Philadelphia International Airport

FAR PART 150

Noise Compatibility Study

FINAL

JUNE 2002

VOLUME I

Since 1949

Landrum & Brown Team

PHILADELPHIA INTERNATIONAL AIRPORT

FAR PART 150 NOISE COMPATIBILITY STUDY

FINAL

June 2002

Prepared by
Landrum & Brown Team

CITY OF PHILADELPHIA

Philadelphia International Airport
Terminal E
Philadelphia, Pennsylvania 19153

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CHARLES J. ISDELL
Director of Aviation

June 18, 2002

Mr. Jim Byers, Environmental Specialist
FAA, Harrisburg ADO
3911 Hatrzdale Drive
Camp Hill, PA 17011

Subject: Submission of Part 150 Study, Including Noise Exposure Maps and Noise Compatibility Study for Philadelphia International Airport

Dear Mr. Byers:

Enclosed please find five (5) copies of the above referenced combined documents submitted under 14 CFR Part 150 for appropriate FAA determination. The Philadelphia International Airport requests approval of the 2001 Noise Exposure Map (NEM) for existing conditions and the 2006 NEM with Noise Compatibility Program (NCP) implementation.

The future NEM is based on reasonable forecasts and planning assumptions contained in the Airport Master Plan. We herein verify that the documentation is representative of existing and future forecast conditions as of the date of submission. The enclosed maps are the first offered NEMs to be submitted for the Philadelphia International Airport.

The elements of the NCP have been coordinated with representatives of the agency or user groups having responsibility for implementation. While it is not practical to obtain formal agreements from every agency or group prior to this submission, each group is aware of these actions which fall within their respective jurisdictions. Flight procedures were coordinated with the FAA Air Traffic Control Tower and airlines throughout the study process.

On behalf of the Philadelphia International Airport, I would like to express our appreciation to the FAA for its support in conducting the Part 150 Study. We look forward to an expeditious Federal review and approval of our plan, so that we can begin immediately to implement the noise abatement and land use mitigation measures for the benefit of the airport's neighbors.

Sincerely,

Charles J. Isdell, Jr.

Enclosures

FAR PART 150 STUDY
NOISE EXPOSURE MAP CHECKLIST -- PART I

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
I. IDENTIFICATION AND SUBMISSION OF MAP DOCUMENT:		
A. Is this submittal appropriately identified as one of the following, submitted under FAR Part 150:		
1. a NEM only	No	N/A
2. a NEM and NCP	Yes	Letter of Transmittal,
3. a revision to NEMs which have previously been determined by FAA to be in compliance with Part 150?	No	N/A
B. Is the airport name and the qualified airport operator identified?	Yes	Letter of Transmittal
C. Is there a dated cover letter from the airport operator which indicates the documents are submitted under Part 150 for appropriate FAA determinations?	Yes	Letter of Transmittal
II. CONSULTATION: [150.21(b), A150.105(a)]		
A. Is there a narrative description of the consultation accomplished, including opportunities for public review and comment during map development?	Yes	Appendix H, I & J, Chapter 1, Page 1-6
B. Identification:		
1. Are the consulted parties identified?	Yes	Appendix H, I & J
2. Do they include all those required by 150.21(b) and A150.105(a)?	Yes	Appendix H, I & J
C. Does the documentation include the airport operator's certification, and evidence to support it, that interested persons have been afforded adequate opportunity to submit their views, data, and comments during map development and in accordance with 150.21(b)?	Yes	Sponsor's Certificate, Appendix H, I & J
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?	Yes	Appendix I

FAR PART 150 STUDY
NOISE EXPOSURE MAP CHECKLIST -- PART I

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
III. GENERAL REQUIREMENTS: [150.21]		
A. Are there two maps, each clearly labeled on the face with year (existing condition year and 5-year)?	Yes	Exhibits NEM-1 & NEM-2
B. Map currency:		
1. Does the existing condition map year match the year on the airport operator's submittal letter?	Yes	Letter of Transmittal & Exhibit NEM-1
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?	Yes	Letter of Transmittal, Appendix C
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 condition and 5-year forecast conditions as of the date of submission?	N/A	N/A
C. If the NEM and NCP are submitted together:	Yes	Letter of Transmittal & Chapter 4
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?		
2. If the 5-year map is based on program implementation:		
a. are the specific program measures which are reflected on the map identified:	Yes	Chapter 4
b. does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	Yes	Chapter 4
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 plan?	N/A	N/A

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
IV. MAP SCALE, GRAPHICS, AND DATA REQUIREMENTS: [A150.101, A150.103, A150.105, 150.21(a)]		
A. Are the maps of sufficient scale to be clear and readable (they must not be less than 1" to 8,000'), and is the scale indicated on the maps?	Yes	Exhibits NEM-1 & NEM-2
B. Is the quality of the graphics such that required information is clear and readable?	Yes	Exhibits NEM-1 & NEM-2
C. Depiction of the airport and its environs.		
1. Is the following graphically depicted to scale on both the existing condition and 5-year maps:		
a. airport boundaries	Yes	Exhibits NEM-1 & NEM-2
b. runway configurations with runway end numbers	Yes	Exhibits NEM-1 & NEM-2
2. Does the depiction of the off-airport data include:		
a. a land use base map depicting streets and other identifiable geographic features	Yes	Exhibits NEM-1 & NEM-2
b. the area within the 65 Ldn (or beyond, at local discretion)	Yes	Exhibits NEM-1 & NEM-2
c. clear delineation of geographic boundaries and the names of all jurisdictions with planning and land use control authority within the 65 Ldn (or beyond, at local discretion)	Yes	Exhibits NEM-1 & NEM-2
D. 1. Continuous contours for at least the Ldn 65, 70, and 75?	Yes	Exhibits NEM-1 & NEM-2
2. Based on current airport and operational data for the existing condition year NEM, and forecast data for the 5-year NEM?	Yes	Exhibits NEM-1 & NEM-2
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?	Yes	Exhibits C-6 & C-7

NOISE EXPOSURE MAP CHECKLIST -- PART I

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
F. Locations of any noise monitoring sites (these may be on supplemental graphics which must use the same land use base map as the official NEMs)	Yes	Exhibit B-1
G. Noncompatible land use identification: 1. Are noncompatible land uses within at least the 65 Ldn depicted on the maps?	Yes	Exhibits NEM-1 & NEM-2
2. Are noise sensitive public buildings identified?	Yes	Appendix D
3. Are the noncompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	Yes	Appendix D
4. Are compatible land uses, which would normally be considered noncompatible, explained in the accompanying narrative?	N/A	N/A
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?	Yes	Chapter 2 & Appendix C
2. Are the underlying technical data and planning assumptions reasonable?	Yes	Chapter 2 & Appendix C
B. Calculation of Noise Contours: 1. Is the methodology indicated? a. is it FAA approved?	Yes	Appendix C
b. was the same model used for both maps?	Yes	Appendix C
c. has AEE approval been obtained for use of a model other than those which have previous blanket FAA approval?	N/A	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?	No	Appendix C
b. if so, does this have written approval from AEE?	N/A	N/A

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?	Yes	Appendix B
4. For noise contours below 65 Ldn, does the supporting documentation include explanation of local reasons? (Narrative explanation is highly desirable but not required by the Rule.)	N/A	N/A
C. Noncompatible Land Use Identification:		
1. Does the narrative give estimates of the number of people residing in each of the contours (Ldn 65, 70 and 75, at a minimum) for both the existing condition and 5-year maps?	Yes	Chapter 2
2. Does the documentation indicate whether Table 1 of Part 150 was used by the airport operator?	Yes	Appendix B, Table B-1
a. If a local variation to Table 1 was used:	N/A	N/A
(1) does the narrative clearly indicate which adjustments were made and the local reasons for doing so?	N/A	N/A
(2) does the narrative include the airport operator's complete substitution for Table 1?	N/A	N/A
3. Does the narrative include information on self-generated or ambient noise where compatible/noncompatible land use identifications consider non-airport/aircraft sources?	N/A	N/A
4. Where normally noncompatible land uses are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?	Yes	Chapter 2 & Appendix C
5. Does the narrative describe how forecasts will affect land use compatibility?	Yes	Chapter 2 & Appendix C

NOISE EXPOSURE MAP CHECKLIST -- PART I

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
VI. MAP CERTIFICATIONS: [150.21(b), 150.21(e)]		
A. Has the operator certified in writing that interested persons have been afforded adequate opportunity to submit views, data, and comments concerning the correctness and adequacy of the draft maps and forecasts?	Yes	Sponsor's Certificate
B. Has the operator certified in writing that each map and description of consultation and opportunity for public comment are true and complete?	Yes	Sponsor's Certificate

S:\02PHL\FINAL DOCUMENT\LISTNEM.DOC

FAR PART 150 STUDY
NOISE COMPATIBILITY PROGRAM CHECKLIST -- PART II

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
I. IDENTIFICATION AND SUBMISSION OF PROGRAM:		
A. Submission is properly identified:		
1. FAR 150 NCP?	Yes	Letter of Transmittal
2. NEM and NCP together?	Yes	Letter of Transmittal
3. Program revision?	No	N/A
B. Airport and Airport Operator's name identified?	Yes	Letter of Transmittal
C. NCP transmitted by airport operator cover letter?	Yes	Letter of Transmittal
II. CONSULTATION: [150.23]		
A. Documentation includes narrative of public participation and consultation process?	Yes	Chapter 1, page 1-6 Appendix H, I & J
B. Identification of consulted parties:		
1. all parties in 150.23(c) consulted?	Yes	Chapter1, page 1-6, Appendix H, I & J
2. public and planning agencies identified?	Yes	Appendix H
3. agencies in 2., above, correspond to those indicated on the NEM?	Yes	Exhibits NEM-1 & NEM-2
C. Satisfies 150.23(d) requirements:		
1. documentation shows active and direct participation of parties in B., above?	Yes	Appendix H, I & J
2. active and direct participation of general public?	Yes	Appendix H, I & J
3. participation was prior to and during development of NCP and prior to submittal to FAA?	Yes	Appendix H, I & J
4. indicates adequate opportunity afforded to submit views, data, etc.?	Yes	Appendix H, I & J
D. Evidence included of notice and opportunity for a public hearing on NCP?	Yes	Appendix I
E. Documentation of comments:		
1. includes summary of public hearing comments, if hearing was held?	Yes	Appendix I
2. includes copy of all written material submitted to operator?	Yes	Appendix H, I & J

NOISE COMPATIBILITY PROGRAM CHECKLIST -- PART II

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
3. includes operator's responses/disposition of written and verbal comments?	Yes	Appendix I
F. Informal agreement received from FAA on flight procedures?	Yes	Letter of Transmittal
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?	Yes	Attached to Checklist, Exhibits NEM-1 & NEM-2; Appendix C
2. Maps previously found in compliance by FAA?	No	N/A
3. Compliance determination still valid?	N/A	N/A
4. Does 180-day period have to wait for map compliance finding?	Yes	None
B. Revised NEMs submitted with program: (Review using NEM checklist if map revisions included in NCP submittal)		
1. Revised NEMs included with program?	Yes	Attached to Checklist, Exhibits NEM-1 & NEM-2
2. Has airport operator requested FAA to make a determination on the NEM(s) when NCP approval is made?	No	Letter of Transmittal
C. If program analysis uses noise modeling:		Appendix C, Page C-1
1. INM, HNM, or FAA-approved equivalent?	Yes	
2. Monitoring in accordance with A150.5?	Yes	Appendix B
D. Existing condition and 5-year maps clearly identified as the official NEMs?	Yes	Attached to Checklist, Exhibits NEM-1 & NEM-2

NOISE COMPATIBILITY PROGRAM CHECKLIST -- PART II

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
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?	Yes	Appendix F, LU-F
2. barriers, acoustical shielding, public building soundproofing	Yes	Appendix E, NA-T,
3. preferential runway system	Yes	Appendix E, NA-D, NA-M & NA-N
4. flight procedures	Yes	Appendix E, NA-A, NA-B, NA-C, NA-F, NA-G, NA-H, NA-I, NA-J, NA-K, NA-L, NA-O, NA-P
5. restrictions on type/class of aircraft (at least one restriction below must be checked)		
a. deny use based on Federal standards	No	N/A
b. capacity limits based on noisiness	No	N/A
c. noise abatement takeoff/approach procedures	No	N/A
d. landing fees based on noise or time of day	Yes	Appendix E, NA-R
e. nighttime restrictions	Yes	Appendix E, NA-R
6. other actions with beneficial impact	Yes	Appendix E
7. other FAA recommendations	Yes	Appendix E
B. Responsible implementing authority identified for each considered alternative?	Yes	Appendix E
C. Analysis of alternative measures:		
1. measures clearly described?	Yes	Appendix E, F, & G
2. measures adequately analyzed?	Yes	Appendix E, F, & G
3. adequate reasoning for rejecting alternatives?	Yes	Appendix E, F, & G

FAR PART 150 STUDY

NOISE COMPATIBILITY PROGRAM CHECKLIST -- PART II

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
D. Other actions recommended by the FAA: Should other actions be added? (list separately on back of this form actions and discussions with airport operator to have them included prior to the start of the 180-day cycle)	No	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?	Yes	Chapter 4
2. final recommendations are airport operator's not those of consultant or third party?	Yes	Chapter 4
B. Do all program recommendations:		
1. relate directly or indirectly to reduction of noise and noncompatible land uses?	Yes	Chapter 4
2. contain description of contribution to overall effectiveness of program?	Yes	Chapter 4
3. noise/land use benefits quantified to extent possible?	Yes	Chapter 4
4. include actual/anticipated effect on reducing noise exposure within noncompatible area shown on NEM?	Yes	Chapter 4
5. effects based on relevant and reasonable expressed assumptions?	Yes	Chapter 4
6. have adequate supporting data to support its contribution to noise/land use compatibility?	Yes	Chapter 4
C. Analysis appears to support program standards set forth in 150.35(b) and B150.5?	Yes	Chapter 4
D. When use restrictions are recommended:	N/A	N/A
1. Are alternatives with potentially significant noise/compatible land use benefits thoroughly analyzed so that appropriate comparisons and conclusions can be made?		

NOISE COMPATIBILITY PROGRAM CHECKLIST -- PART II

AIRPORT NAME: Philadelphia International Airport REVIEWER: _____

	Yes/No/NA	Page No.\Other Reference
2. Use restriction coordinated with APP-600 prior to making determination on start of 180-days?	N/A	N/A
E. Do the following also meet Part 150 analytical standards:		
1. formal recommendations which continue existing practices?	Yes	Chapter 4
2. new recommendations or changes proposed at end of Part 150 process?	Yes	Chapter 4
F. Documentation indicates how recommendations may change previously adopted plans?	Yes	Chapter 4
G. Documentation also:		
1. identifies agencies which are responsible for implementing each recommendation?	Yes	Chapter 4
2. indicates whether those agencies have agreed to implement.	Yes	Chapter 4
3. Indicates essential government actions necessary to implement recommendations.	Yes	Chapter 4
H. Timeframe:		
1. includes agreed-upon schedule to implement alternatives?	Yes	Chapter 4
2. indicates period covered by the program?	Yes	Chapter 4
I. Funding/Costs:		
1. includes costs to implement alternatives?	Yes	Chapter 4
2. includes anticipated funding sources?	Yes	Chapter 4
VI. PROGRAM REVISION: [150.23(e)(9)] Supporting documentation includes provision for revision?	N/A	N/A

S:\02PHL\FINAL DOCUMENT\LIST-NCP.DOC

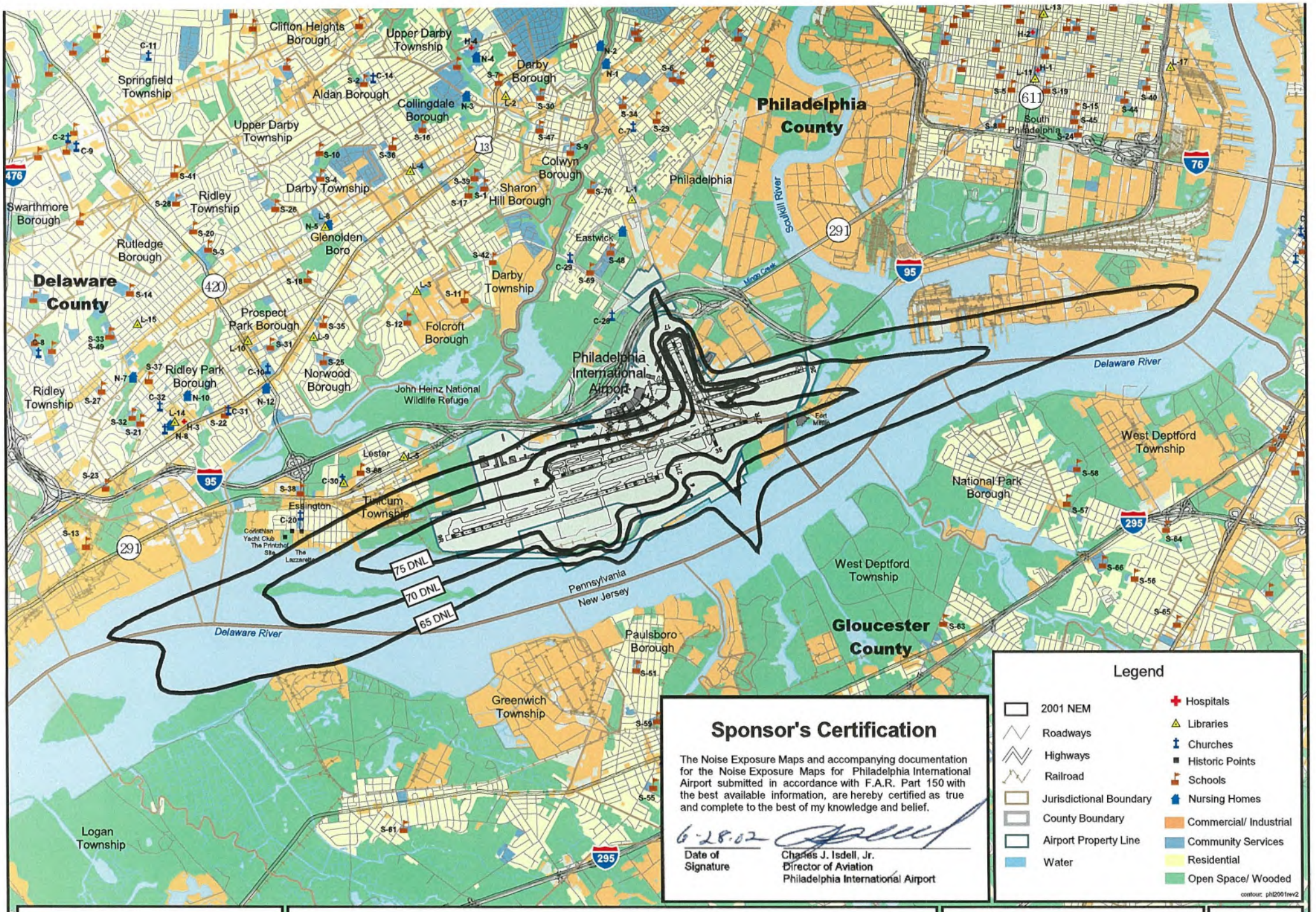
STATEMENT OF CERTIFICATION AND PUBLIC NOTIFICATION

These maps, the Existing (2001) and Future (2006) Noise Exposure Maps; the Noise Compatibility Program (NCP); and accompanying documentation for Philadelphia International Airport, are submitted in accordance with Part 150 of the Federal Aviation Regulations (14 CFR 150). To the best of my knowledge and belief, the Existing (2001) and Future (2006) Noise Exposure Maps were prepared with the best available information and on the basis of reasonable assumptions and are hereby certified as true, complete, and representative of existing and future aircraft noise levels.

I also hereby certify that interested persons have been afforded adequate opportunity to submit their view, data, and comments concerning the correctness and adequacy of the draft noise exposure maps and descriptions of forecast aircraft operations; and on the formulation and adequacy of the Noise Compatibility Program and accompanying documentation. A copy of all written comments received during development of the Noise Exposure Maps and the Noise Compatibility Program is included in this document.

Date 6-28-02

Charles J. Isdell, Jr.
Director of Aviation
Philadelphia International Airport
City of Philadelphia



Sponsor's Certification

The Noise Exposure Maps and accompanying documentation for the Noise Exposure Maps for Philadelphia International Airport submitted in accordance with F.A.R. Part 150 with the best available information, are hereby certified as true and complete to the best of my knowledge and belief.

6-28-02
Date of Signature

Charles J. Isdell, Jr.
Director of Aviation
Philadelphia International Airport

Legend

- 2001 NEM
- Roadways
- Highways
- Railroad
- Jurisdictional Boundary
- County Boundary
- Airport Property Line
- Water
- Hospitals
- Libraries
- Churches
- Historic Points
- Schools
- Nursing Homes
- Commercial/ Industrial
- Community Services
- Residential
- Open Space/ Wooded

contour: phl2001rev2

FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

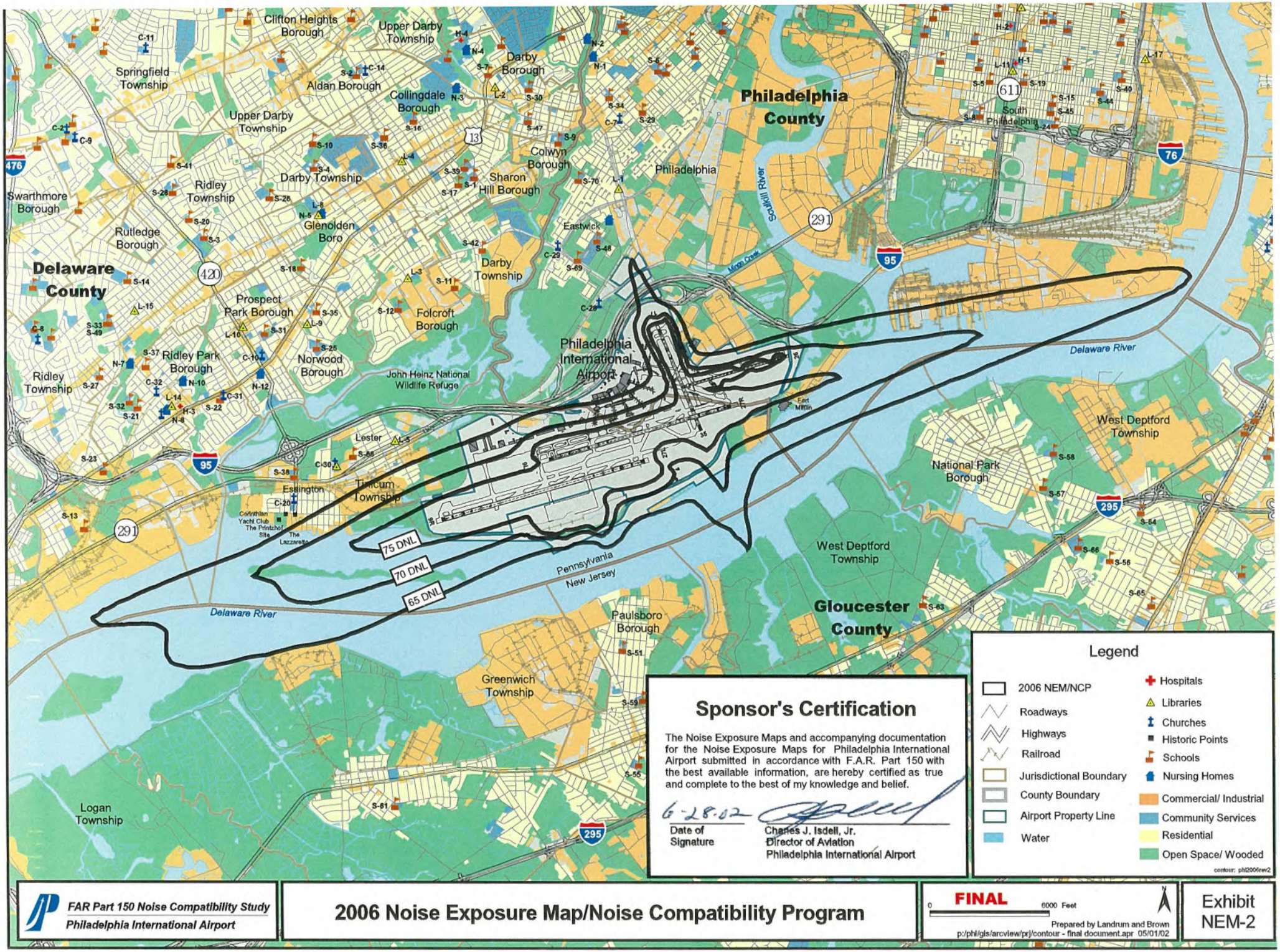
2001 Noise Exposure Map

FINAL

0 6000 Feet

Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/01/02

Exhibit NEM-1



Sponsor's Certification

The Noise Exposure Maps and accompanying documentation for the Noise Exposure Maps for Philadelphia International Airport submitted in accordance with F.A.R. Part 150 with the best available information, are hereby certified as true and complete to the best of my knowledge and belief.

