourage Conformance with Abatement Measures

(16) It is recommended that Jetport Management continue to bring pressure to local representatives of any company operating a Stage 2 or re-certified Stage 3 aircraft at PWM in order to achieve full compliance with all Noise Abatement Measures, including but not limited to (a) requesting clearances from FAA to fly the CASCO DEPARTURE to 3,000 feet, or its RNAV update if approved, or to fly either of the other recommended Voluntary Noise Abatement Departure Procedures, and (b) following all pertinent guidance on use of the preferential runway program, and (c) complying fully with maintenance run-up procedures.

6.9.5 Request NAS Brunswick and USAF Flying Units to Curtail Practice Instrument Approaches at PWM

(17) U.S. Air Force KC-135s and to a lesser degree U.S. Navy P-3s were responsible for a number of loud noise events during the noise measurement program conducted as part of this Update. NAC Committee members also reported occasional atypical flight patterns by Navy P-3 aircraft. Because of the sensitivity of many of the neighborhoods surrounding PWM, it is recommended that Jetport Management contact each of the two major flying units and request that they conduct their training elsewhere.

6.9.6 Continue Meetings with Noise Advisory Committee

The NAC remains a body of highly dedicated and knowledgeable individuals representing various community groups. Many of these individuals have spent 10 years or more staying actively involved with aviation noise issues at Portland. They are important conduits to their constituencies. The Jetport could use the meeting opportunities to present periodic updates on the progress of implementing NCP recommendations, provide an annual review on the successes and weaknesses of the program, get feedback on the Jetport's website, and discuss many other topics of mutual interest and concern.

(18) It is recommended that the Noise Advisory Committee remain active and provide important feedback to Jetport Management on the success or lack thereof of the new NCP. Of particular concern will be the need for dialogue on the noise abatement departure procedures and preferential runway use program, with the goal of eventually developing comparable GPS(RNAV) procedures so that additional precision can be added to existing procedures. The NAC will also be very interested in implementation of the flight track monitoring system.

6.9.7 Attend Periodic Meetings of Local Homeowner Associations

(19) With an on-going need to develop and maintain trust, understanding, and dialogue with airport neighbors, it is recommended that Jetport Management visit each of the Homeowner Associations in Portland and South Portland at least annually to discuss recent developments at PWM, progress on noise issues, upcoming events or construction, changes in activity, and any other issues of local interest.

7 CONSULTATIONS WITH PUBLIC, USERS AND OUTSIDE AGENCIES

This final chapter briefly summarizes the public participation process followed during this Part 150 Update.

7.1 Noise Abatement Committee Process

The Jetport established the Noise Abatement Committee (NAC) as a result of the original Part 150 study. The group has continued to meet to discuss changes in the noise environment in the communities surrounding PWM and was involved in the development of this NEM update.

The NAC met eleven times during the development of this Updated NCP. All eleven meetings were open to the general public, with opportunity for public involvement and questions. The meetings consisted of a presentation with questions and answers taking place throughout the presentation. Appendix F presents copies of the power point presentations presented by the consultant, meeting notes, and sign-in sheets from these meetings.

7.2 Web Listings

In addition to public consultation through the NAC meetings, copies of most power point presentations and records of meetings were posted to the City's web site (http://www.portlandjetport.org/noise.asp) for public review. Only when those presentations were very large in size and cumbersome to download were they excluded from the website.

7.3 Public Workshop and Hearing

On 12 May 2003, the Jetport and the Study Team held a public workshop to describe the project and the City's goals for the outcome. Announcements of the meeting were sent to four newspapers, including a ¼-page announcement in Portland's largest paper, the *Portland Press Herald*, on both the Thursday and the Sunday preceding the workshop. Other announcements appeared in *The Forecaster*, *The Island Times*, *West End News*, and the Westbrook newsletter. Personal announcements were emailed to the all email addresses on file with the Jetport. A total of 16 people appeared at the workshop, though only four individuals had not been intimately involved with the project up to that point. No formal comments were submitted at that time.

A final public hearing occurred on 13 July 2004 to receive any final public comment. A transcript of the hearing is included in Appendix F, along with one written comment received from a resident who could not attend the hearing. Copies of this report , including the hearing transcript, are on file at the New England Region of the FAA, 12 New England Executive Park in Burlington, Massachusetts.