6-28-02
Date of Signature

Charles J. Isdell, Jr.
Director of Aviation
Philadelphia International Airport

Legend

- 2006 NEM/NCP
- Roadways
- Highways
- Railroad
- Jurisdictional Boundary
- County Boundary
- Airport Property Line
- Water
- Hospitals
- Libraries
- Churches
- Historic Points
- Schools
- Nursing Homes
- Commercial/ Industrial
- Community Services
- Residential
- Open Space/ Wooded

contour: phl2006rev2

FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

2006 Noise Exposure Map/Noise Compatibility Program

FINAL

0 6000 Feet

Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/01/02

Exhibit NEM-2

Table of Contents

TABLE OF CONTENTS

PAGE

APPENDICES

LIST OF EXHIBITS

PAGE

CHAPTER ONE

CHAPTER TWO

CHAPTER THREE

CHAPTER FOUR

LIST OF EXHIBITS
(Continued)

PAGE

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

LIST OF EXHIBITS
(Continued)

PAGE

APPENDIX E (Continued)

APPENDIX F

LIST OF TABLES

PAGE

CHAPTER ONE

CHAPTER THREE

CHAPTER FOUR

APPENDIX A

APPENDIX B

LIST OF TABLES
(Continued)

PAGE

APPENDIX C

APPENDIX D

Chapter 1

CHAPTER ONE
BACKGROUND

This chapter provides the background information to afford the public and/or governmental reviewer to make an informed decision as to the adequacy of the study in meeting the requirements set forth by Federal Aviation Regulation (FAR) Part 150 under which it is prepared.

1.1 FAR PART 150

Part 150 is a section of the Federal Aviation Regulations (FAR) that sets forth regulations and guidelines for airports desiring to undertake airport noise compatibility planning. The regulations were promulgated by the Federal Aviation Administration (FAA) pursuant to the Aviation Safety and Noise Abatement Act (ASNA) of 1979, Public Law 96-193. ASNA was enacted to "... provide and carry out noise compatibility programs, to improve assistance to assure continued safety in aviation and for other purposes." The FAA was vested with the authority to implement and administer the act. This legislation required the establishment of a single system for measuring aircraft noise, determining noise exposure, and identifying land uses, which are normally compatible with various noise exposure levels.

Through FAR Part 150, the FAA established regulations governing the technical aspects of aircraft noise analysis and the public participation process for airports choosing to prepare airport noise compatibility plans.

1.1.1 WHAT IS THE PURPOSE OF CONDUCTING A PART 150 STUDY?

The purpose for conducting a Part 150 Study at an airport is to develop a balanced and cost-effective plan for reducing current noise impacts from an airport's operations, where practical, and to limit additional impacts in the future. By following the process, the airport operator is assured of the FAA's cooperation through the involvement of air traffic control professionals in the study and the FAA's review of the recommended Noise Compatibility Program (NCP). An airport with a FAA-approved NCP also becomes eligible for funding assistance for the implementation of measures in the NCP.

Among the general goals and objectives addressed by a Part 150 Study are the following:

- To reduce, where feasible, existing and forecasted noise levels over existing noise-sensitive land uses;
- To reduce new noise-sensitive developments near the airport;

- To mitigate, where feasible, adverse impacts in accordance with Federal guidelines;
- To provide mitigation measures that are sensitive to the needs of the community and its stability;
- To minimize the impact of mitigation measures on local tax bases; and
- To be consistent, where feasible, with local land use planning and development policies.

1.1.2 WHAT IS THE PART 150 PLANNING PROCESS?

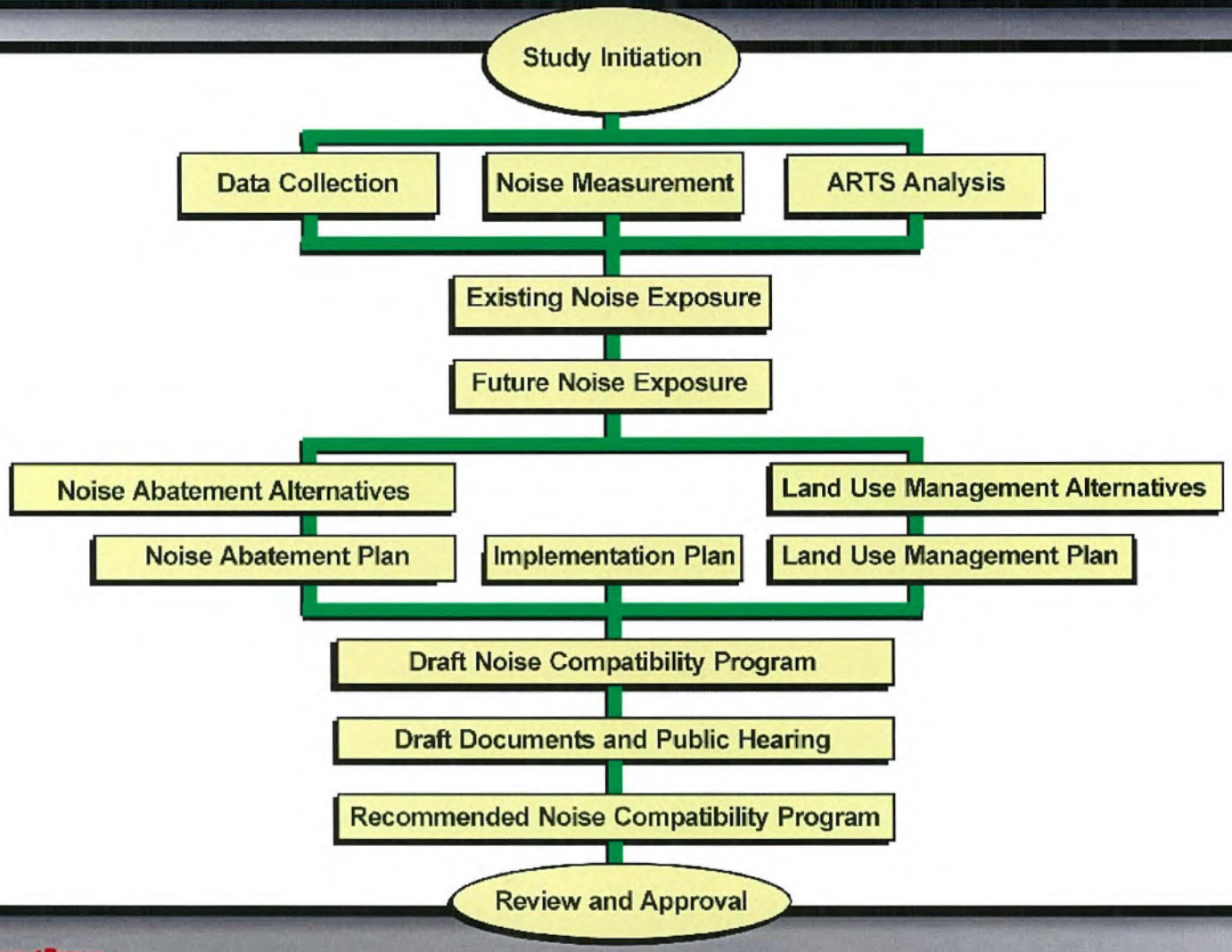
The Part 150 planning process involves the methods and procedures an airport operator must follow in developing a NCP. The decision to undertake noise compatibility planning is entirely voluntary on the part of the airport operator. If the airport operator chooses to prepare a NCP, the FAA will provide funding assistance if the operator follows the regulations of FAR Part 150. As a further inducement to undertake noise compatibility planning, an airport operator becomes eligible for Federal funding assistance for the implementation of measures in a FAA-approved NCP.

The planning process has both technical and procedural components. FAR Part 150 requires that the analysis of aircraft noise exposure and potential noise abatement and land use mitigation measures use specific technical criteria and methods. The regulations also require that potentially affected airport users, local governments, and the public be consulted with during the study. The process must culminate with the opportunity for a public hearing on the airport's recommended NCP. See **Exhibit 1-1**, *Noise Compatibility Planning Process*, for a flowchart of the Process.

A Part 150 Study involves six major steps:

- Identification of airport noise and land use issues and problems;
- Definition of current and future noise exposure patterns;
- Evaluation of alternative measures for abating noise (e.g., changing aircraft flight paths), mitigating the impact of noise (e.g., sound insulation), and managing local land uses (e.g., airport-compatible zoning);
- Development of a noise compatibility plan;
- Development of an implementation and monitoring plan; and
- FAA review and approval of the recommended noise compatibility program, including the analysis of alternatives, the compatibility plan, and the implementation and monitoring plan.

Noise Compatibility Planning Process



50 Landrum&Brown

- Insert Exhibit 1-1

Color

NOISE COMPATIBILITY PLANNING PROCESS

FAR Part 150 allows for the development of two final documents, Noise Exposure Maps (NEMs) and a Noise Compatibility Program (NCP). In practice, these documents are typically combined into a single document package for submission to the FAA for review and approval.

1.1.3 NOISE EXPOSURE MAPS

The NEM component of a Part 150 Study presents airport noise exposure contours for current conditions and a forecast condition five years in the future. For this study, the NEMs use 2001 as the current year and 2006 as the five-year forecast. The noise contours are first developed assuming the implementation of no additional noise abatement procedures. The noise contours are superimposed on a land use map to show areas of incompatible land use. The documentation provides detailed supporting information explaining the methods used to develop the maps. Appendix C, *Noise Modeling Methodology*, contains detailed information on the inputs and methodology for preparing the noise exposure contours. The official NEMs are located at the front of this document with the NEM and NCP checklist.

FAR Part 150 requires the use of standard methodologies and metrics for analyzing and describing noise. It also establishes guidelines for the identification of land uses that are incompatible with noise of different levels. In Section 150.21(d), airport proprietors are required to update noise exposure maps when changes in the operation of the airport would create any new, substantial incompatible use. This is considered to be an increase in DNL noise levels of 1.5 dBA over incompatible land uses when the aircraft noise level exceeds DNL 65 dBA. Of course, the airport operator may update the noise exposure maps at any time based on their own needs and concerns. In this case, the Philadelphia International Airport (PHL) is conducting an initial Part 150 Study.

The airport proprietor can gain limited protection through preparation, submission, and publication of noise exposure maps. ASNA provides in Section 107(a) that:

No person who acquires property or an interest therein ... in an area surrounding an airport with respect to which a noise exposure map has been submitted shall be entitled to recover damages with respect to the noise attributable to such airport if such person had actual or constructive knowledge of the existence of such noise exposure map unless ... such person can show that:

(i) A significant change in the type or frequency of aircraft operations at the airport; or

(ii) A significant change in the airport layout; or

(iii) A significant change in the flight patterns; or

(iv) A significant increase in nighttime operations; occurred after the date of acquisition of such property.

ASNA provides that "constructive knowledge" shall be imputed to any person if a copy of the noise exposure map was provided to them at the time of property acquisition or if notice of the existence of the noise exposure map was published three times in a newspaper of general circulation in the area. In addition, Part 150 defines "significant increase" as an increase of 1.5 dBA of DNL. For purposes of this provision, FAA officials consider the term "area surrounding an airport" to mean an area within the 65 DNL contour. (See FAR Part 150, Section 150.21(d), (f), and (g).

An acceptance of the NEMs by the FAA is required before the FAA will approve a NCP for the airport.

1.1.4 NOISE COMPATIBILITY PROGRAM

A NCP includes provisions for the abatement of aircraft noise through aircraft operating procedures, air traffic control procedures, or airport facility modifications. It also includes provisions for land use compatibility planning and may include actions to mitigate the impact of noise on incompatible land uses. Chapter Four, *Noise Compatibility Program*, includes detailed information for the PHL NCP recommendations. The program must also contain provisions for updating and periodic revision.

FAR Part 150 establishes procedures and criteria for FAA evaluation of NCP. Two criteria are of particular importance: the airport proprietor may not take any action that imposes an undue burden on interstate or foreign commerce, nor may the proprietor unjustly discriminate between different categories of airport users.

The FAA also reviews changes in flight procedures proposed for noise abatement for potential effects on flight safety, safe and efficient use of the navigable airspace, management and control of the national airspace and traffic control systems, security and national defense, and compliance with applicable laws and regulations. Since the FAA has the ultimate authority for air traffic control and flight procedures related to air traffic control requirements, any measures relating to these subjects that are recommended in an NCP must be explicitly approved by the FAA and may not be implemented unilaterally by the airport proprietor.

FAA approval of Part 150 measures, through a Record of Approval, supported by an environmental assessment and a finding of no significant impact (or an environmental impact statement and a Record of Decision), environmentally clears the agency to participate in actions over which it has primary implementation responsibility (e.g., air traffic modifications). With an approved NCP, an airport proprietor becomes eligible for

Federal funding to implement the eligible items of the program. Approval by the FAA does not, however, commit the agency to either a specific schedule of implementation or guarantee the allocation of Federal funds for implementation of any measure.

1.2 PUBLIC INVOLVEMENT

As discussed previously, a key element in the Part 150 process is public involvement. In order to inform and gather input from the public regarding the findings of the PHL Part 150 Study, a Study Advisory Committee (SAC) was convened, focus group meetings were conducted, public workshops were held in the community, and a public hearing was completed.

1.2.1 STUDY ADVISORY COMMITTEE

A SAC was organized early during the planning process to provide feedback and advice to the planning team on the contents and preparation of the Part 150 study. The SAC provided residents, airport users, agencies, and local officials an opportunity to be involved in developing PHL's first Part 150 NCP. In refining the NCP, the City of Philadelphia, airport staff, and the consultants wanted to benefit from the SAC members' special viewpoints and the people and resources they represented. A process was designed to encourage the open exchange of creative ideas to achieve results. The members of the SAC assisted the process in several ways.

- **As a Sounding Board** – The SAC provided a forum in which the consulting team and other SAC members could present information, findings, ideas, and recommendations. All benefited from listening to the diverse viewpoints and concerns of the wide range of interests represented on the committee.
- **As a Link to the Community** – Each member represented a key constituent interest -- local neighborhoods, local governments, public agencies, or airport users. Committee members could bring together the consulting team and the people they represented, could inform their constituents about the study as it progressed, and could bring the views of others into the committee.
- **As a Critical Reviewer** – The consulting team needed its work scrutinized closely for accuracy, completeness of detail, clarity of thought, and intellectual honesty. The committee membership was urged to point out any shortcomings in our work and to help improve it.
- **As an Aid to Implementation** – Each member has a unique role to play in implementing the plan, ranging from making changes in flight procedures to changes in local land use plans and regulations.

The SAC operated informally, with no compulsory attendance, no voting, and no offices. The final decision on which measures to include in the Part 150 NCP rests with the Airport. The meetings were conducted by the consultant team and were called at

various points in the study (five times) when committee input was especially needed. Ordinarily, meetings were scheduled with sufficient advance notice to permit members to arrange their schedules. Members were urged to attend five general public information workshops held during the study to listen firsthand to the concerns that were raised and speak with people one-on-one.

Many organizations were contacted and invited to designate a representative to serve on the SAC. The membership list shows a very broad range of interests to be represented – pilots, fixed-base operator, commerce, community, environmental, air traffic controllers, government and planning, as well as interested and affected citizens. A roster of the membership of the SAC is provided in Appendix H, *Public Involvement*.

1.2.2 Public Information Workshops

During the course of the Part 150 Study, five public information workshops were held in the community. These workshops were attended by interested citizens, elected officials, and local media representatives. Appendix H, *Public Involvement*, includes copies of meeting notices, sign-in sheets, comments received, and meeting handouts. The following provides a summary of the dates, times, and locations of the public information workshops.

- April 17, 2001
  4:30 p.m. – 7:00 p.m.
  Tinicum School
  Tinicum Township, PA
- August 7, 2001
  4:00 p.m. – 7:00 p.m.
  Mercy Wellness Center
  Philadelphia (Eastwick), PA
- October 25, 2001
  5:00 p.m. – 7:30 p.m.
  Brandywine High School
  Wilmington, DE
- December 12, 2001
  4:30 p.m. – 7:00 p.m.
  Airport Hilton Hotel
  Philadelphia, PA
- March 21, 2002
  6:00 p.m. – 9:00 p.m.
  Airport Hilton Hotel
  Philadelphia, PA

1.2.3 Public Hearing and Comment Period

FAR Part 150 requires that Draft Part 150 NCP documents be made available to the public prior to conducting a Public Hearing. The Draft Part 150 NCP document was made available to the public on February 19, 2002 and was available at local libraries, city administration buildings, at the airport, and on-line at www.PHL.org. A Public Hearing/Public Information Workshop was held on March 21, 2002 at the Airport Hilton from 6:00 p.m. to 9:00 p.m. Approximately 110 people attended the Public Hearing and Public Information Workshop. The Draft Part 150 NCP received 28 written comments, as well as 23 oral comments during the hearing and subsequent comment period. These comments are reproduced and addressed in Appendix J of this document. The comment period began on February 19, 2002 and was closed on March 29, 2002.

1.2.4 Additional Public Coordination

In addition to the efforts described above, the consultants and airport staff made themselves available for meetings with neighborhood organizations, airport user groups, local government officials, and local residents throughout the study period.

1.3 AIRPORT FACILITIES AND ACTIVITY

The following sections provide a basic description of the existing airport facilities and an introduction to the typical aircraft activity at PHL.

1.3.1 AIRPORT HISTORY

The City of Philadelphia officially entered the field of air transportation in 1925 when it provided 125 acres of land (now part of the northeast corner of Philadelphia International Airport) for training aviators of the Pennsylvania National Guard. In 1926, the City executed an agreement with Ludington Exhibition Company, the forerunner of Eastern Airlines, to operate the facility as the "Municipal Aviation Landing Field."

The Airport was formally opened as Philadelphia Municipal Airport on June 20, 1940. The four airlines then serving Philadelphia through Central Airport in nearby Camden, NJ (American, Eastern, TWA, and United) terminated their operations at that location.

Approximately 40,000 passengers were transported in the Airport's first year of operation. The airlines primarily flew two-motor Douglas DC-3 21-passenger planes, including sleepers. In 1945, Philadelphia Municipal Airport became Philadelphia International Airport when American Overseas Airlines inaugurated transatlantic service at the facility.

In the late 1960s, the City and the airlines based at Philadelphia International Airport began intensive planning for a vast improvement project to meet the challenge of the jet age. Subsequently, the Division of Aviation erected new passenger and airfield facilities to meet the needs of the traveling public. The scheduled airlines were also committed to massive Airport modernization and development, the project which created the present Airport facility. The keystone of the project, a $22 million all-weather runway (9R-27L) was dedicated on December 11, 1972.

The Airport's Overseas Terminal opened in April 1973. In the spring of 1977, the modernization and development of the domestic terminal area was completed, replacing the "central type" terminal with four unit terminals (B, C, D, and E). In the late 1980's, a $695 million, six-year capital improvement program began that called for construction to begin on a new international terminal (Terminal A, completed in 1991) and the total renovation of Terminals B, C, D and E. The Airport in August 1999 broke ground on a new international terminal (new International Terminal A) and opened a new commuter terminal (Regional Terminal F) in June 2001.

On December 3, 1999, Philadelphia International Airport commissioned its new commuter Runway 8-26. This 5000-foot runway serves regional and general aviation aircraft.

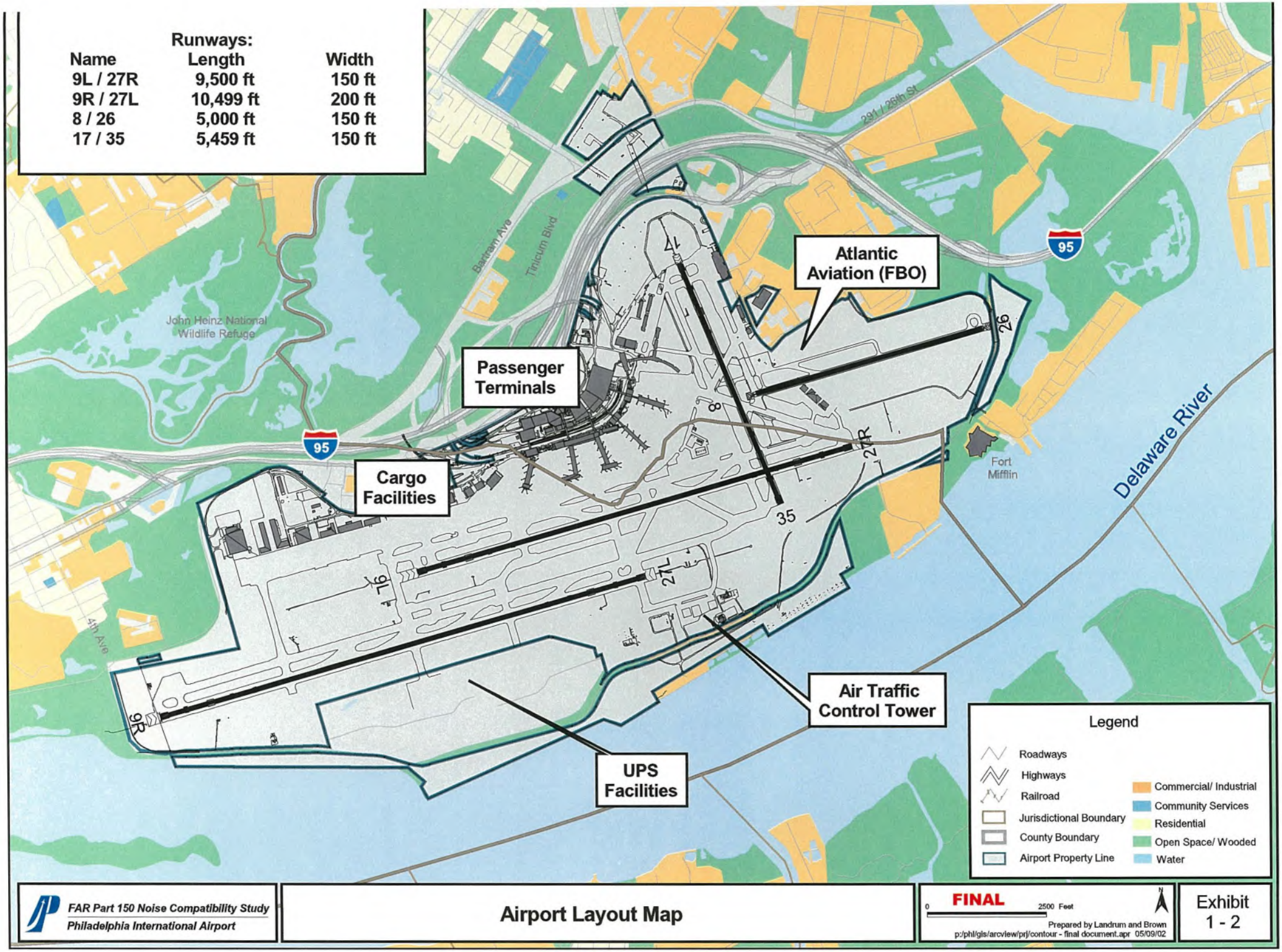
While Philadelphia Municipal Airport transported more than 40,000 passengers in 1940, Philadelphia International Airport now serves over 24.9 million passengers annually.

1.3.2 AIRPORT RUNWAYS

There are four active runways at the airport. They are:

- Runway 9L/27R (primary), 9,500 feet x 150 feet; principally used for arrivals in west flow and departures in east flow.
- Runway 9R/27L (primary), 10,499 feet x 200 feet; principally used for arrivals in east flow and departures in west flow.
- Runway 8/26 (secondary), 5,000 feet x 150 feet; principally used by light general aviation and commuter aircraft; restricted to operations east of PHL.
- Runway 17/35, 5,459 feet x 150 feet; principally used by light general aviation and commuter aircraft.

Exhibit 1-2 provides a schematic layout of the airport.


Runways:
Name Length Width
9L / 27R 9,500 ft 150 ft
9R / 27L 10,499 ft 200 ft
8 / 26 5,000 ft 150 ft
17 / 35 5,459 ft 150 ft
Atlantic Aviation (FBO)
Passenger Terminals
Cargo Facilities
Air Traffic Control Tower
UPS Facilities
John Heinz National Wildlife Refuge
Bartram Ave
Tinicum Blvd
291 / 26th St
Fort Mifflin
Delaware River
4th Ave
95
Legend
Roadways
Highways
Railroad
Jurisdictional Boundary
County Boundary
Airport Property Line
Commercial/ Industrial
Community Services
Residential
Open Space/ Wooded
Water
FAR Part 150 Noise Compatibility Study
Philadelphia International Airport
Airport Layout Map
FINAL
0 2500 Feet
Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/09/02
Exhibit 1 - 2

1.3.3 BUILDINGS AND AIRCRAFT ACTIVITY AREAS

The airfield is divided by the runways into three developed areas. The activities on the airport that generate aircraft ground traffic are listed below by area. They are shown on Exhibit 1-2, *Airport Layout Map*, and include aircraft parking, loading, and maintenance areas.

1.3.3.1 North Airfield

- Passenger Terminals
- US Airways Maintenance Hanger
- Cargo City Facilities
- West Cargo Apron
- Deicing Apron

1.3.3.2 South Airfield

- United Parcel Service Eastern Package Transfer Facility
- Control Tower

1.3.3.3 Northeast Airfield

- Atlantic Aviation Terminal and Hangars
- US Airways Commuter Maintenance Hanger
- Fuel Farm

1.3.4 AIRLINES

As of Fall 2001, the airport was served by eleven (11) domestic and six (6) foreign flag passenger air carriers, as well as five (5) regional/commuter and four (4) all-cargo carriers.

- Major Domestic Airline Service: AirTran, America West, American, ATA, Continental, Delta, Midwest Express, National, Northwest, United, and US Airways
- Major Foreign Airline Service: Air Canada, Air France, Air Jamaica, British Airways, Lufthansa German Airlines, US Airways International
- Regional and Commuter Airline Service: American Eagle, Continental Express, Delta Connection, United Express, and US Airways Express

- Scheduled Service by All-Cargo Airlines: Airborne Express, Emery, Federal Express, and United Parcel Service.

1.3.5 FIXED BASE OPERATOR

Atlantic Aviation offers pilot and passenger lounges, flight planning facilities, a 24-hour maintenance service, aircraft engines, aircraft supplies and parts, aircraft storage and tie down, and Jet A fuel and AV gas.

1.3.6 BASED AIRCRAFT

Table 1-1 provides the number of based aircraft at PHL by aircraft type. A total of 34 aircraft are based at the airport.

Table 1-1
BASED AIRCRAFT
Philadelphia International Airport

Aircraft Type	Number
Single-engine Aircraft	5
Multi-engine Aircraft	12
Jet Aircraft	14
Helicopters	3
Total	**34**

Source: www.airnav.com. Airport information published as of July 12, 2001.

1.3.7 ANNUAL OPERATIONS

Philadelphia International Airport is one of the busiest airports in the United States, accommodating more than 480,000 landings and departures by all aircraft during each of the last two years. The great majority of these operations are conducted by aircraft that carry passengers. Hub operations by United Parcel Service are responsible for most other air carrier operations. Together these two groups of operators account for approximately 88% of the operations during 1999 and 2000. General aviation activity accounted for more than 11% of the remainder and military operations comprised the rest. **Table 1-2** indicates the distribution of activity for 1999 and 2000. For a detailed breakdown of the annual operations, refer to Appendix C, *Noise Modeling Methodology*.

Table 1-2
CALENDAR YEARS 1999 AND 2000 OPERATIONS
Philadelphia International Airport

Year	Air Carrier	Commuter & Air Taxi	General Aviation	Military	Total
1999	281,930	146,250	51,021	1,078	480,279
2000	296,059	125,777	61,186	545	483,567

Note: Air Taxi aircraft are those which fly passengers or cargo, but are not affiliated with major airlines or cargo carriers such as U.S. Airways or UPS.

Source: FAA APO Web site, 2001.

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Chapter 2

CHAPTER TWO
AFFECTED ENVIRONMENT

This chapter describes the Part 150 study area, identifies the local governments in the study area and the extent of their jurisdiction, and local land use and development trends. Refer to Appendix D, *Land Use Assessment Methodology*, for a detailed discussion of how the land use data was gathered and assessed.

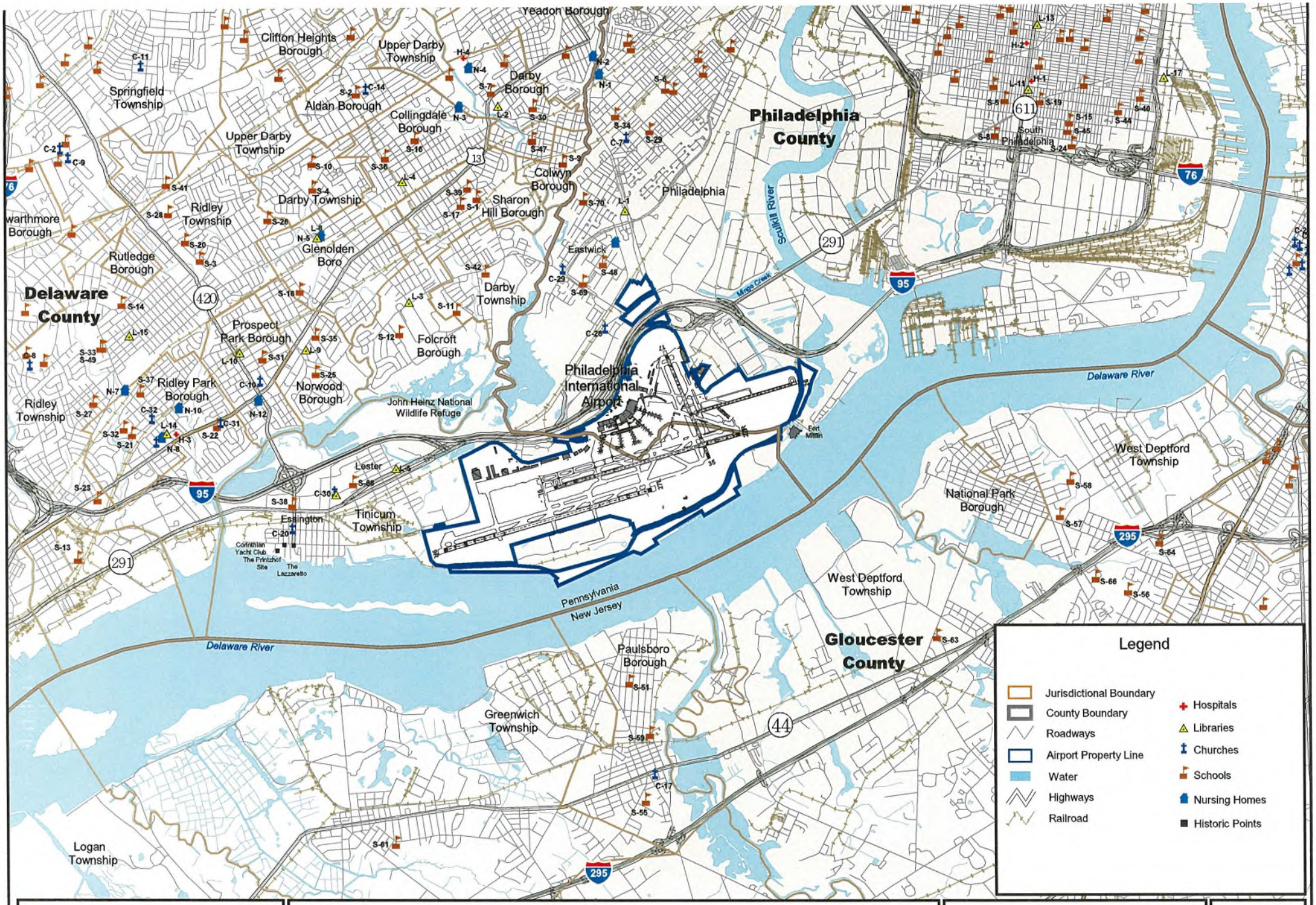
2.1 AIRPORT ENVIRONS

The Philadelphia International Airport (PHL) environs, shown on **Exhibit 2-1**, *Airport Environs*, are comprised of a number of townships and boroughs occurring within close proximity of the airport. This includes the southwest portion of the City of Philadelphia in Philadelphia County (the Eastwick neighborhood is the only residential portion of the city in close proximity to the airport), Tinicum Township; the Boroughs of Folcroft and Norwood in Delaware County; and Logan, Greenwich, West Deptford Townships in Gloucester County, New Jersey. While the State of Delaware lies within the flight patterns used by aircraft serving the airport, it does not lie within the area of study adopted for detailed investigation in this Part 150 analysis. Within the Part 150 study area, detailed land use, zoning, and land use planning data was gathered.

2.2 EXISTING LAND USES

Land use information, including roads, counties, and municipal boundaries were obtained from the Delaware Valley Regional Planning Commission (DVRPC), the U.S. Bureau of the Census, and the U.S. Geological Survey. Zoning information was obtained from individual municipalities and, where appropriate, the DVRPC. Noise-sensitive facility information was obtained from field surveys of the airport environs and through online directories.

Most of the developed property in the airport environs is used for commercial and industrial purposes, with residential areas interspersed to the north and west of the airport. Further north and west from the airport, beyond the John Heinz National Wildlife Refuge at Tinicum, the land use becomes more residential in nature and further to the east the character of the land use is more industrial. South of the airport, the land uses across the Delaware River in New Jersey are generally rural, interspersed with residential and industrial developments. **Exhibit 2-2**, *Generalized Existing Land Use*, shows land use within the study area.



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Airport Environs

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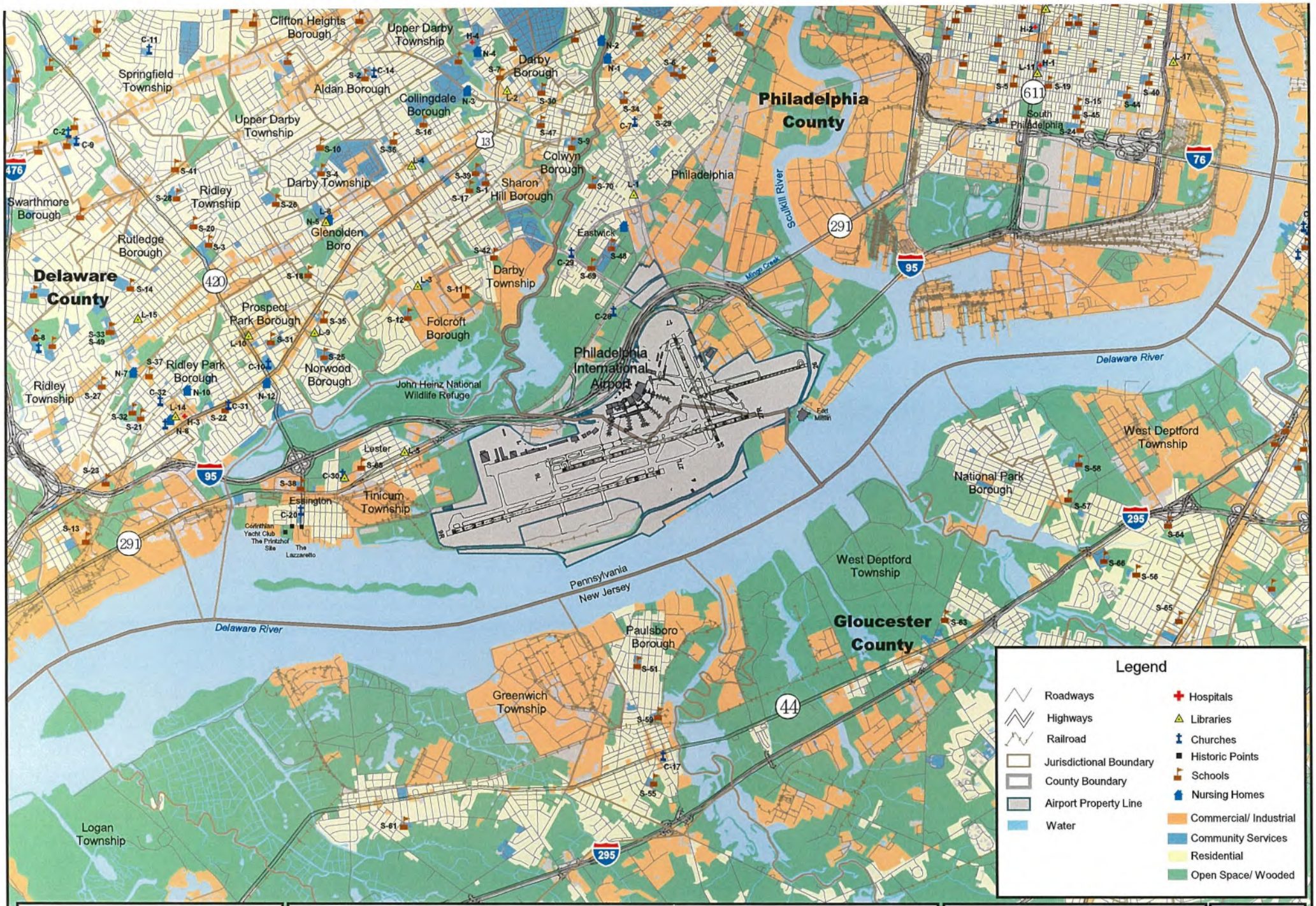
Exhibit 2 - 1



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Generalized Existing Land Use

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Prepared by Landrum and Brown
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Exhibit 2 - 2

Land uses located near the airport, and therefore likely to experience the loudest noise exposure, fall within the boundaries of Tinicum Township and the City of Philadelphia. The land in these areas is almost completely developed and consequently is predicted to remain approximately the same in 2006 as they are today. The following paragraphs provide a description of the land uses in both jurisdictions that may be exposed to significant levels of aircraft noise.[1]

West of the airport is Tinicum Township of Delaware County. Pockets of residential development are interspersed among larger tracts of commercial, light and heavy industrial land use. Some small parcels of open space are also present in the area. The properties closest to the airport include industrial, waterfront/recreational, airport property and open space land uses.

East of the airport, there is land located in Philadelphia that is mostly developed and dominated by commercial, industrial, and governmental land uses. The former Philadelphia Naval Base and Shipyard, now owned by the City of Philadelphia, is also located to the east of the airport. One area located in the center of the base in the vicinity of Broad Street has been designated as an historic district, however all of the land is currently all designated for industrial use. Fort Mifflin, a national historic site, is located on the east side of the airport, very near the end of Runway 27R.

North of the airport, along the extended centerline of Runway 17/35 is airport property and the I-95 corridor. Immediately beyond I-95, the area is primarily open space and commercial endeavors. North of this area is the Philadelphia neighborhood of Eastwick.

2.2.1 Noise-Sensitive Public Facilities

Noise-sensitive public facilities include schools, churches, libraries, hospitals, and nursing homes. There are a number of public and community facilities located within the airport environs area: 70 schools, 32 churches, 14 nursing homes, 4 hospitals, and 17 libraries. Appendix D, *Land Use Assessment Methodology*, discusses the methodology for collecting and organizing the noise-sensitive facility data and provides a list of all facilities.

2.2.2 Historic Properties

As part of the land use analysis, research was conducted on historic properties located within the noise exposure contours. The findings of this research indicate that four sites exist as shown on Exhibit 2-2 and further described below.[2]

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1 The significant level of aircraft noise over residential properties is defined as 65 decibels of Day-Night Sound Level (DNL) or more. See Appendices A and D for further definitions of DNL and significance.

2 Philadelphia International Airport Environmental Assessment - Airport Layout Plan Update, February 1993. HNTB.

Fort Mifflin (Registered National Historic Landmark)

Fort Mifflin is located within the City of Philadelphia on the east side of the airport, and very near the end of Runway 27L. It is currently owned by the City of Philadelphia and leased to "Fort Mifflin on the Delaware" (FMD). It is open to the public and provides interpretive-educational programs highlighting the historical aspects of the Fort.

Fort Mifflin was designed and constructed by the British in 1771 to protect the first city of the Colonies, particularly at a time when war with the French seemed imminent. The English government decided to erect a series of fortifications around Philadelphia. The principal fortification was planned for installation on what was known at the time as Mud Island located about 500 feet from the mainland in the Delaware River just below its confluence with the Schuylkill River. The island was diked and filled in about 1770, and work began on the construction of the Fort walls in 1772. Construction was stopped in 1773 as the political tensions rose in the Colonies.

Once the Declaration of Independence was adopted in 1776, the Americans completed the construction of the fort and other defense structures such as sunken obstacles in the river, earthen embankments, and palisades. The siege of the Fort by the British took place in November 1777. According to research, an estimated 50 shots per minute were fired at the Fort in an event that was considered the most severe bombardment of the Revolutionary War. More than half of a 450-man garrison were reportedly killed or wounded and the American defenders were forced to abandon the Fort and the British fleet was able to reach Philadelphia.

The Fort underwent its first restoration in 1779 and the U.S. Army used the Fort until 1954. In 1959 it was turned over to the City of Philadelphia and in 1970 the Fort was designated a National Historic Landmark. Fort Mifflin on the Delaware began an on-going restoration and preservation effort in 1984 and now hosts educational tours and events, historical reenactments, and entertainment services for those who are interested in history.

The Printzhof Site (National Register Site)

The seven-acre Printzhof site is located at Taylor Avenue and 2nd Street in the Governor Printz Park in Tinicum Township, Delaware County, Pennsylvania. The park was the location of a small fortress and residence that housed Pennsylvania's first European government, that of "New Sweden". In 1643, John Printz established the community and the capital building of the 17th century Swedish settlements, the "Printzhof". At the time, the settlement included several houses, a church, a school, and a court of law. Conquered first in 1655 the Dutch and then the English in 1664, New Sweden vanished from history including the Printzhof. Today, the first governor of Pennsylvania, John Printz, is commemorated with a statue erected in 1972 and a self-guided walking tour. The park belongs to the Pennsylvania Historic and Museum Commission.

The Lazaretto (National Register Site)

The Lazaretto is one of the nation's first immigration quarantine stations. In 1799 there was concern over a possible epidemic of yellow fever and prompted official to relocate the quarantine station farther from Philadelphia. The site selected was in Tinicum on a ten-acre site on present day Wannamaker Avenue and 2nd Street on the Delaware River.

For nearly a century, the Lazaretto served as a quarantine hospital for Philadelphia-bound ships. It could isolate up to 500 people with yellow fever or other infectious diseases. The name Lazaretto comes from the Italian word lazzaro, which means leper.

The quarantine functions were moved to Marcus Hook in 1893. By 1900 the Lazaretto grounds had become a resort operated by the Philadelphia Athletic Club. In 1915, the Philadelphia Seaplane Base was established and was commandeered by the United States Army Signal Corps in 1916 and remained Chambers Field. The Lazaretto building was used as the main barracks and headquarters at the time.

The property was on the market for years and was purchased in 2000 by a developer with plans to demolish the building for future development purposes. However, township officials, representatives from the Preservation Alliance for Greater Philadelphia, and the Delaware County Planning Commission have been working with the owners to determine how the building could be preserved and incorporated into a commercial development.

Corinthian Yacht Club (determined eligible by Delaware County)

The privately owned Corinthian Yacht Club of Philadelphia is located in Tinicum, Delaware County, Pennsylvania adjacent to the Governor Printz Park. It occupies the site of the 17th century Swedish Fort Gottenberg which was destroyed by the Dutch in 1656. The central section of the present building was constructed originally as an inn by John Hart. In 1923, the Swedish Colonial Society erected on the grounds of the Corinthian Yacht Club a monolith in honor of Governor John Printz and the Swedish colonists.

Presently the private Yacht Club operates a fully staffed clubhouse located on a seven-acre estate that is used for a variety of for-hire events such as weddings, banquets, etc. Youth sailing programs are held in the summer for a three-week period as well.

2.3 LAND USE AND ZONING JURISDICTIONS

Under Pennsylvania State Planning Laws, cities, towns, and villages have the primary responsibility to regulate land use activities within their jurisdiction. The chief regulatory document controlling land use is the zoning code while subdivision regulations control

the manner in which parcels of land may be converted into building lots. Both Tinicum Township and the City of Philadelphia have adopted zoning and subdivision regulations and an accompanying zoning map that subdivides the community into use districts. Presently, neither community has specific requirements related to aircraft noise in their zoning or subdivision regulations.

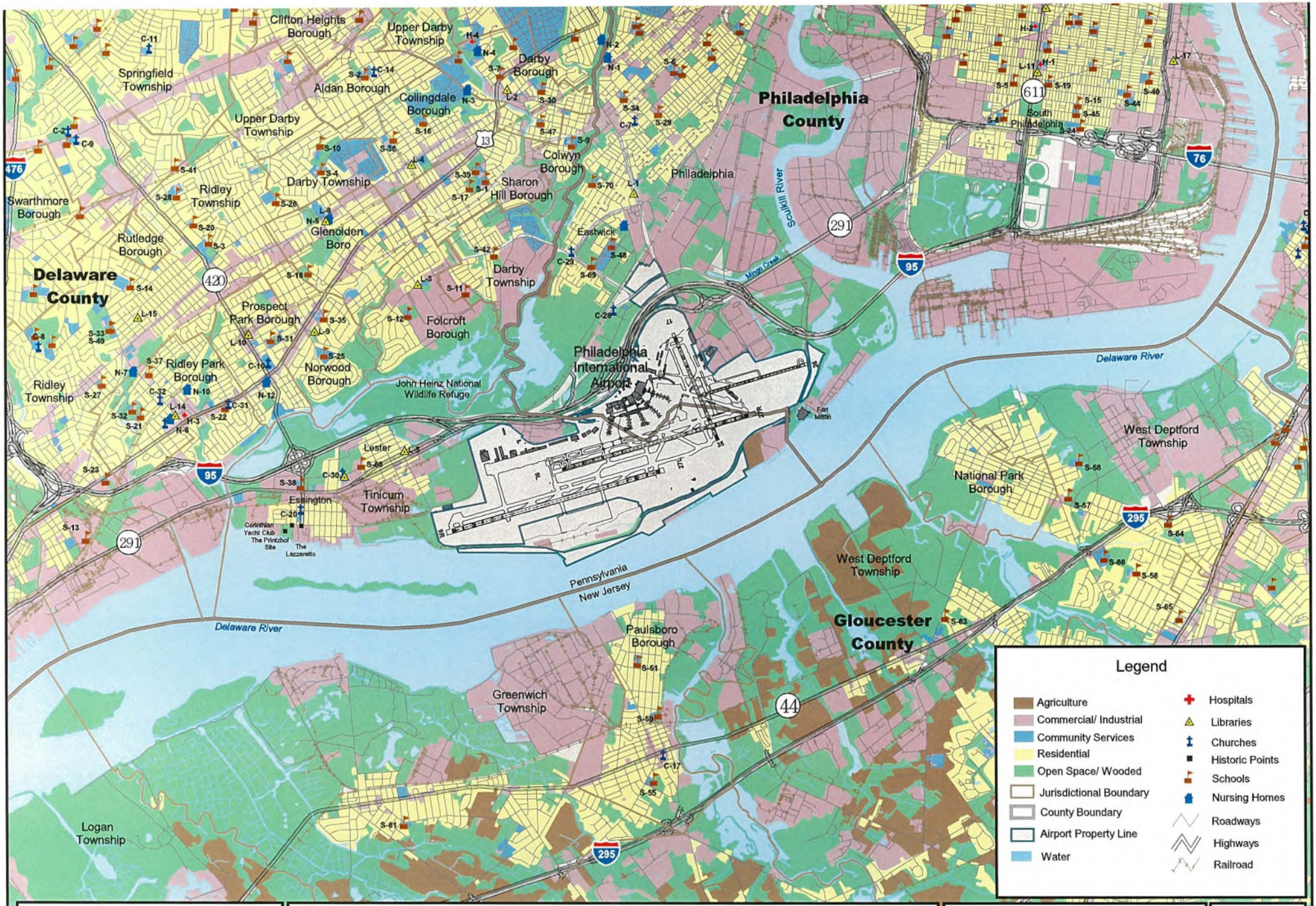
The Philadelphia International Airport (PHL), although owned by the City of Philadelphia, is physically located within both Tinicum Township and the City of Philadelphia boundaries. Approximately two-thirds of the airport lies within Tinicum's boundaries. Therefore, any airport improvement or mitigation projects located within the Tinicum Township jurisdictions portion of the airport must be permitted and approved by the Township Commission.

Tinicum Township, located in Delaware County, works with the Delaware County Planning Commission for zoning and land use issues. The Township is currently in the process of revising it's zoning map, shown in **Exhibit 2-3**, *Generalized Zoning*. The City of Philadelphia has provided comments to Tinicum Township regarding the latest update to the zoning map (see attachment to Appendix F, *Land Use Alternatives*, for letter and meeting materials).

The Philadelphia City Planning Commission is the responsible agency for the management of land use and proposed zoning ordinance changes/amendments and for the regulations concerning the subdivision of land within Philadelphia. The current zoning for the areas near the airport calls for uses that are compatible with airport noise. The Eastwick neighborhood and the Philadelphia Naval Shipyard are the only two specific areas within the jurisdiction of the City of Philadelphia that are presented and described in the following paragraphs. Both have planning agencies that were coordinated with during the preparation of the Part 150 Study.

2.4 LOCAL LAND USE PLANNING INITIATIVES

The Eastwick Project Area Commission, Inc. (PAC) is a community organization, which represents the civic associations within Eastwick, a neighborhood located within the city limits of Philadelphia, just north of the end of Runway 17. The Eastwick PAC was organized to promote the welfare of the Eastwick community and all of its inhabitants, by expanding the opportunities and benefits for better education, health, safety, housing, and economic security. Their activities include an ongoing review of urban renewal plans, establishment of direct relationships with all community residents and other city agencies, such as the airport, and the coordination of community activities related to the improvement of the Eastwick Community. The Philadelphia City Planning Commission has complete jurisdiction over zoning and land uses within Eastwick; however, they do maintain a close working relationship with the Eastwick PAC.



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Generalized Existing Zoning

FINAL

0 6000 Feet

Prepared by Landrum and Brown
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Exhibit 2 - 3

League Island, the location of the former Philadelphia Naval Base and Shipyard is located east of the airport under the aircraft approach and departure paths. In 1994, the City of Philadelphia began to develop a community reuse plan in preparation of the base closing and its transfer to city ownership. The goal of the city was to convert the property from a military industrial enterprise to a civilian industrial enterprise capable of producing jobs and revenue equal to or greater than what the facility previously produced.

The City of Philadelphia took ownership of the old naval base in April 2000, however the Navy did retain some areas for the Ship Systems Engineering Station. The Philadelphia Industrial Development Corporation is the city's economic development agency that oversees the redevelopment effort of the base. Currently the land uses in this area are all compatible with the airport. They include industrial uses and tenants such as Kvaerner Philadelphia Shipyard, the Vitetta Group, Inc., an architectural firm, and Metro Machine Corp. a Navy ship repair contractor. **Exhibit 2-4,** *Navy Shipyard Plan*, depicts the existing plan for the old base.

2.5 GROWTH RISK

The land area located within the immediate airport environs has little to no risk of development in incompatible use. There are few, if any, vacant land parcels west of the airport in Tinicum, and the Township has agreed that any construction of future residential buildings located in the area of significant noise exposure (contours defined by this study) will be subject to building codes that require sound insulation to be incorporated into the structure. Additionally, disclosure of impacts to properties in the Tinicum area will be provided to potential buyers based on the findings of the Final Part 150 NCP.

Much of the land located east of PHL is owned by the City of Philadelphia and is now planned to be compatible with airport operations. The current land uses in the area of the 65 DNL noise contours are expected to remain as industrial/commercial, as is any future development of the area. The area north of the end of Runway 17 that is within or near the 65 DNL contours is also zoned compatible with airport operations and is expected to continue to be used for commercial/industrial purposes and remain zoned accordingly for future development. The City of Philadelphia Planning Commission has been contacted to discuss overlaying noise contours on future zoning maps for community awareness and disclosure purposes.

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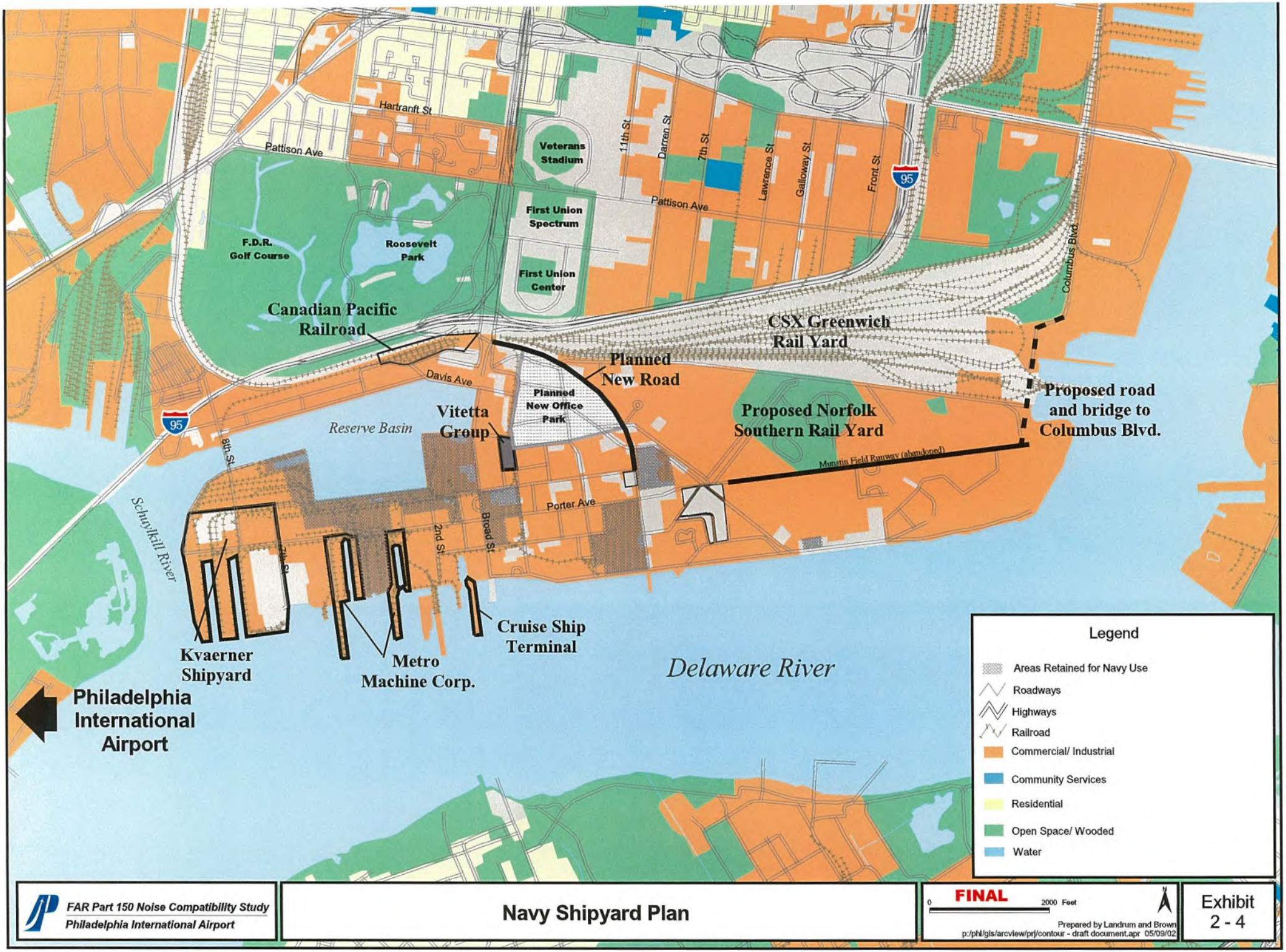

FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Navy Shipyard Plan

FINAL

0 2000 Feet

Prepared by Landrum and Brown
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Exhibit 2 - 4

Chapter 3

CHAPTER THREE
BASELINE NOISE EXPOSURE

3.1 OVERVIEW

The land uses in the vicinity of Philadelphia International Airport (PHL) may be generally described as compatible with the aircraft noise present there. Under the Federal guidance that indicates significant impact by aircraft noise on incompatible land uses within the 65 DNL contour (see Appendix A, *FAA Policies, Guidance, and Regulations*), only the Lester and Essington portions of Tinicum Township, west of the airport, are significantly effected. It is within this level of significant impact that the Part 150 Study is focused.

As may be discerned from the description of noise complaint locations and the noise measurement program provided in Appendix B, *Noise Complaints and Measurement,* residents of other areas exposed to noise of less than 65 DNL are concerned about the noise in their neighborhoods. While FAA guidance does not consider these areas to be significantly impacted for Part 150 purposes, they are known to be exposed to numerous over flights by aircraft that produce single event noise levels which residents find offensive. Where Part 150 recommendations can benefit both the areas within and beyond the 65 DNL contour, every effort is made to do so. Other areas that have expressed concerns about aircraft noise are in the Eastwick area of Philadelphia and in the Brandywine Hundred area of Northern Delaware.

Appendix C, *Noise Modeling Methodology*, presents the information necessary to compute the noise exposure patterns in the vicinity of the airport with the Integrated Noise Model (INM), Version 6.0b. This information details the operating characteristics in use at the airport, the number of operations, and the use of flight paths to and from the airport both now and as they are expected to be in 2006. Permanent measurements in several locations around the airport indicate a general conformity with the noise levels computed for the present condition, particularly as applied to individual aircraft types. Variations from the average noise levels may be in part attributed to unidentified ambient noise sources not related to aircraft flight operations.

This chapter provides information about the current and potential noise levels in five years if no action is taken to change the noise exposure pattern through abatement. The noise patterns are presented on exhibits and the numbers of persons and housing units that fall within them are quantified.

3.2 EXISTING BASELINE NOISE CONTOURS (EXISTING NOISE EXPOSURE MAP)

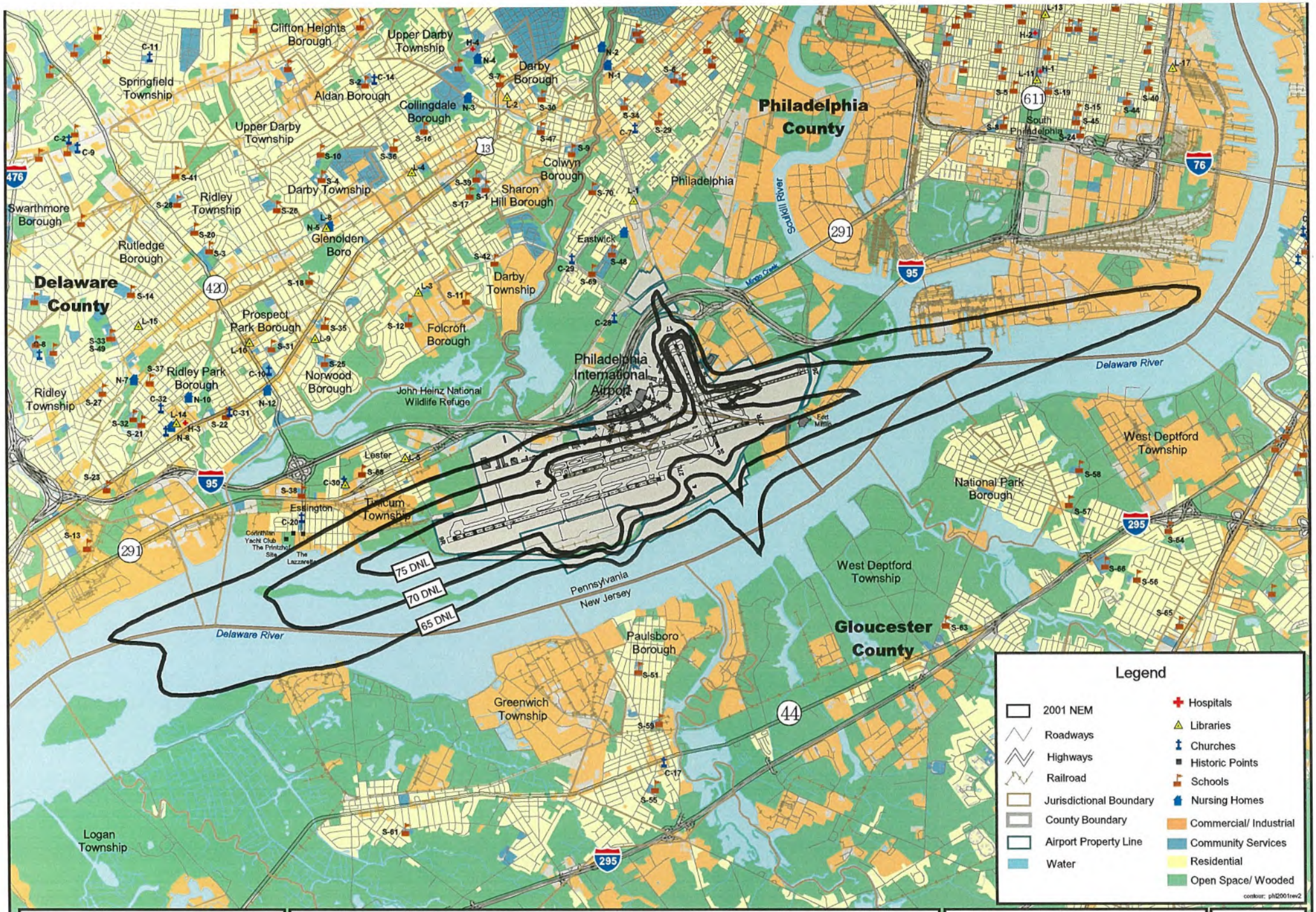
The operations, runway use, flight track and trip length data presented In Appendix C, *Noise Modeling Methodology*, is used as input to the INM computer model for the calculation of noise exposure in the airport environs. **Exhibit 3-1** reflects the average annual noise exposure pattern present at the airport during the current baseline period and **Table 3-1** summarizes the area within each noise contour level. The noise contours do not represent the noise levels present on any specific day, but, rather, represent the energy-average of all 365 days of operation during the year. The noise contour pattern extends from the airport along each extended runway centerline, reflective of the flight tracks used by all aircraft. The relative distance of the contours from the airport along each route is a function of the frequency of use of each runway for total arrivals and departures, as well as its use at night, and the type of aircraft assigned to it.

The shape of the noise contours is primarily a function of the combination of flight tracks and runway use at PHL. The contours extend farther and are wider off of runways to the east and west than to the north and south. This is a result of Runways 9R/27L and 9L/27R being the preferred runways for most commercial jet flights. Virtually all commercial jet departures and 99 percent of commercial jet arrivals occurred on these two runways during the baseline period. General aviation and air carrier propeller flight distributions are more dependent upon wind and weather conditions.

To the east of the airport, the noise contours reflect usage by aircraft arriving from the east and aircraft departing to the east. The 65 DNL noise contour extends approximately 3.7 miles beyond the east end of Runway 8/26, passing over areas of the Delaware River, as well as open space and industrial use near the Philadelphia Navy Shipyard. There are no incompatibly used lands located within the 65 DNL contour east of the airport with the exception of portions of the historic Fort Mifflin. The 70 and 75 DNL contours also remain over open space, industrial land, or the Delaware River.

West of the airport, the noise contours reflect usage by aircraft arriving from the west and departing to the west. The 65 DNL noise contour extends approximately 3.3 miles beyond the west end of Runway 9R/27L, passing mostly over the Delaware River, but also including portions of Lester and Essington in Tinicum Township. Beyond the airport boundary, the 70 and 75 DNL noise contours remain over compatibly used industrial, open space, or river uses.

South of the airport, under the approach to Runway 35, all of the noise contours remain over the airport, open space or the Delaware River. To the north, under the approach to Runway 17, the contours remain over the airport or I-95.



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Current Baseline Contour

FINAL

0 6000 Feet

Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/01/02

Exhibit 3 - 1

Table 3-1
AREAS WITHIN NOISE EXPOSURE CONTOURS (IN SQUARE MILES)
Philadelphia International Airport

CONTOUR RANGE	CURRENT BASELINE		PROJECTED 2006 BASELINE	
	On Airport	Off Airport	On Airport	Off Airport
65-70 DNL	0.7	4.56	0.69	4.89
70-75 DNL	0.8	1.81	0.8	1.85
75 + DNL	1.63	0.5	1.74	0.5
65 + DNL	.46	12.15	.38	12.79

Contour: phl2001rev2/phl2006rev2

Source: Landrum & Brown, 2002.

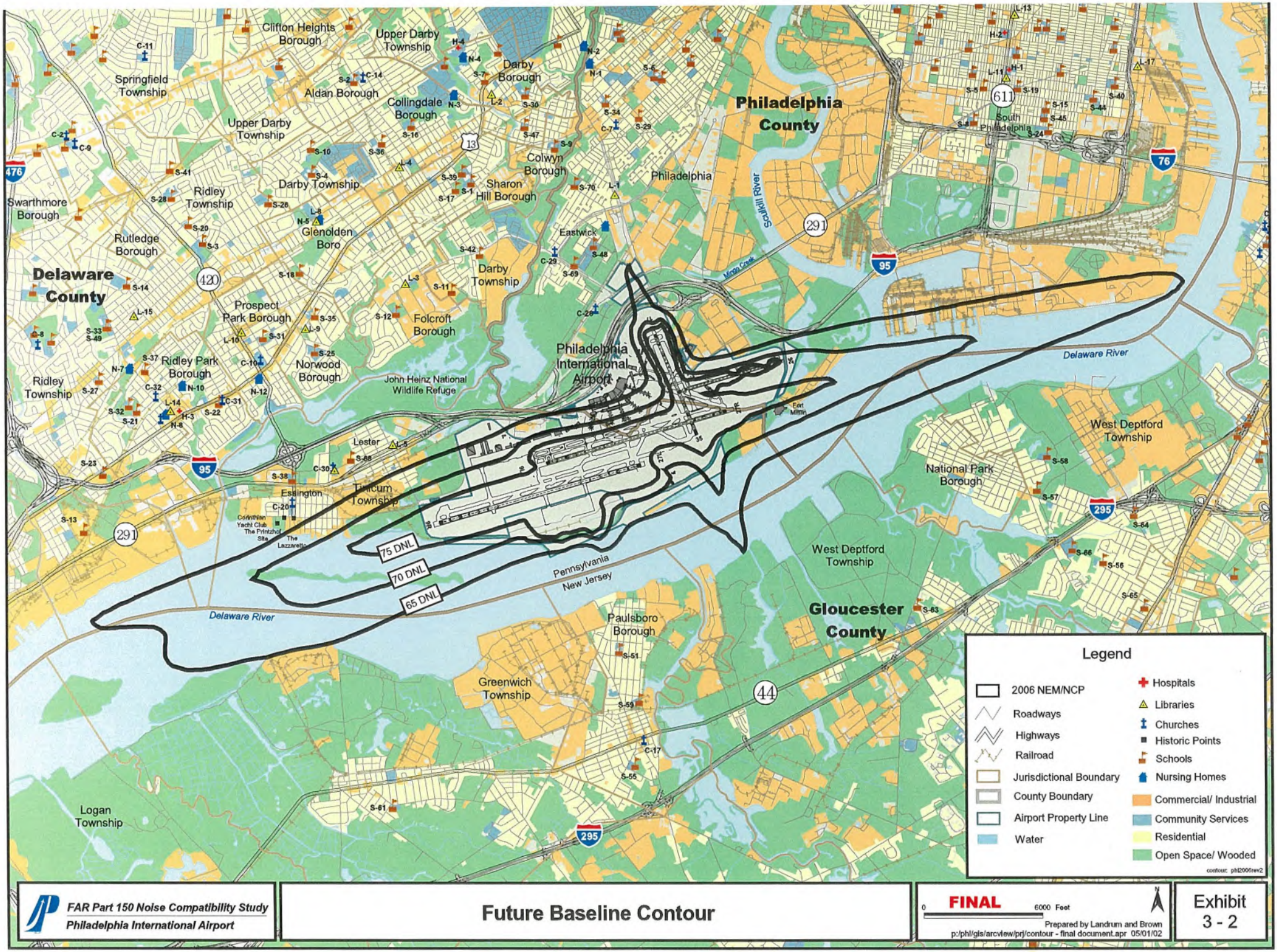
3.3 2006 BASELINE NOISE CONTOURS

The baseline noise exposure contours projected for 2006 are presented in **Exhibit 3-2**. These projected contours assume growth as forecasted by the Airport Master Plan in 2001, supplemented by specific information provided to this study by the airline operators, with no change in the current method of operation. The projected 2006 contour is slightly larger than the current contour, owing to a 15 percent increase in operations. Table 3-1 provides a comparison of the areas within the current (2001) and 2006 baseline noise exposure patterns.

Although the 2006 operations levels are forecast to be 15 percent greater than 2001, the noise contours do not significantly change in size and shape. They are slightly enlarged in all extents, with each contour end extending slightly farther from the airport than it currently does. The increase in operations is somewhat offset by an absence of growth in older Stage 2 aircraft hushkitted to meet Stage 3 noise level requirements.

3.4 BASELINE NOISE CONTOUR INCOMPATIBILITIES

Identifying and evaluating all land uses within the airport environs is necessary to quantify residential and other noise-sensitive land uses impacted by aircraft noise. Chapter Two, *Affected Environment*, and Appendix D, *Land Use Assessment Methodology*, summarize the land use data collection process. The FAA has created land use compatibility guidelines relating types of land use to airport sound levels. These guidelines are defined in 14 CFR Part 150, *Land Use Compatibility with Yearly Day-Night average Sound Levels.* The compatibility table is reproduced in Appendix A, *FAA Policies, Guidance, and Regulations*, of this document (see Table A-1). These



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Future Baseline Contour

FINAL

0 6000 Feet

Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/01/02

Exhibit 3 - 2

guidelines show the compatibility parameters for residential, public (schools, churches, nursing homes, hospitals), commercial, manufacturing, and production, and recreational land uses. All land uses exposed to noise levels below 65 DNL noise contour are generally considered compatible with airport operations.

Summaries of the residential population, housing units, and noise-sensitive facilities affected by noise levels exceeding 65 DNL noise contour for current (2001) and future (2006) baseline noise contours are provided in **Table 3-2**. The information is presented by DNL noise level (65, 70, and 75).

The total population exposed to the 65 DNL noise contour and higher noise levels is projected to increase from 593 currently to 600 in 2006, while total aircraft operations are forecast to increase by 15 percent. These residents reside in 209 and 210 housing units, respectively, located on the southeast sides of Lester and Essington in Tinicum Township west of the airport. No noise-sensitive public facilities (schools, churches, libraries, hospitals, nursing homes) fall within the 65 DNL contour for either the current or 2006 projected condition. One historic property, Fort Mifflin, is located east of the airport in the 70 DNL contour (see Chapter Two, *Affected Environment*, for more information on Fort Mifflin).

Table 3-2
BASELINE HOUSING, POPULATION, AND NOISE-SENSITIVE FACILITY INCOMPATIBILITIES
Philadelphia International Airport

	TOTAL POPULATION				TOTAL HOUSING UNITS				NOISE-SENSITIVE PUBLIC USES			
Condition	65-70 DNL	70-75 DNL	75+ DNL	Total	65-70 DNL	70-75 DNL	75+ DNL	Total	65-70 DNL	70-75 DNL	75+ DNL	Total
Baseline 2001	593	0	0	593	209	0	0	209	0	0	0	0
Baseline 2006	600	0	0	600	210	0	0	210	0	0	0	0

Notes:
- Noise contours were generated using the Integrated FAA's Noise Model, Version 6.0b computer model.
- Housing counts are based on 1990 aerial photography, supplemented by field verification.
- Population numbers are approximate based on the housing counts multiplied by the 2000 census block housing to population ratio.
- Baseline conditions assume the continuation of the existing operating procedures without modification.
- Noise-Sensitive Public Uses include schools, churches, libraries, hospitals, and nursing homes.

Source: Landrum & Brown, 2002

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Chapter 4

CHAPTER FOUR
NOISE COMPATIBILITY PLAN

The culmination of the Part 150 planning process is the development of a set of measures designed to enhance the compatibility between the airport and its surrounding environs. This chapter presents the measures for implementation that have resulted from the planning process. Seven **noise abatement measures** are related to the operation of aircraft to and from Philadelphia International Airport (PHL). Five **land use mitigation measures** relate to the future development of land and mitigation of existing aircraft noise impacts in the areas significantly impacted by the aircraft that operate at the airport, and six **program management measures** relate to the oversight and management of the implementation of the other fourteen measures. Appendix E, F, and G include a list of all alternatives assessed for the Noise Compatibility Program (NCP). Appendix H contains working papers and meeting summaries from Study Advisory Committee meetings and technical conferences. These meetings were integral in the development and evaluation of all NCP measures.

The measures are presented as a series of plates that summarize pertinent information required about each of the measures by FAR Part 150 guidance. This information includes:

- A description of the background and intent of the measure
- The anticipated effect on land use compatibility
- The party(ies) responsible for implementation
- The steps necessary for implementation, its anticipated cost, and the projected timing of implementation
- The relationship to other planning programs and other measures

Where helpful for clarification, an exhibit associated with the measure is provided. **Table 4-1** summarizes the measures included in PHL's NCP.

Following the plates for individual program measures is the NCP map which incorporates each of the program measures, as well as a description of the population, housing, and noise-sensitive use impacts associated with it's full implementation. The final section of this chapter summarizes the anticipated costs of implementing the NCP and provides an implementation schedule for the program. As discussed previously, the approval of the NCP by the FAA does not commit the FAA or PHL to the costs or the implementation schedule listed in this document. This information is provided here as a planning tool to assist the implementation of the NCP.

Table 4-1
NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS
Philadelphia International Airport
Page 1 of 5

Measure	Responsible Party	Cost to Airport	Cost to Local Governments	Cost to Users	Implementation Schedule Target
NA-1 Continue existing departure procedure by aircraft weighing 12,500 pounds or more departing Runways 9L/9R/17/35/8 fly runway heading until reaching 2,000' Above Ground Level.	PHL Air Traffic management	None	None	None	Completed
NA-2 Continue existing departure procedure by aircraft weighing 12,500 pounds or more departing Runway 27L turn left to a 255 degree heading until reaching 3,000' Above Ground Level.	PHL Air Traffic management	None	None	None	Completed
NA-3 Continue existing departure procedure by aircraft weighing 12,500 pounds or more departing Runway 27R turn left to a 240 degree heading until reaching 3 DME, thence turn right to a 255 degree heading until reaching 3,000' Above Ground Level.	PHL Air Traffic management	None	None	None	Completed
NA-4 Continue existing nighttime runway use program from midnight to 6:00 a.m.	PHL Air Traffic management	None	None	None	Completed
NA-5 Continue existing run-up procedures providing for location and orientation preferences with requirements for pre-approval and limitation to 20 minutes or less.	DOA Operations	None	None	None	Completed

Table 4-1 (Continued)
NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS
Philadelphia International Airport
Page 2 of 5

Measure	Responsible Party	Cost to Airport	Cost to Local Governments	Cost to Users	Implementation Schedule Target
NA-6 Support creation of Area Navigation (RNAV) overlay procedures for selected existing and future flight procedures.	DOA	None	None	None	2002
NA-7 Encourage noise attenuating standards in airport development	DOA, Planning and Noise Offices	Unknown	None	Unknown	2002 and continuing
LU-1 Develop and implement a residential sound insulation program.	DOA, Noise Office, program management consultant (if hired).	Depending on the # of homes in program the costs could range between $7 million and $16 million.	None	None	2002 and continuing until all homes in program are insulated.
LU-2 Develop and implement a purchase and resale program as a supplement to the residential sound insulation program (LU-1).	DOA, Noise Office, program management consultant (if hired)	Minimal, once completed, but seed money may be required to initiate program.	None	None	2002 and continuing
LU-3 Develop and implement a land use controls program.	Local municipalities	None	Minimal	None	2002
LU-4 Develop and implement a land use development controls program.	Local municipalities	None	Minimal	None	2002

Table 4-1 (Continued)
NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS
Philadelphia International Airport
Page 3 of 5

Measure	Responsible Party	Cost to Airport	Cost to Local Governments	Cost to Users	Implementation Schedule Target
LU-5 Prepare a Study to Determine Feasibility of Implementing Noise Mitigation Measures at Historic Fort Mifflin	City of Philadelphia, Division of Aviation, Division of Parks and Recreation, Philadelphia Historic Commission, State Historic Preservation Office (SHPO), Airport Noise Office, FAA, and Noise Program Management Consultant	$125,000 to $175,000 for the study. Cost to perform sound insulation would be determined through the study.	None	None	2002
PM-1 Establish a Noise Abatement Advisory Committee.	DOA and Noise Office	Approximately $16,000 annually	None	None	2002 and continuing
PM-2 Enhance the airport's noise monitoring system.	DOA and Noise Office	One time charge of approximately $150,000 to $200,000	None	None	2002

Table 4-1 (Continued)
NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS
Philadelphia International Airport
Page 4 of 5

Measure	Responsible Party	Cost to Airport	Cost to Local Governments	Cost to Users	Implementation Schedule Target
PM-3 Install additional noise monitors.	DOA and Noise Office	One time consultant charge of about $50,000. Each monitor costs $25,000 to $30,000, installed. Both aspects are eligible for inclusion in the Airport's PFC program and the new monitors are eligible for federal grant funding at 80%.	None	None	2002/2003
PM-4 Establish full time Noise Office with staff.	DOA	Approximately $150,000 to $200,000 annually	None	None	2002 and continuing
PM-5 Establish a pilot/community awareness program.	DOA and Noise Office	One time start up cost of approximately $150,000, with subsequent costs in the budget of the Noise Office (PM-4).	None	None	2002 and continuing

Table 4-1 (Continued)
NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS
Philadelphia International Airport
Page 5 of 5

Measure	Responsible Party	Cost to Airport	Cost to Local Governments	Cost to Users	Implementation Schedule Target
PM-6 Update the Noise Exposure Maps and Noise Compatibility Program.	DOA and Noise Office	NEMs ($150,000) NCPs ($250,000) Both are eligible for federal grant participation at 80%.	None	None	Update NEMs in 2002/2003 and with NCP update in 2006/2007, unless required earlier by changed conditions.

NOISE COMPATIBILITY PROGRAM MEASURE: NA-1 Exhibit: 4-1

Description: Aircraft weighing 12,500 pounds or more departing Runways 9L/9R/17/35/8 fly runway heading until reaching 2,000' Above Ground Level.

Background and Intent: This measure is a part of the existing condition. On departure to the east, north, or south, aircraft weighing more than 12,500 pounds normally fly along the runway heading until reaching altitudes 2000 feet above the ground. Turns are typically initiated over the Delaware River after the aircraft has reached the procedural altitude. Under conditions of adverse weather, or for reasons of safety and/or operating efficiency, deviations from this procedure may occur. Modifications are not justified by Part 150 findings, and hence are not suggested at this time. The concurrent New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project (the Project), in general, may be considering modifications to noise abatement measures at some of the Project airports in its five-state study area. However, at this time, no specific modification to noise abatement measures are planned in the Project for PHL.

Land Use Compatibility Improvement: The measure results in the maintenance of a compatible departure course from Runways 8, 9R, and 9L, and maintains a predictable departure corridor from Runways 17 and 35 over areas of scattered land use beyond the extents of the 65 DNL contour.

Responsible Implementing Parties: Not Applicable

Implementation Steps, Costs, and Phasing:
Steps: In place as part of baseline condition.

Costs: No additional costs.

Schedule: Not Applicable.

Effects on Other Programs/Measures: May be reviewed as part of the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project.

NOISE COMPATIBILITY PROGRAM MEASURE: NA-2 Exhibit: 4-1

Description: Aircraft weighing 12,500 pounds or more departing Runway 27L turn left to a 255 degree heading until reaching 3,000' Above Ground Level.

Background and Intent: This measure is a part of the existing condition. On departure to the west from Runway 27L, aircraft weighing more than 12,500 pounds turn left to a heading of 255 degrees and fly along the that heading until reaching altitudes 3000 feet above the ground. Turns from the 255 heading are typically initiated over the Delaware River after the aircraft has reached the procedural altitude. Under conditions of adverse weather, or for reasons of safety and/or operating efficiency, deviations from this procedure may occur. Modifications are not justified by Part 150 findings, and hence are not suggested at this time. The concurrent New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project (the Project), in general, may be considering modifications to noise abatement measures at some of the Project airports in its five-state study area. However, at this time, no specific modification to noise abatement measures are planned in the Project for PHL.

Land Use Compatibility Improvement: The measure results in the maintenance of a compatible departure course from Runway 27L over the Delaware River until the aircraft has passed beyond the extents of the 65 DNL contour.

Responsible Implementing Parties: Not Applicable

Implementation Steps, Costs, and Phasing:
Steps: In place as part of baseline condition.

Costs: No additional costs.

Schedule: Not Applicable.

Effects on Other Programs/Measures: May be reviewed as part of the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project.

NOISE COMPATIBILITY PROGRAM MEASURE: NA-3 Exhibit: 4-1

Description: Aircraft weighing 12,500 pounds or more departing Runway 27R turn left to a 240 degree heading until reaching 3 DME, thence turn right to a 255 degree heading until reaching 3,000' Above Ground Level.

Background and Intent: This measure is a part of the existing condition. On departure to the west from Runway 27R, aircraft weighing more than 12,500 pounds turn to a heading of 240 degrees and fly that heading until reaching a position 3 nautical miles from the Instrument Landing System (ILS). The aircraft then turn right to a heading of 255 degrees and fly that heading until reaching altitudes 3000 feet above the ground. Turns from the 255-degree heading are typically initiated over the Delaware River after the aircraft has reached the procedural altitude. Under conditions of adverse weather, or for reasons of safety and/or operating efficiency, deviations from this procedure may occur. Modifications are not justified by Part 150 findings, and hence are not suggested at this time. The concurrent New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project (the Project), in general, may be considering modifications to noise abatement measures at some of the Project airports in its five-state study area. However, at this time, no specific modification to noise abatement measures are planned in the Project for PHL.

Land Use Compatibility Improvement: The measure results in the frequent use of a compatible departure course from Runway 27R over the Delaware River until the aircraft has passed beyond the extents of the 65 DNL contour.

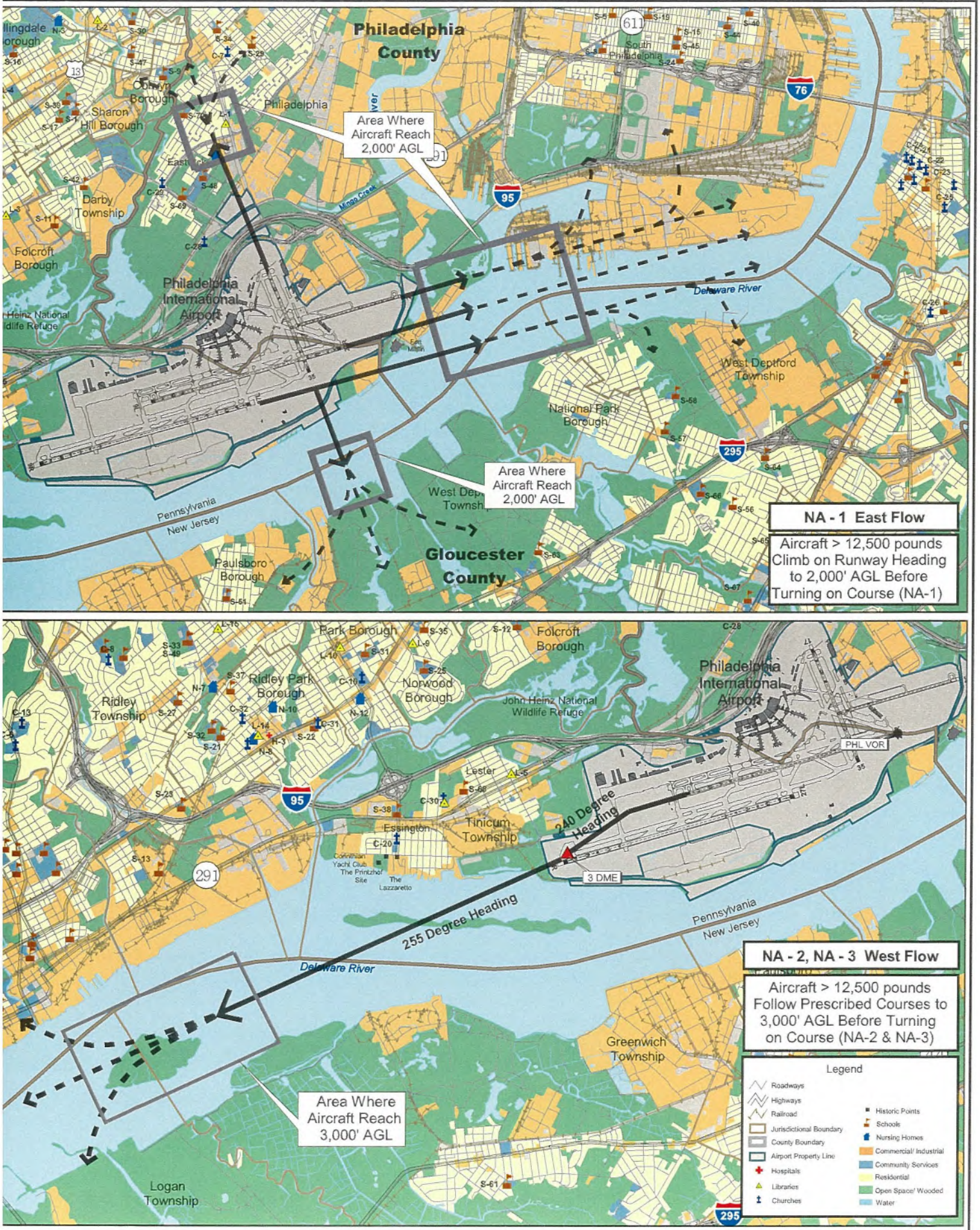
Responsible Implementing Parties: Not Applicable

Implementation Steps, Costs, and Phasing:
Steps: In place as part of baseline condition.

Costs: No additional costs.

Schedule: Not Applicable.

Effects on Other Programs/Measures: May be reviewed as part of the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project.



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Takeoff Corridors for Noise Abatement (NA-1, NA-2, and NA-3)

FINAL

0 6000 Feet

05/09/02

Prepared by Landrum and Brown

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Exhibit 4 - 1

NOISE COMPATIBILITY PROGRAM MEASURE: NA-4 Exhibit: 4-2

Description: Continue existing nighttime runway use program from midnight to 6:00 a.m.

Background and Intent: This measure is a part of the existing condition. When winds and operating conditions permit, the following preference is in effect: between midnight and 6:00 a.m., in east traffic flow, takeoffs are made from Runways 9R and 9L, landings are made on Runway 9R. During west flow, takeoffs are made on Runway 27L and landings are made on Runways 27R and 27L. When the crosswind runway is used, landings are made on Runway 35 and takeoffs are made on Runway 17. This preference is not applied when winds are from the east or when one or more of the runways is closed.

Land Use Compatibility Improvement: The measure results in the maintenance of compatible departure and approach courses over the Delaware River or over areas of generally compatible land use south of the airport within the extents of the 65 DNL contour.

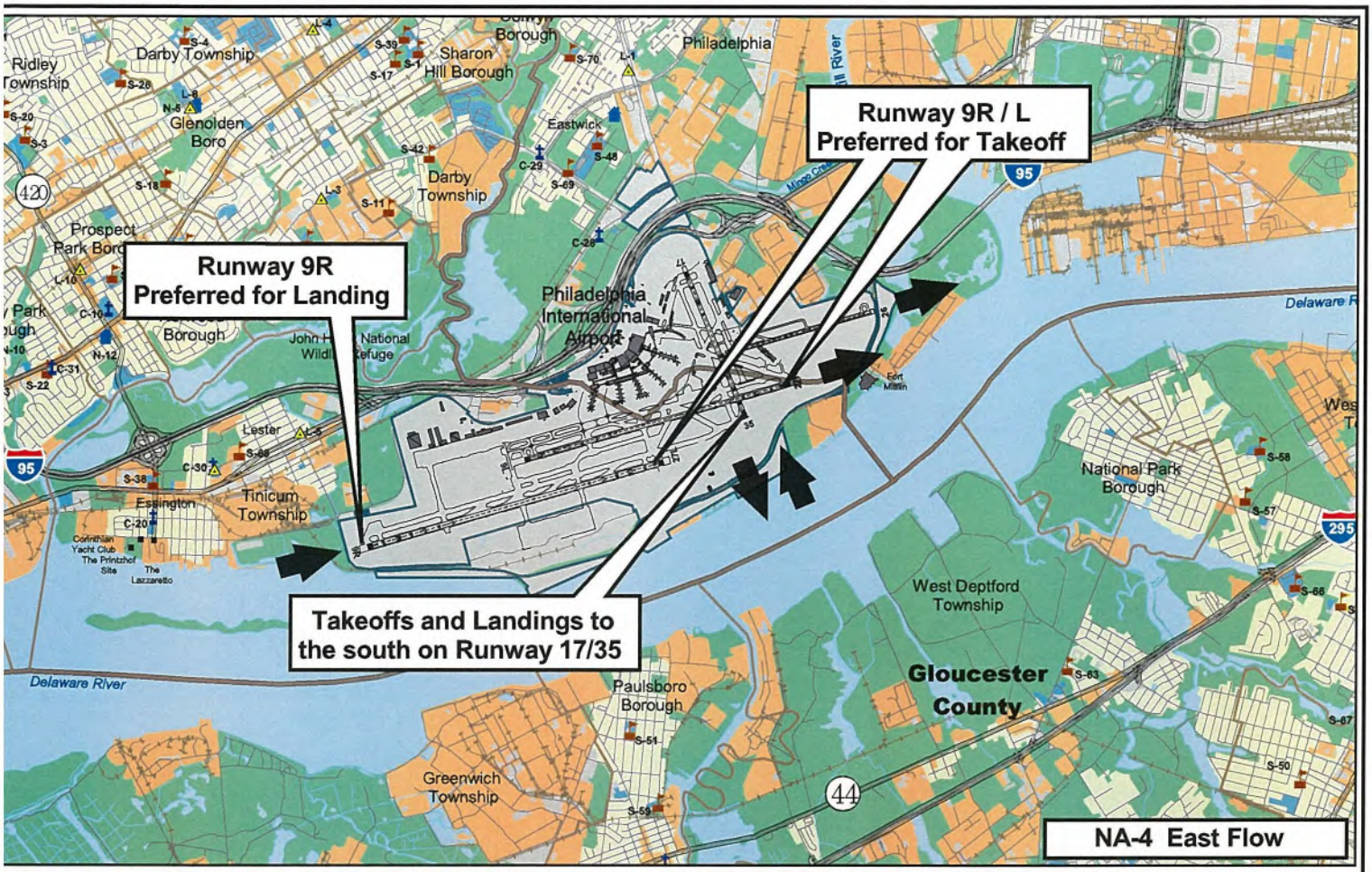
Responsible Implementing Parties: The measure has been implemented by the local Airport Traffic Control for several years and is incorporated into the baseline operating condition.

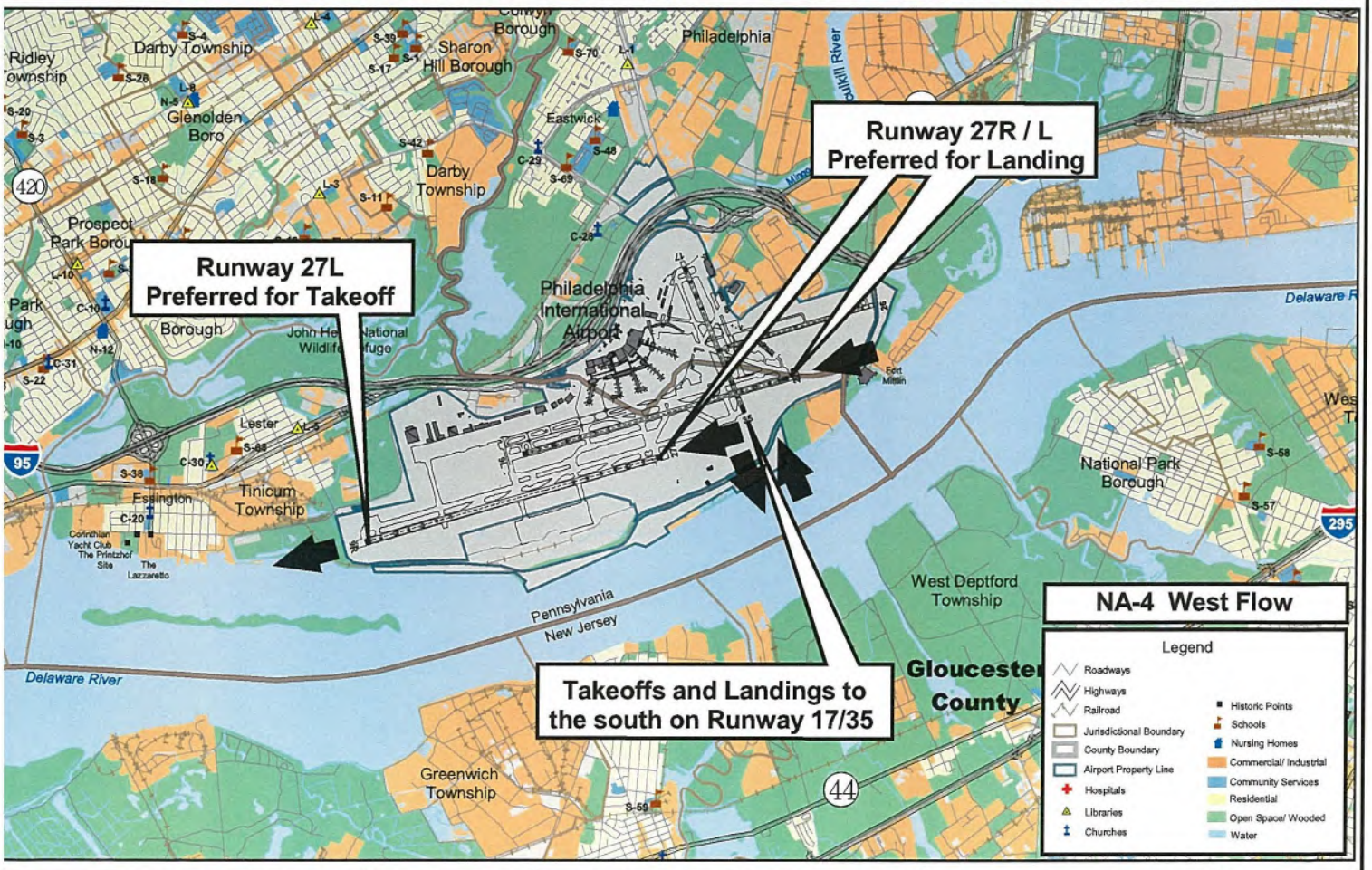
Implementation Steps, Costs, and Phasing:
Steps: In place as part of baseline condition.

Costs: No additional costs.

Schedule: Not Applicable.

Effects on Other Programs/Measures: None.





FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Preferential Nighttime Runway Use
East and West Flow (NA-4)

FINAL
0 6000 Feet
05/09/02
Prepared by Landrum and Brown
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Exhibit
4 - 2

NOISE COMPATIBILITY PROGRAM MEASURE: NA-5 Exhibit: 4-3

Description: Continue existing run-up procedures providing for location and orientation preferences with requirements for pre-approval and limitation to 20 minutes or less.

Background and Intent: This measure is a part of the existing condition. Engine run-ups are currently restricted to two locations on the airport – at the intersection of Taxiway K with Taxiway H (preferred location) with the aircraft facing east, and at the intersection of Taxiway P with Taxiway W, with the aircraft facing west. Engine run-ups require prior approval by Airport Operations and are limited to twenty (20) minutes duration. Between 11:00 p.m. and 6:00 a.m., run-ups are restricted unless failure to conduct the run-up will delay the departure of a scheduled flight. In addition, these run-ups are to be conducted at the preferred east location.

Land Use Compatibility Improvement: No effect within the 65 DNL contour.

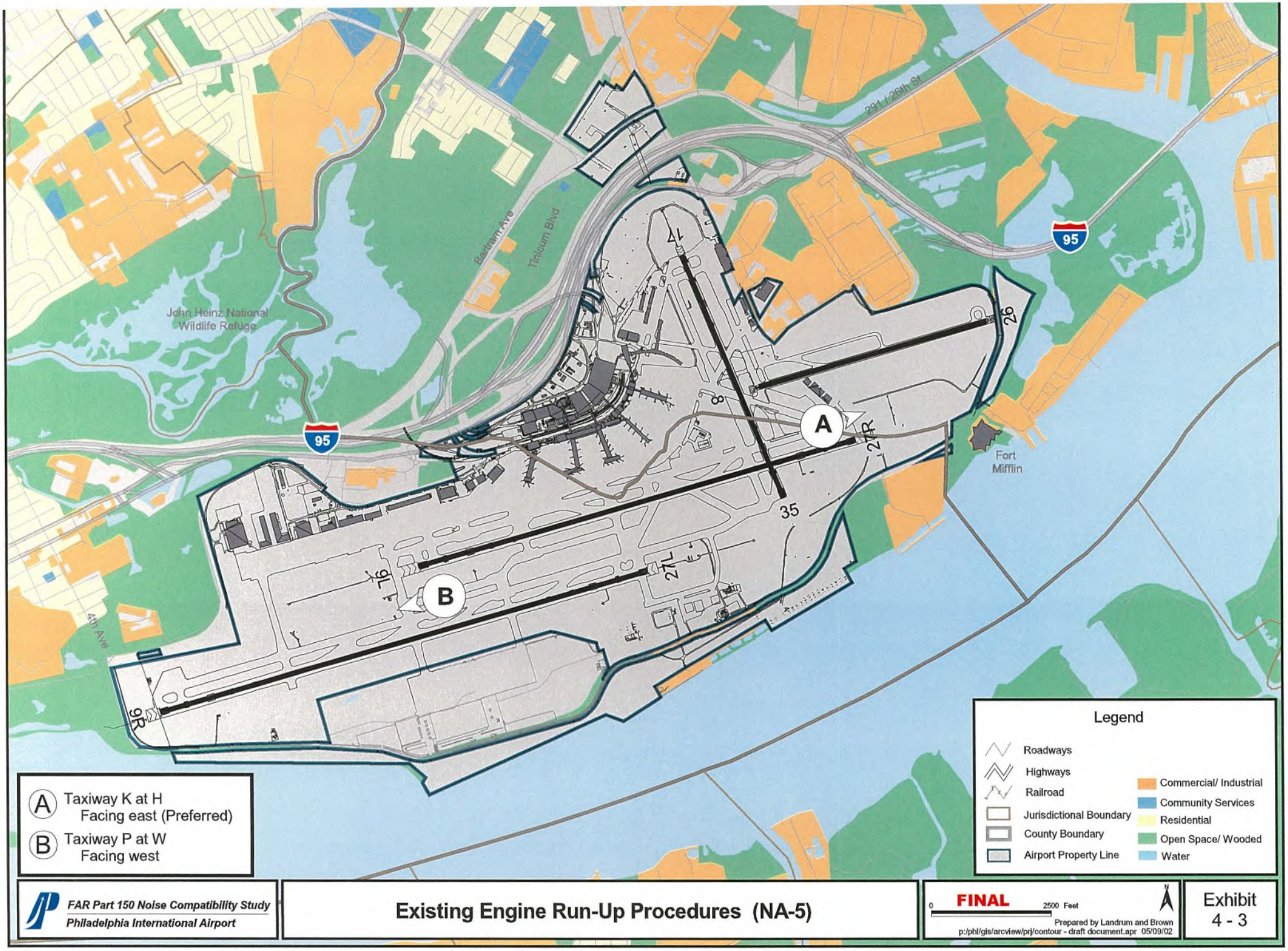
Responsible Implementing Parties: Measure is in effect and implemented by users and Airport Operations.

Implementation Steps, Costs, and Phasing:
Steps: In place as part of baseline condition.

Costs: No additional costs.

Schedule: Not Applicable.

Effects on Other Programs/Measures: None.


John Heinz National Wildlife Refuge
Bartram Ave
Tinicum Blvd
291 / 26th St
95
95
4th Ave
Fort Mifflin
A
B
9R
9L
8
17
35
27L
27R
26
(A) Taxiway K at H
Facing east (Preferred)
(B) Taxiway P at W
Facing west
Legend
Roadways
Highways
Railroad
Jurisdictional Boundary
County Boundary
Airport Property Line
Commercial/ Industrial
Community Services
Residential
Open Space/ Wooded
Water
FAR Part 150 Noise Compatibility Study
Philadelphia International Airport
Existing Engine Run-Up Procedures (NA-5)
FINAL
0
2500 Feet
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Prepared by Landrum and Brown
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Exhibit
4 - 3

NOISE COMPATIBILITY PROGRAM MEASURE: NA-6 Exhibit: N/A

Description: Support creation of Area Navigation (RNAV) overlay procedures for selected existing and future flight procedures.

Background and Intent: The New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project is examining the possibility of creating RNAV overlays for selected instrument approach procedures in the region RNAV procedures utilize ground based (DGPS), satellite based (GPS), and on-board (FMS/GPS) equipment to assist the pilot in navigating from point to point. These procedures normally provide for greater accuracy and tighter flight corridors than traditional flight using controller-assigned or procedural headings (vectors). Some older aircraft are not equipped with the technology to use RNAV procedures and would continue to use traditional techniques. It is the FAA's intent that the airspace environment in the region ultimately become entirely RNAV, so aircraft will continue to be modified to use the technology and new aircraft will be so equipped. This measure does not require specific implementing action by the Airport, but rather the Airport should support the development of such procedures by the FAA for the regional airspace system.

Land Use Compatibility Improvement: RNAV procedures may result in a narrowing of the noise patterns along the paths defined by the procedures and reduce the dispersion of traffic associated with traditional vectoring of aircraft, but no substantial effect within the 65 DNL contour.

Responsible Implementing Parties: Development of RNAV procedures will be accomplished by the FAA. However, the development of RNAV precision approaches and departure procedures under 3,000 feet altitude may require the installation of a DGPS antenna. The Airport would be responsible for this development.

Implementation Steps, Costs, and Phasing:
Steps: Provide written and oral support to the examination of the measure by the FAA during the preparation of its New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project and beyond.

Costs: Minimal administrative costs. No additional costs to the FAA for development (the measure is already incorporated in the Airspace Redesign Project). If DGPS is required, the cost is approximately $1,000,000.

Schedule: Provide written support upon acceptance of the NCP by the FAA.

Effects on Other Programs/Measures: Provides support and recommendations to the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project.

NOISE COMPATIBILITY PROGRAM MEASURE: NA-7 Exhibit: N/A

Description: Encourage noise attenuating standards in airport development.

Background and Intent: As the development envisioned by the Master Plan is accomplished, the Airport should consider the benefits associated with the placement of structures relative to the surrounding land uses. Where practicable, the design of such facilities should be made to place unbroken lineal blocks between sources of ground noise and noise-sensitive uses in surrounding neighborhoods. Such blocks may take the form of walls or barriers, of building footprints that are staggered with adjacent footprints, landscaping, roadway design, etc., all of which can be interruptions to the flow of aircraft ground noise between its source and receiver sites nearby. The development of facilities that use appropriate design standards that block the flow of ground noise may result in reductions of several decibels between the source and receiver.

Land Use Compatibility Improvement: No effect within the 65 DNL contour. The measure is intended to reduce intrusive ground noise events from aircraft that are on the ramp, taxiing, in ground roll before or after flight, or while being run up or otherwise serviced.

Responsible Implementing Parties: Airport Engineering and Planning and the Airport Noise Office (see Measure PM-4) should have responsibility for this measure.

Implementation Steps, Costs, and Phasing:
Steps: Plans for development should be evaluated for their potential to reduce ground noise early in the planning process, preferably as initial parameters for design are created. Plans should be reviewed throughout the planning process to assure that the design standards are maintained.

Costs: Costs of implementation are unknown and unknowable until specific projects are designed. Review costs by the Airport are minimal.

Schedule: As development occurs.

Effects on Other Programs/Measures: The measure may affect development programs as reviews for the utility of the measure are conducted.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-1 Exhibit: 4-4

Description: Develop and implement a residential sound insulation program.

Background and Intent:

- Offer sound insulation to all single-family owner occupied residential homes located within or immediately adjacent to the 65 DNL and higher levels of the 2006 Noise Compatibility Plan (NCP) noise contour. Sound insulation should be accomplished on a most impacted basis, where homes in the highest noise levels are insulated first. To accomplish this, two Options have been identified that would provide sound insulation to homes located in Tinicum Township as described below.
- **Option LU-1A** as displayed in Exhibit 4-4, defines the boundaries for the initial sound insulation program. This option would be defined by "squaring off" of neighborhood blocks that are included within, adjacent to or intersected by the 2006 NCP 65 DNL noise contour, thereby maintaining block continuity. The area identified in Lester has the railroad track as a natural boundary and includes 101 homes. The area in Essington does not have such a clear "natural" boundary; therefore 180 homes located 1) south of 3rd St., on Putcon, Erickson, Jansen, Bartram, Saude and on the east side of Carre; and 2) south of 2nd St., on La Grange Ave., would be included.
- Should additional federal funding be made available, **Option LU-1B** as displayed in Exhibit 4-4, would include an additional 164 homes and is the preferred program boundary. All homes south of the railroad tracks and east of Wannamaker Ave. would be included under this scenario. Tinicum Township, does experience frequent overflights due to its proximity west of the runways at PHL. The 65 DNL does not encompass all of Tinicum, however noise complaints indicate that high single-event aircraft noise levels frequently affect these residents. Extending the area of eligibility from the 65 DNL contour to this natural boundary would ensure continuity throughout the community, as well as significantly decrease potential incompatible land uses and the impact of aircraft noise on the airport's closest neighbors.
- Avigation easements will be attached to the property deed as a requirement to participate in this program.

Land Use Compatibility Improvement:

- Reduces the interior noise levels of participating homes.
- Properties would have an avigation easement attached to the deed, guaranteeing the right of flight over the dwelling.

Responsible Implementing Parties: City of Philadelphia, Department of Commerce, Division of Aviation, and other program management consultants.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-1 (Continued) Exhibit: 4-4

Implementation Steps, Costs, and Phasing:

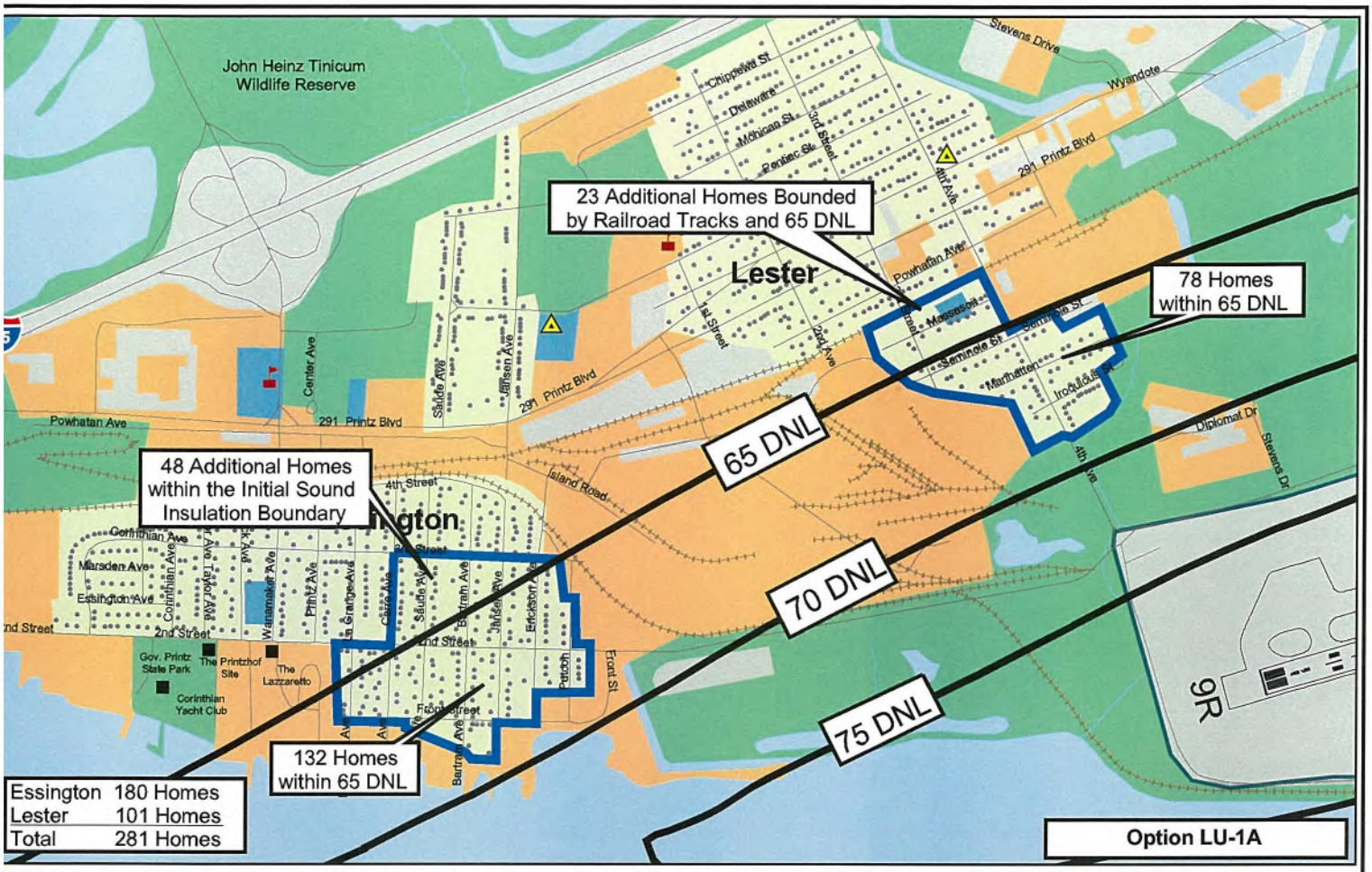
Steps: Implement the sound insulation program after the Part 150 NCP is approved and funding is received. Hire consultants to develop a pilot program to determine final costs, effectiveness of the insulation, and expected schedule to complete. Begin insulating residences within the 65 DNL or greater noise contour and work outward to those least impacted. Seek funding approval to insulate between 25 and 50 homes annually in order to complete the program within 5 years or less.

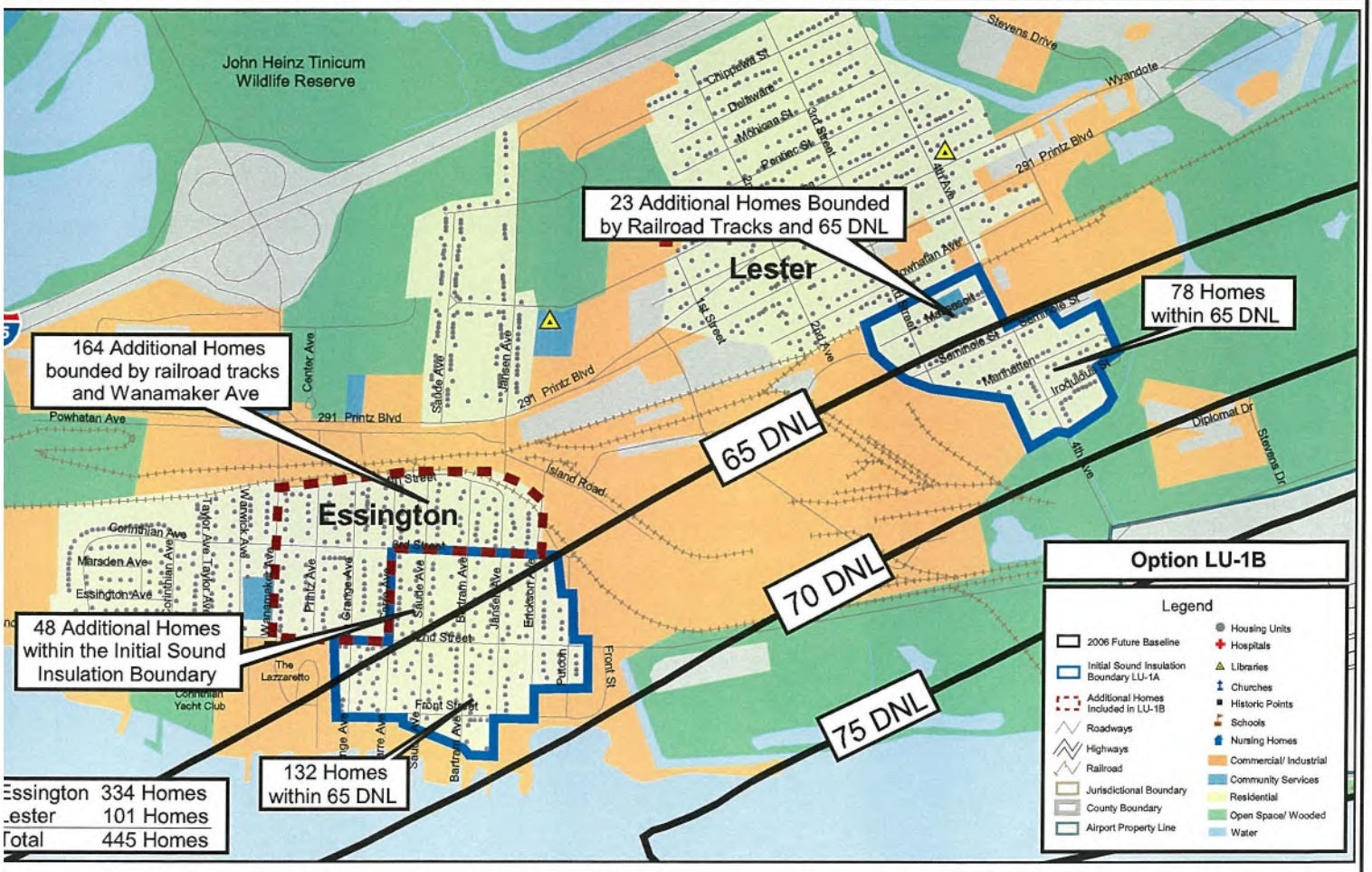
Costs: Conducting a pilot program to identify the best type of insulation for various dwelling structures would be the first step of the Sound Insulation Program. The estimated cost for this study, using an estimated five test sites is estimated to be $500,000.

- Insulation costs are expected to range between $25,000 and $35,000 per residence. Assuming 100 percent participation by all 281 residences of **LU-1A** located within and adjacent to the 65 DNL noise contours, the cost of this project could range between $7.0 million and $10.0 million.
- An extended **LU-1B** program to include the additional 164 homes ($4.1m to $5.75m) would be approximately $11 million to $16 million (for 445 homes.)
- Total Program Costs: **Pilot Program** - $500,000
  LU-1A - $7.0 to $10.0 million
  LU-1B - $11.0 to $16.0 million

Schedule: To begin immediately following approval of the NCP by the FAA and receipt of funding.

Effects on Other Programs/Measures: None expected.





FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Develop and Implement a Residential Sound Insulation Program (LU-1)

FINAL

0 1000 Feet

05/09/02

Prepared by Landrum and Brown

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Exhibit 4 - 4

NOISE COMPATIBILITY PROGRAM MEASURE: LU-2 Exhibit: N/A

Description: Develop and implement a purchase and resale program as a supplement to the residential sound insulation program (LU-1).

Background and Intent:

- A purchase and resale program would be offered to supplement Measure LU-1, Residential Sound Insulation Program, for those eligible homes that do not qualify for the sound insulation program. For example, if a home did not meet local building codes required to qualify for sound insulation, the homeowner would have the option to sell the property to the Airport.
- Under this program the Airport would purchase an eligible home at fair market value and attempt to resell the home to a new owner. The home may be sound insulated and/or upgraded prior to resale and would have an avigation easement attached to the property deed.

Land Use Compatibility Improvement:

- Provides an option for eligible residents who may not qualify for the sound insulation program.
- Properties would have an avigation easement attached, which would guarantee the right of flight over them.

Responsible Implementing Parties: City of Philadelphia, Department of Commerce, Division of Aviation, and other program management consultants.

Implementation Steps, Costs, and Phasing:

Steps: After implementation of Measure LU-1, determine what homes if any would not qualify for sound insulation and could be purchased instead. Implement the purchase and resale program on a case-by-case basis as needed.

Costs: Costs are expected to be minimal to run the program, however the cost to provide an internal manager or consultant would be required at the start. Costs for acquiring homes would be determined by the number of homes participating in the program. A working estimate for the cost of each such unit is approximately $135,000, of which most should be recaptured after structural modification and sound insulation. Consequently, this Measure is expected to have little or no net capital cost to the airport after completion.

Schedule: To be implemented in conjunction with Measure LU-1.

Effects on Other Programs/Measures: None expected.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-3 Exhibit: N/A

Description: Develop and implement a land use controls program.

Background and Intent:
Encourage local municipalities, such as Tinicum Township and the City of Philadelphia, to implement various Land Use Controls, such as re-zoning, and disclosure, for areas within and adjacent to the 2006 NCP/NEM DNL 65 dB noise contour. Although it is not expected that re-zoning will be required, it was still considered for the land use mitigation program as a method to prevent future incompatibilities. This re-zoning measure will be implemented when necessary to maintain land-use compatibility in the Tinicum Township area. It is not expected that the City of Philadelphia would need to exercise the re-zoning measure. The main focus of this measure is intended to be on a mandatory disclosure to buyers and developers that a property is located within a noise impact zone. The requirement for new development to consider the noise zones and build-in sound attenuating features as a means to prevent incompatibilities is another important focus. Both of these measures are discussed further under Implementation Steps, Costs and Phasing.

Land Use Compatibility Improvement:
- Prevents future development of incompatible land use within the DNL 65 dB noise contour.
- Disclosure will advise potential developers, real estate agents, and homebuyers that the property is impacted by aircraft noise
- Protects land uses that are already compatible with the Airport.

Responsible Implementing Parties: Local municipalities.

Implementation Steps, Costs, and Phasing:
Steps: Meetings have been held with the Philadelphia Planning Commission and Tinicum Township to discuss the feasibility of implementing various land use control programs. In addition, the City of Philadelphia provided comments to the Tinicum Township Commissioners regarding their latest zoning update (See Attachment to Appendix F, *Land Use Alternatives*, for a copy of meeting materials and the referenced letter).

The Philadelphia Planning Commission indicated that rezoning may not be necessary for areas that fall within their jurisdiction since there are no homes located within the 65 DNL or greater. Disclosure, however, may be an option for those neighborhoods closest to the airport that experience overflight noise but are not located within the 65 DNL contour, such as Eastwick.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-3 (Continued) Exhibit: N/A

Implementation Steps, Costs, and Phasing (Continued):

The Airport will continue coordination with local planning agencies in order to implement Measure LU-3 as soon as practical. This measure does not require the approval of the FAA to implement; therefore it may be developed and implemented prior to the final approval of the NCP.

Costs: Costs are expected to be minimal to implement the program. Some costs to the local communities involved are to be expected.

Schedule: Continue developing the program parameters and implement as soon as feasible.

Effects on Other Programs/Measures: None expected.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-4 Exhibit: N/A

Description: Develop and implement a land use development controls program.

Background and Intent: Encourage local municipalities, such as Tinicum Township and the City of Philadelphia, to amend their building codes to require any new construction and major alteration/addition within or adjacent to the DNL 65 dB NCP noise contour to meet an interior Noise Reduction Level (NRL) standard of 45 dB.

Land Use Compatibility Improvement:

- Prevents new incompatible development.
- Ensures that any new construction or alteration will utilize materials that will minimize noise exposure on the interior of a structure.

Responsible Implementing Parties: Local municipalities

Implementation Steps, Costs, and Phasing:
Steps: Meetings have been held with the Philadelphia Planning Commission and Tinicum Township to discuss the feasibility of implementing various land use development programs. In addition, the City of Philadelphia provided comments to the Tinicum Township Commissioners regarding their latest zoning update (See Attachment to Appendix F, *Land Use Alternatives*, for a copy of meeting materials and the referenced letter).

The Airport will continue coordination with local planning agencies in order to implement Measure LU-4 as soon as practical. This measure does not require the approval of the FAA to implement; therefore it may be developed and implemented prior to the final approval of the NCP.

Costs: Costs are expected to be minimal to implement the program. Some costs to the local communities and developers are expected.

Schedule: Continue developing program parameters and implement as soon as feasible.

Effects on Other Programs/Measures: None expected

NOISE COMPATIBILITY PROGRAM MEASURE: LU-5 Exhibit: N/A

Description: Prepare a Study to Determine Feasibility of Implementing Noise Mitigation Measures at Historic Fort Mifflin

Background and Intent:

- Historic Fort Mifflin, a National Historic Landmark, is located within the limits of the City of Philadelphia, just East of Philadelphia International Airport. It is further located within the 70 DNL level of the 2006 Noise Compatibility Plan (NCP) noise contour, with some portions falling within the 75 DNL. According to Appendix A of FAR Part 150, (Part B Sec. A150.101, (e) (6)) the location of properties on or eligible for inclusion in the National Register of Historic Places must be identified on the Noise Exposure Maps. In addition, Sec A150.101 (c) indicates that if there are other uses with greater sensitivity to noise permitted by local government at a site, a determination of compatibility must be based on that use that is most adversely affected by noise.
- Fort Mifflin is frequently used for educational purposes, however, due to the close proximity and orientation to the runways at the Airport, educational programs are frequently interrupted by extremely low and loud aircraft operations. School groups visit the Fort year round to take part in a variety of educational programs and from April through November the general public is welcomed to visit the Fort.
- The Fort is authorized to provide housing for a year round on-site caretaker, in order to maintain and provide security for the facility when it is closed and especially during the nighttime. Unfortunately, due to the extreme noise levels experienced at the Fort, the administration has not been able to take advantage of this option.
- The intent of this measure is to authorize and fund a detailed study to determine if potential noise mitigation measures, such as sound insulation, could be effective in reducing the interior noise levels at that location. Key to the effort will be identifying suitable and effective mitigation measures that would not alter the character of this historic resource. Areas of concentration should include those facilities at Fort Mifflin that are commonly used for educational purposes, daily business activities, and the caretaker's quarters.

Land Use Compatibility Improvement:

- Land uses at Fort Mifflin such as a caretaker residence, business offices and public educational facilities would be considered sensitive uses. Therefore, only those specific areas of use at Fort Mifflin could be eligible for noise mitigation, and could be partially funded by the FAA.
- Effective mitigation could reduce the interior noise levels of the areas within Fort Mifflin used for caretaker housing as well as the portion of the visitor's center that is used for educational purposes and staff business offices.

Responsible Implementing Parties: City of Philadelphia, Division of Aviation, Division of Parks and Recreation, Philadelphia Historic Commission, State Historic Preservation Office (SHPO), Airport Noise Office, FAA, and Noise Program Management Consultant.

NOISE COMPATIBILITY PROGRAM MEASURE: LU-5 (Continued) Exhibit: N/A

Implementation Steps, Costs, and Phasing:

Steps: Appropriate scoping should be conducted with the SHPO and Philadelphia Historic Commission to identify qualified consultants with the capability to conduct such a study. The study would aim to determine what, if any, mitigation measures would be effective while maintaining the historic setting and character of Fort Mifflin. The SHPO and Philadelphia Historic Commission must be consulted to determine if the proposed mitigation methods could damage or alter the historic resource.

Costs: The estimated cost for a study of this type is $125,000 to $175,000. The costs of effective implementation measures would be identified within the study, however funds should be set-aside for a "Phase 2 – Implementation Program" as well.

Schedule: To begin immediately following approval of the NCP by the FAA and receipt of funding.

Effects on Other Programs/Measures: None expected.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-1 Exhibit: N/A

Description: Establish a Noise Abatement Advisory Committee.

Background and Intent: Using the Part 150 Study Advisory Committee as a basis of membership, request additional volunteers or appointments from local municipalities within the area affected by operations at the airport to serve on a continued Noise Abatement Advisory Committee. The purpose of this committee would be to maintain regular communication and exchange of ideas between the Airport and surrounding communities, to enhance community understanding of the constraints on airport users and operators, to serve as a vehicle for disseminating information to the community. The committee would be advisory in nature and chaired by the Director of Aviation or his designee. The Airport Noise Office unit of the Airport's Marketing and Public Affairs department would handle administrative duties. The committee would meet quarterly, or as necessary at its convenience.

Land Use Compatibility Improvement: The committee is intended to communicate the nature of land use compatibility to the community and to assist in describing the Airports Noise Compatibility Program.

Responsible Implementing Parties: The Airport Noise Office unit of the Airport's Marketing and Public Affairs department under the direction of the Director of Aviation.

Implementation Steps, Costs, and Phasing:

Steps:

- Identify organizations and communities desired for participation.
- Request each organization/community to identify/assign a participant (continuation of membership by current members of the Part 150 SAC should be encouraged).
- Establish agenda and committee goals
- Begin meetings

Costs: Administrative costs for printing, staff support, report production, meeting facilities and refreshments, and potentially special speaker costs. Total cost not including Noise Office cost, estimated at approximately $16,000. Funded through airport administrative budget.

Schedule: Meetings quarterly, with continuing participation by all members during interim periods.

Effects on Other Programs/Measures: None.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-2 Exhibit: N/A

Description: Enhance the Airport's Noise Monitoring System.

Background and Intent: The existing Airport Noise Monitoring System (ANMS) is aging and would benefit from an upgrade of computer hardware to increase the reliability of the system and the efficiency of the Noise Office staff. Upgrades should include increasing processor speed, increasing data storage capabilities, and enhancing noise monitoring and mapping software.

Land Use Compatibility Improvement: Improvement of the system will better enable the Airport's Marketing and Public Affairs Noise Office staff to be responsive to community inquiries.

Responsible Implementing Parties: The Airport Noise Office unit of the Airport's Marketing and Public Affairs department under the direction of the Director of Aviation.

Implementation Steps, Costs, and Phasing:
Steps: Seek/obtain budget approval for upgrade equipment.

Costs: Equipment and installation/calibration estimated at $100,000-150,000. Funded through airport administrative budget.

Schedule: Could be implemented immediately upon funding approval.

Effects on Other Programs/Measures: None.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-3 Exhibit: N/A

Description: Install additional noise monitors.

Background and Intent: Evaluate the locations and number of noise monitors existing at the airport to determine whether or not relocated or additional monitors would be beneficial to the airport and the community. Most likely, one additional monitor could be installed in Tinicum Township and another could be installed in the Brandywine Hundred section of Northern Wilmington, DE. Other locations will be determined as any modifications to flight locations resulting from the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project become resolved. That project may suggest additional locations to both the east and west of the airport. Additionally, the results of the Airport's Master Planning effort may suggest the installation of monitors in other locations to better measure noise from future airport modifications that may be recommended. To accomplish this evaluation, the Airport may wish to employ outside services to assess existing locations, recommend future sites, and specify equipment and its placement. Alternately, the Airport's Marketing and Public Affairs department may assign this effort to its Noise Office staff as part of its regular duties, with support from a specialized consultant.

Land Use Compatibility Improvement: Additional noise monitors would allow the Airport to have more and better data related to aircraft noise and flight paths that could be incorporated into planning studies. Additionally, long-term actual noise levels can then be shared with the communities that are affected by aircraft noise through the production of standard periodic reports.

Responsible Implementing Parties: The Airport Noise Office unit of the Airport's Marketing and Public Affairs department under the direction of the Director of Aviation.

Implementation Steps, Costs, and Phasing:

Steps:

- Conduct evaluation of existing system and recommendations for enhancement.
- Determine schedule of installation and apply for funding for system improvement.
- Award contract to install, calibrate, and assure utility of each new or relocated monitor.
- Initiate measurement and data compilation

Costs: If a consultant were hired to evaluate the location of existing monitors and recommend the location of future monitors, the approximate cost would be $50,000. The cost for each additional monitor would be approximately $25,000 to $30,000.

Schedule: If funded through regular Airport administrative budget, the effort could begin upon budget approval. If funded through PFCs, the project would need to await the next round of PFC approvals. If funding is through AIP (80% noise set aside) moneys, an application for equipment and installation may be prepared, but must await submittal upon approval of the Part 150 NCP.

Effects on Other Programs/Measures: None.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-4 Exhibit: N/A

Description: Establish full time Noise Office with staff

Background and Intent: The role of the Noise Office, which is a sub unit of the Airport's Marketing and Public Affairs department, will likely increase when the Part 150 Noise Compatibility Program is approved. The other Program Management measures, which are intended to increase the lines of communication between the airport and its surrounding communities, as well as to improve the quality and efficiency of the Noise Office, may necessitate greater staffing. To meet the demands anticipated for this office, both by the Program Management measures, but also in the expected increase in responsibilities associated with the residential sound insulation program (LU-1) and the purchase/resale program (LU-2), a full time commitment will be required. Staffing, which could be adjusted as conditions warrant, should include both technical and public relations expertise. Clerical assistance may be dedicated to the office or shared with other administrative functions of the Airport.

The responsibilities of the Noise Office should include management of the Airport Noise Monitoring System (ANMS), management and oversight of the residential sound insulation program, coordination of the noise complaint function and coordination of the Noise Abatement Advisory Committee. The Office should also maintain communication with Air Traffic Control to assure understanding of modifications to the airspace utilization as a result of the New York/New Jersey/Philadelphia Metropolitan Airspace Redesign Project and other such efforts that may evolve from that Project. The Office should also participate in the review of development designs to comment upon the application of noise abatement standards in plans for physical development on the Airport (NA-7).

Land Use Compatibility Improvement: The Noise Office is intended to provide a single point of contact for community involvement with Airport staff on noise related issues and to relieve senior Airport management of daily coordination functions related to aircraft noise.

Responsible Implementing Parties: The City of Philadelphia, Department of Commerce, and Division of Aviation.

Implementation Steps, Costs, and Phasing:
Steps:
- Establish parameters for staffing and funding the Noise Office.
- Advertise and hire staff.
- Identify, set up, and equip office space.

Costs: Administrative costs for salaries, equipment, operation and support of NCP programs, funded through airport administrative budget.

Schedule: Implementation upon budgetary approval and funding.

Effects on Other Programs/Measures: Enhances all other NCP measures by identifying the office/individual responsible for their implementation.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-5 Exhibit: N/A

Description: Establish a pilot/community awareness program

Background and Intent: A pilot and community awareness program would be designed to deliver information prepared by the Noise Office to both users and neighbors of the Airport. Communications to the community would carry messages of anticipated changes in the nature or character of noise in the environs, based on construction or other actions that may produce noticeable differences between normal and abnormal conditions. These messages could be distributed through a developing mailing list of interested neighbors, beginning with the membership of the NAAC and attendees at Public Workshops held during the Part 150 Study, through press releases, and through other means of direct communication.

Communications with controllers, pilots and air carriers would be intended to inform them of the noise-sensitivity of various areas around the airport and to request their consideration in using quiet flying techniques over those areas. Additionally, printed materials may be produced for posting or distribution in crew lounges, at fixed base operator (FBO) flight planning centers, or potentially as insertable plates for the Jeppeson charts used by all commercial pilots. The specific form of such materials would become a responsibility of the Airport Noise Office.

Land Use Compatibility Improvement: No improvement to land use compatibility, but improved communications between the airport and the neighboring communities would reduce the unexpected nature of changes and would explain the expected length of time changes might be in effect.

Responsible Implementing Parties: The Airport Noise Office unit of the Airport's Marketing and Public Affairs department under the direction of the Director of Aviation.

Implementation Steps, Costs, and Phasing:
Steps:
- Develop informational materials to explain the NCP to the neighboring communities.
- Develop informational material for distribution to air carriers and FBOs.
- Design and implement a Noise Office web site.

Costs: Administrative costs for printing and distribution explanatory materials and for web site development. Continuing communication after the initial efforts of this measure would fall under measure PM-4. Funded through airport administrative budget.

Schedule: Implementation upon budgetary approval and funding.

Effects on Other Programs/Measures: Enhances all other NCP measures by communicating the desired actions of the NCP to the users and maintains communication with the public.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-6 Exhibit: N/A

Description: Update the Noise Exposure Maps and Noise Compatibility Program

Background and Intent: The Noise Exposure Maps (NEMs) are likely to become outdated and will need to be brought current periodically. Given the concurrent Master Plan Study, it is expected that new Noise Exposure Maps will need to be produced in two to three years, upon completion of the planning process and prior to the implementation of any newly anticipated facilities. Following the initial update, the NEMs should continue to be updated at least every three years to consider changes in traffic and traffic flows, as well as updates of the noise modeling software.

The Noise Compatibility Program should be updated as necessary to reflect larger changes in the nature of aircraft noise surrounding the Airport. Should the Master Plan make recommendations that would enlarge the area of incompatible use exposed to aircraft noise above 65 DNL, or should major changes such as runway realignments or significant modifications to ground facilities be planned, the NCP should be updated prior to the implementation of those improvements. A full update may not be required, but rather, a targeted assessment of the changes occasioned by specific development projects may suffice to bring the NCP to currency and to qualify additional areas for NCP programs, if appropriate. After five years, if such changes occur, or if the number and character of operations changes significantly, the NCP should then be updated.

A qualified planning consultant should be retained to conduct the NEM update and the NCP update, separately or together.

Land Use Compatibility Improvement: No improvement to land use compatibility, the measure provides for continuing planning and care in assuring the greatest compatibility between the airport and its environs.

Responsible Implementing Parties: The Airport Noise Office or Airport Planning, under the direction of senior Airport management, should be responsible for oversight of the project.

Implementation Steps, Costs, and Phasing:

Steps:

- Evaluate the need of NEM or NCP update based on conditions in 2003.
- If appropriate, retain a qualified planning consultant to conduct the update(s).
- Complete and publish the results, modifying or expanding NCP programmatic boundaries as appropriate at the time of update.

Costs: Completion of the project should not approach that required for the first time effort conducted during this study. Each update of the NEMs should be accomplished for $150,000 or less if the Noise Office is in place and the ANMS is fully functional. The Airport should be able to have the NCP updated for $250,000 or less, assuming timely implementation of the current NCP measures, timely completion of the FAA's Airspace Redesign Project, and moderate facility changes through the Master Plan. Substantial changes in any of the three factors could increase the costs of NCP update significantly. Both updates are eligible for funding through AIP grant monies.

NOISE COMPATIBILITY PROGRAM MEASURE: PM-6 (Continued) Exhibit: N/A

Implementation Steps, Costs, and Phasing (Continued):

Schedule: NEM update in 2003/2004, with NCP update at the same time or in conjunction with the second NEM update in 2006/2007.

Effects on Other Programs/Measures: Reviews all other programs and measures to assure their incorporation into the description of the noise condition at the Airport.

4.1 NOISE COMPATIBILITY PROGRAM MAP

The Noise Abatement measures included in the NCP and presented in this chapter will not substantively change the pattern of aircraft noise at the airport. Only the development of RNAV overlays (measure NA-6) would have a potential effect within the 65 DNL contour, and it is not known what that effect might be until the FAA reaches its conclusions on the New York/New Jersey/Philadelphia Metropolitan Airspace Design Project. When the Noise Exposure Maps (NEMs) are next updated (measure PM-6), the RNAV overlay definitions are likely to be known and may then be incorporated into the noise exposure pattern. The information indicated on **Exhibit 4-5**, *Future (2006) NEM/NCP*, constitutes the official Noise Exposure Map for the year 2006.

Table 4-2 compares the baseline impacts and the impacts with the implementation of the NCP. As the table indicates, the land use mitigation measures of the NCP, when completed, will eliminate the incompatible land uses in areas exposed to noise greater than 65 DNL.

Table 4-2
COMPARISON OF BASELINE AND NCP HOUSING, POPULATION, AND NOISE-SENSITIVE FACILITY INCOMPATIBILITIES
Philadelphia International Airport

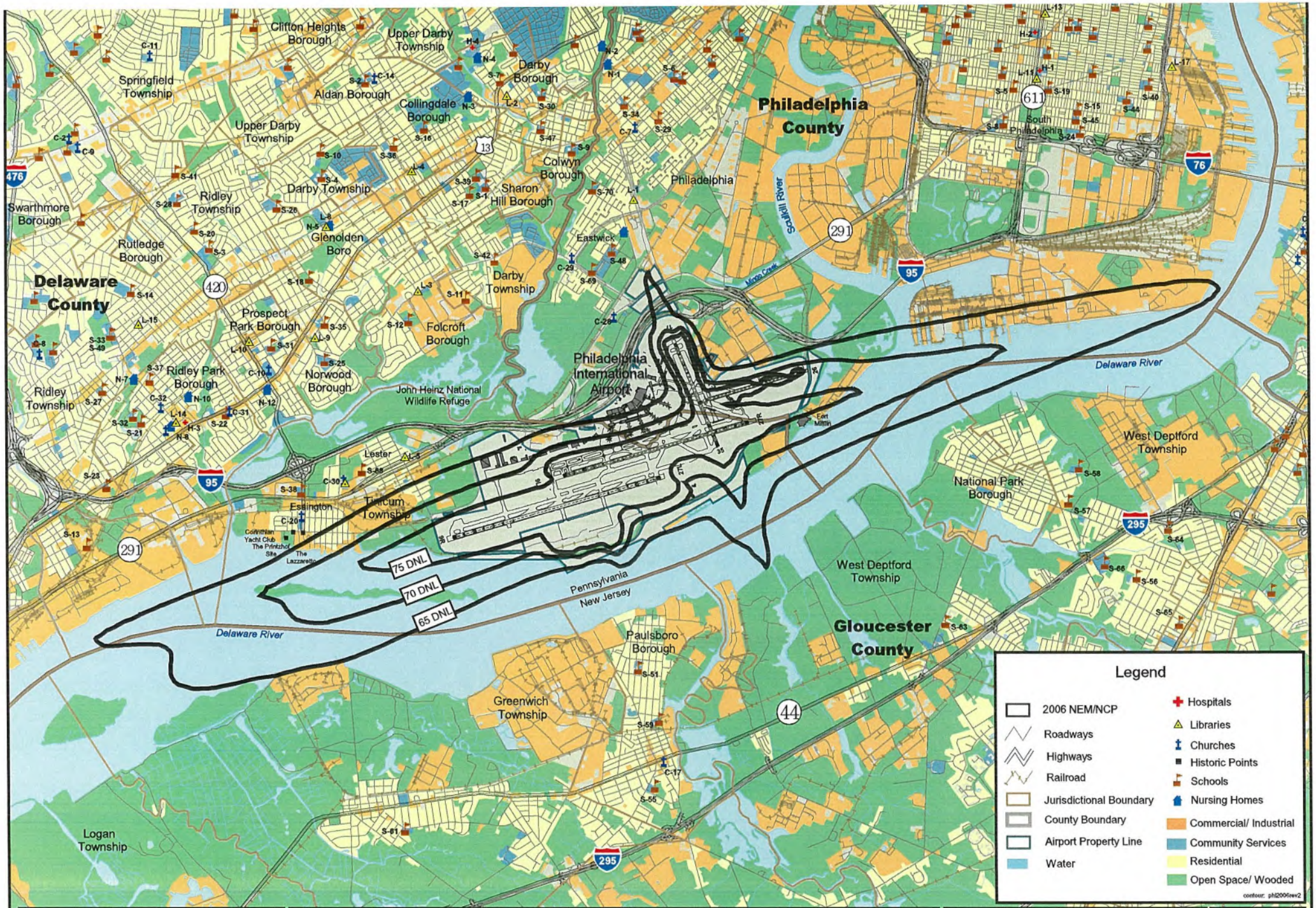
	TOTAL POPULATION (All Residential Units)				TOTAL DWELLING UNITS				NOISE-SENSITIVE PUBLIC USES (churches, schools, etc.)			
Condition	65-70 DNL	70-75 DNL	75+ DNL	TOTAL	65-70 DNL	70-75 DNL	75+ DNL	TOTAL	65-70 DNL	70-75 DNL	75+ DNL	TOTAL
Baseline												
2001	593	0	0	593	209	0	0	209	0	0	0	0
2006	600	0	0	600	210	0	0	210	0	0	0	0
NEM/NCP												
2001	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0

Notes: Noise contours were generated using the Integrated FAA's Noise Model, Version 6.0b computer model. Housing counts are based on 1990 aerial photography, supplemented by field verification. Population numbers are approximate based on the housing counts multiplied by the 1990 census block housing to population ratio.

Baseline conditions assume the continuation of the existing operating procedures without modification.

Noise Compatibility Program conditions assume the implementation of all recommended measures presented in this chapter.

Source: Landrum & Brown, 2002



FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Future (2006) NEM/NCP

FINAL

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Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/contour - final document.apr 05/01/02

Exhibit 4 - 5

4.2 NOISE COMPATIBILITY PROGRAM COSTS

Philadelphia International Airport, the FAA, and airport users, supplemented by eligible funding by the FAA, will incur the direct costs associated with the recommended NCP measures. Costs for completion of the program have been estimated in 2001 dollars and are presented in **Table 4-3**. These costs consist of annual or one-time expenditures, with PHL carrying the vast majority of responsibility for funding the program measures.

Annual costs consist of the administrative expenses to implement a continuing measure or to operate aircraft according to the recommended measures. One-time costs include the expenditures to implement major mitigation programs such as residential sound insulation, update current noise monitoring system equipment, and purchase additional noise monitors. The total estimated cost to PHL for all NCP recommendations is between $7,975,000 and $17,275,000. The PHL-funded mitigation actions recommended for implementation are eligible, however, for federal matching funds amounting to approximately 80 percent of the total program cost. The costs of each individual measure are detailed earlier in this chapter.

4.3 IMPLEMENTATION SCHEDULE

As shown in Table 4-1, a number of the recommended noise abatement measures are currently being used at PHL today (NA-1 through NA-5). Measure NA-6, which calls for the development of RNAV procedures for selected airspace routes will require FAA approval to become part of the NCP. These measures can be implemented in 2002. Measure NA-7, development standards on the airfield, can also be implemented after FAA approval of the NCP and should continue as long as it is appropriate.

The corrective land use measures (LU-1, LU-2, and LU-5) require FAA approval of the NCP prior to being funded. Implementation could begin in 2002 and continue for a number of years depending on the number of homes participating. The preventive land use measures (LU-3 and LU-4) may be implemented at any time because it is the responsibility of the local jurisdictions. These measures will require FAA approval prior to being incorporated into the NCP.

The program management measures (PM-1 through PM-6) all can be implemented immediately. However, for the measures that will request Federal funding, FAA approval of the NCP is required. It is anticipated that the FAA will issue a Record of Approval in October/November 2002.

Table 4-3
NCP IMPLEMENTATION COSTS
Philadelphia International Airport

Type of Measure	Direct Cost to Airport	Direct Cost to Local Government	Direct Cost to Users
Noise Abatement	**TOTAL:** None	None	Minimal if any
Land Use Management	**TOTAL:** $7,125,000 - $16,175,000	Minimal	None
Implementation	**TOTAL:** $850,000 - $1,100,000	None	None
TOTAL:	**$7,975,000 - $17,275,000**	**Minimal**	**Minimal if any**

Source: Landrum & Brown, 2002

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Glossary of Terms

GLOSSARY OF TERMS

The following list of terms and definitions are intended to assist the reader in understanding the various technical discussions presented in the following chapters.

A-Weighted Sound (dBA) – A system for measuring sound energy that is designed to represent the response of the human ear to sound. Energy at frequencies more readily detected by the human ear is more heavily weighted in the measurement, while frequencies less well detected are assigned lower weights. A-weighted sound measurements are commonly used in studies where the human response to sound is the object of the analysis.

Air Route Traffic Control Center (ARTCC or Center) – A FAA facility established to provide air traffic control service to aircraft operating on Instrument Flight Rules (IFR) flight plans within controlled airspace during the en route portion of flight.

Air Traffic Control (ATC) – A service operated to promote the safe, orderly, and expeditious flow of air traffic.

Airman's Information Manual (AIM) – A publication containing basic flight information and ATC procedures, designed primarily as a pilot's information and instructional manual for use in the National Airspace System.

Airport Elevation – The highest point on an airport's usable runways, expressed in feet above mean sea level (MSL).

Airport Improvement Program (AIP) – A Federal funding program for airport improvements. Congress periodically reauthorizes AIP with funding appropriated from the Aviation Trust Fund. Proceeds to the Trust Fund are derived from excise taxes on airline tickets, aviation fuel, etc.

Airport Layout Plan (ALP) – A scaled drawing of existing and proposed land and facilities necessary for the operation and development of the airport. The ALP shows boundaries and proposed additions to all areas owned or controlled by the airport operator for airport purposes, the location and nature of existing and proposed airport facilities and structures, and the location on the airport of existing and proposed non-aviation areas and improvements thereon.

Airport Operations – Landings (arrivals) and takeoffs (departures) from an airport.

Airport Surveillance Radar (ASR) – A radar system which allows air traffic controllers to identify an arriving or departing aircraft's distance and direction from an airport.

Airport Traffic Control Tower (ATCT) – The airport traffic control facility located on an airport that is responsible for traffic separation within the immediate vicinity of the airport and on the surface of the airport.

Airway – A corridor of controlled airspace whose centerline is established by radio navigational aids (NAVAIDs). Low altitude airways (between 3,000 and 18,000 feet MSL) are identified by number with the letter V as a prefix. High altitude airways (above 18,000 feet MSL) are known as Jet airways and are identified by number with the letter J as a prefix.

Ambient Noise – The total sum of noise from all sources in a given place and time.

Approach Light Systems (ALS) – A series of lights that assists the pilot when aligning aircraft with the extended runway centerline on final approach.

Attenuation – Acoustical phenomenon whereby sound energy is reduced between the noise source and the receiver. This energy loss can be attributed to atmospheric conditions, terrain, vegetation, other natural features, and man-made features (e.g., sound insulation).

Automated Radar Terminal System (ARTS) – Computer-aided radar display subsystems capable of associating alphanumeric data – such as aircraft identification, altitude, and airspeed – with aircraft radar returns.

Azimuth – An arc of the horizon measured between a fixed point (such as true north) and the vertical circle passing through the center of an object.

Bank – (1) A cluster of arrivals or departures in a short period of time, characteristic of an airline hub operation; (2) to turn, as in to bank left or right along a flight course; (3) to put away for later use, as in to bank land for future airport development.

Base leg – A flight path at right angles to the approach of a runway end. It usually extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

Baseline Condition – The existing condition or conditions prior to future development or the enactment of additional noise abatement procedures, which serve as a foundation for analysis.

Building Restriction Line (BRL) – A line drawn on an airport layout plan which distinguishes between areas that are suitable for buildings and areas that are unsuitable. The BRL is drawn to exclude the runway protection zones, the runway visibility zones required for clear line of sight from the airport traffic control tower, and all airport areas with a clearance of less than 35 feet (10.5 meters) beneath the FAR Part 77 surfaces.

Commuter Aircraft – Commuters are commercial operators that provide regularly scheduled passenger or cargo service with aircraft seating less than 60 passengers. A typical commuter flight operates over a trip distance of less than 300 miles.

Connecting Passenger – An airline passenger who transfers from an arriving aircraft to a departing aircraft in order to reach his or her ultimate destination.

Controlled Airspace – Airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Controlled airspace is designated as Class A, Class B, Class C, Class D, or Class E. Aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements as specified in FAR Part 91, depending upon the class of airspace in which they are operating.

Crosswind leg – A flight path at right angles to the approach runway end off of its upwind end.

Day-Night Average Sound Level (DNL) – A noise measure used to describe the average sound level over a 24-hour period, typically an average day over the course of a year. In computing DNL, an extra weight of 10 decibels is assigned to noise occurring between the hours of 10 p.m. and 7 a.m. to account for increased annoyance when ambient noise levels are lower and people are trying to sleep. DNL may be determined for individual locations or expressed in noise contours.

Decibel (dB) – Sound is measured by its pressure or energy in terms of decibels. The decibel scale is logarithmic. A 10-decibel increase in sound is equal to a tenfold increase in sound energy.

Displaced Threshold – A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold may be available for takeoffs in both directions and landings from the opposite direction.

Distance Measuring Equipment (DME) – A flight instrument that measures the line-of-sight distance of an aircraft from a navigational radio station in nautical miles.

Easement – The legal right of one party to use part of the rights of a piece of real estate belonging to another party. This may include, but is not limited to, the right of passage over, on or below the property; certain air rights above the property, including view rights; and the rights to any specified form of development or activity.

Enplanements – The number of passengers boarding an aircraft at an airport. Does not include arriving or through passengers.

Enroute System – That part of the National Airspace System where aircraft are operating between origin and destination airports.

Enroute Control – The control of IFR traffic in route between two or more adjacent approach control facilities.

Environmental Assessment (EA) – A concise document that assesses the environmental impacts of a proposed Federal Action. It discusses the need for, and environmental impacts of, the proposed action and alternatives. An environmental assessment should provide sufficient evidence and analysis for a Federal determination whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). Public participation and consultation with other Federal, state, and local agencies is a cornerstone of the EA process.

Environmental Impact Statement (EIS) – An EIS is a document that provides a discussion of the significant environmental impacts which would occur as a result of a proposed project, and informs decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts. Public participation and consultation with other Federal, state, and local agencies is a cornerstone of the EIS process.

Equivalent Sound Level (Leq) – The average A-weighted sound level over any specified time period.

Federal Aviation Administration (FAA) – The FAA is the Federal agency responsible for insuring the safe and efficient use of the nation's airspace, for fostering civil aeronautics and air commerce, and for supporting the requirements of national defense. The activities required to carry out these responsibilities include: safety regulations; airspace management and the establishment, operation, and maintenance of a system of air traffic control and navigation facilities; research and development in support of the fostering of a national system of airports, promulgation of standards and specifications for civil airports, and administration of Federal grants-in-aid for developing public airports; various joint and cooperative activities with the Department of Defense; and technical assistance (under State Department auspices) to other countries.

Federal Aviation Regulations (FAR) – The body of Federal regulations relating to aviation. Published as Title 14 of the Code of Federal Regulations.

Final Approach – A flight path that follows the extended runway centerline. It usually extends from the base leg to the runway.

Finding of No Significant Impact (FONSI) – If, following the preparation of an environmental assessment, the Federal Agency determines a proposed project will not result in any significant environmental impact, a finding of no significant impact (FONSI) is issued by the Federal Agency. A FONSI is a document briefly explaining the reasons why an action will not have a significant effect on the human environment and for which an EIS, therefore, is not necessary.

Fixed Base Operator (FBO) – A business located on the airport that provides services such as hangar space, fuel, flight training, repair, and maintenance to airport users.

Flight Track Utilization – The use of established routes for arrival and departure by aircraft to and from the runways at the airport.

Glide Slope (GS) – Provides vertical guidance for aircraft during approach and landing. The glide slope consists of the following:

- Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS, or
- Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

Global Positioning System (GPS) – A system of 24 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude. The accuracy of the system can be further refined by using a ground receiver at a known location to calculate the error in the satellite range data. This is known as differential GPS (DGPS).

Grid Analysis – A type of aircraft noise analysis that evaluates the noise levels at individual points rather than through generation of noise contours.

Ground Effect – Noise attenuation attributed to absorption or reflection of noise by man-made or natural features on the ground surface.

Hourly Noise Level (HNL) – A noise summation metric including primarily those single events that exceed a specific threshold or duration during one hour.

Hub – An airport that services airlines that have hubbing operations.

Hubbing – A method of airline scheduling that times the arrival and departure of several aircraft in a close period of time in order to allow the transfer of passengers between different flights of the same airline in order to reach their ultimate destination. Several airlines may conduct hubbing operations at an airport.

Infill – Urban development occurring on vacant lots in substantially developed areas. May also include the redevelopment of areas to a greater density.

Instrument Approach – A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

Instrument Flight Rules (IFR) – That portion of the Federal Aviation Regulations (14 CFR 91) specifying the procedures to be used by aircraft during flight in Instrument Meteorological Conditions. These procedures may also be used under visual conditions and provide for positive control by ATC. (See also VFR).

Instrument Landing System (ILS) – An electronic system installed at some airports which helps to guide pilots to runways for landing during periods of limited visibility or adverse weather.

Instrument Meteorological Conditions (IMC) – Weather conditions expressed in terms of visibility, distance from clouds, and cloud ceilings during which all aircraft are required to operate using instrument flight rules (IFR).

Integrated Noise Model (INM) – A computer model developed, updated and maintained by the FAA to predict the noise exposure generated by aircraft operations at an airport.

Knots – Airspeed measured as the distance in nautical miles (6,076.1 feet) covered in one hour. (Approximately equal to 1.15 miles per hour.)

Land and Hold Short Operations (LAHSO) – An air traffic control procedure intended to increase overall airport capacity without compromising safety. LAHSO include landing and holding short of an intersecting runway, taxiway, or some other designated point on a runway or taxiway.

Land Use Compatibility – The ability of land uses surrounding the airport to coexist with airport-related activities with minimum conflict.

Landing and Takeoff (LTO) Cycle – The time that an aircraft is in operation at or near an airport. An LTO cycle begins when an aircraft starts its final approach (arrival) and ends after the aircraft has made its climb-out (departure).

Ldn – See DNL. Ldn is used in place of DNL in mathematical equations only.

Leq – Equivalent Sound Level. The steady A-weighted sound level over any specified period of time (not necessarily 24 hours) that has the same acoustic energy as the fluctuating noise during that period (with no consideration of nighttime weighting). It is a measure of cumulative acoustical energy. Because the time interval may vary, it should be specified by a subscript (such as Leq_8 for an 8-hour exposure to noise) or be clearly understood from the context.

Local Passenger – A passenger who either enters or exits a metropolitan area on flights serviced by the area's airport. A local passenger is the opposite of a connecting passenger.

Localizer – The component of an ILS which provides lateral course guidance to the runway.

Loudness – The subjective assessment of the intensity of sound.

Mean Sea Level (MSL) – The average height of the surface of the sea for all stages of the tide; used as a reference for elevations. Also called sea level datum.

Merge – Combining noise events that exceed a given threshold level and occur within a selected period of time.

Missed Approach – A prescribed procedure to be followed by aircraft that cannot complete an attempted landing at an airport.

Narrow-body Aircraft – A commercial passenger jet having a single aisle and maximum of three seats on each side of the aisle. Common narrow-body aircraft include A320, B717, B727, B737, B757, DC9, MD80, and MD90.

National Airspace System (NAS) – The common network of U.S. airspace; air navigation facilities, equipment, services, airports, or landing areas; aeronautical charts, information, and services; rules, regulations, and procedures; technical information, manpower, and materials, all of which are used in aerial navigation.

National Environmental Policy Act of 1969 (NEPA) – The original legislation establishing the environmental review process for proposed Federal actions.

Nautical Mile – A measure of distance equal to one minute of arc on the earth's surface (6,076.1 feet or 1,852 meters).

NAVAIDs (Navigational Aids) – Any facility used by an aircraft for navigation.

Noise Abatement – A measure or action that minimizes the amount of impact of noise on the environs of an airport. Noise abatement measures include aircraft operating procedures and use or disuse of certain runways or flight tracks.

Noise Berm – A manmade soil structure designed to interrupt the direct transmission of noise from a source to a noise-sensitive area.

Noise Contour Map – A map representing average annual noise levels summarized by lines connecting points of equal noise exposure.

Nondirectional Beacon (NDB) – A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to and from the station. When the radio beacon is installed in conjunction with the ILS marker, it is normally called a compass locator.

Nonprecision Approach – A standard instrument approach procedure providing runway alignment but no glide slope or descent information.

Operation – A takeoff or landing by an aircraft.

Outer Fix – An air traffic control term for a point in the airspace from which aircraft are normally cleared to the approach fix or final approach course.

Positive Control – The separation of all air traffic within designated airspace as directed by air traffic controllers.

Precision Approach Path Indicator (PAPI) – Provides visual approach slope guidance to aircraft during an approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

Precision Approach Procedure – A standard instrument approach procedure in which an electronic glideslope/glidepath is provided (e.g., ILS and PAR).

Precision Approach Radar (PAR) – Navigational equipment located on the ground adjacent to the runway, and consisting of one antenna which scans the vertical plane and a second antenna which scans the horizontal plane. The PAR provides the controller with a picture of the descending aircraft in azimuth, distance, and elevation, permitting an accurate determination of the aircraft's alignment relative to the runway centerline and the glide slope.

Primary Commercial Service Airport – A commercial airport which enplanes 0.01 percent or more of the total annual U.S. enplanements.

Primary Runway – The runway on which the majority of operations take place.

Profile – The position of the aircraft during an approach or departure in terms of altitude above the runway and distance from the runway end.

Propagation – Sound propagation is the spreading or radiating of sound energy from the noise source. It usually involves a reduction in sound energy with increased distance from the source. Atmospheric conditions, terrain, natural objects, and manmade objects affect sound propagation.

Public Use Airport – An airport open to public use without prior permission, and without restrictions within the physical capabilities of the facility. It may or may not be publicly owned.

Reliever Airport – An airport which, when certain criteria are met, relieves the aeronautical demand on a busier air carrier airport.

Run-Up – A routine procedure for testing aircraft systems by running one or more engines at a high power setting. Engine run-ups are normally conducted by airline maintenance personnel checking an engine or other on board systems following maintenance.

Runway End Identifier Lights (REIL) – Two synchronized flashing lights, one on each side of the runway threshold, which identify the approach end of the runway.

Runway Protection Zone (RPZ) – An area, trapezoidal in shape and centered about the extended runway centerline, designated to enhance the safety of aircraft operations. It begins 200 feet (60 M) beyond the end of the area usable for takeoff or landing. The RPZ dimensions are functions of the aircraft, type of operation and visibility minimums. (Formerly known as the clear zone).

Runway Safety Area (RSA) – A defined surface surrounding the runway prepared or suitable for reducing the risk or damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

Runway Threshold – The beginning of that portion of the runway usable for landing.

Runway Use Program – A noise abatement runway selection plan crafted to further noise abatement efforts for communities around airports. A runway selection plan is developed into a runway use program. It typically applies to all turbojet aircraft 12,500 pounds or heavier. Turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. These programs are coordinated with the FAA in accordance with FAA Order 8400.9, National Safety and Operational Criteria for Runway Use Programs, and are administered as either "formal" or "informal" programs.

Runway Use Program (formal) – An approved runway use program outlined in a Letter of Understanding between the FAA–Flight Standards, FAA–Air Traffic Service, the airport proprietor, and the users. It is mandatory for aircraft operators and pilots as provided for in FAR Section 91.87.

Runway Use Program (informal) - An approved runway use program that does not require a Letter of Understanding. Participation in the program by aircraft operators and pilots is voluntary.

Single event – One noise event. For many kinds of analysis, the sound from single events is expressed using the Sound Exposure Level (SEL) metric.

Slant-range distance – The distance along a straight line between an aircraft and a point on the ground.

Sound – Sound is the result of vibration in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source in the same way as ripples do on water after a stone is thrown into it. The result of the movement is fluctuation in the normal atmospheric pressure or sound waves.

Sound Exposure Level (SEL) – A standardized measure of a single sound event, expressed in A-weighted decibels, that takes into account all sound above a specified threshold set at least 10 decibels below the maximum level. All sound energy in the event is integrated over one second.

Special Use Airspace – Airspace of defined dimensions identified by an area on the earth's surface wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations which are not part of those activities.

Stage 2 Aircraft – Aircraft that meet the noise levels prescribed by FAR Part 36 which is less stringent than those established for the quieter Stage 3 designation. The Airport Noise and Capacity Act required the phase-out of all Stage 2 aircraft over 75,000 pounds by December 31, 1999, with the potential for case-by-case exceptions through the year 2003.

Stage 3 Aircraft – Aircraft that meet the most stringent noise levels set in FAR Part 36.

Standard Instrument Departure Procedure (SID or DP) – A planned IFR air traffic control departure procedure published for pilot use in graphic and textual form. SIDs provides transition from the terminal to the en route air traffic control structure.

Standard Terminal Arrival Route (STAR) – A planned IFR air traffic control arrival procedure published for pilot use in graphic and textual form. STARs provide transition from the en route air traffic control structure to an outer fix or an instrument approach fix in the terminal area.

Statute Mile – A measure of distance equal to 5,280 feet.

Tactical Air Navigation (TACAN) -- A navigational system used by the military. TACAN provides both azimuth and distance information to a receiver on board an aircraft.

Terminal Radar Approach Control (TRACON) – An FAA Air Traffic Control Facility which uses radar and two-way communication to provide separation of air traffic within a specified geographic area in the vicinity of one or more airports.

Terminal Radar Service Area (TRSA) – Airspace surrounding certain airports where ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft.

Through Passenger – An airline passenger who arrives at an airport and departs without deplaning the aircraft.

Time Above (TA) – The amount of time that sound exceeds a given decibel level during a 24-hour period (e.g., time in minutes that the sound level is above 75 dBA).

Touchdown Zone Lighting (TDZ) – A system of two rows of transverse light bars located symmetrically about the runway centerline, usually at 100-foot intervals and extending 3,000 feet along the runway.

Traffic Pattern – The traffic flow for aircraft landing and departure at an airport. Typical components of the traffic pattern include upwind leg, crosswind leg, downwind leg, base leg, and final approach.

UNICOM – A nongovernment communication facility which may provide airport information at certain airports. Aeronautical charts and publications show the locations and frequencies of UNICOMs.

Upwind Leg – A flight path parallel to the approach runway in the direction of approach.

Vector – Compass heading instructions issued by ATC in providing navigational guidance by radar.

Very High Frequency Omnidirectional Range (VOR) Station – A ground-based radio navigation aid transmitting signals in all directions. A VOR provides azimuth guidance to pilots by reception of electronic signals.

Very High Frequency Omnidirectional Range Station with Tactical Air Navigation (VORTAC) - A navigational aid providing VOR azimuth and TACAN distance measuring equipment (DME) at one site.

Visual Approach – An approach conducted on an IFR flight plan that authorizes the pilot to proceed visually and clear of clouds to the airport.

Visual Approach Slope Indicator (VASI) – A visual aid to final approach to the runway threshold, consisting of two wing bars of lights on either side of the runway. Each bar produces a split beam of light – the upper segment is white, the lower is red.

Visual Flight Rules (VFR) – Rules and procedures specified in 14 CFR 91 for aircraft operations under visual conditions. Aircraft operations under VFR are not generally under positive control by ATC. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate a type of flight plan.

Visual Meteorological Conditions (VMC) – Weather conditions expressed in terms of visibility, distance from cloud, and cloud ceiling equal to or greater than those specified in 14 CFR 91.155 for aircraft operations under Visual Flight Rules (VFR).

Wide-Body Aircraft - A commercial jet with a wingspan generally greater than 155 feet and, in passenger configuration, having two aisles with 8 to 11 seats across in a row. Common wide-body aircraft include the A300, A310, B747, B767, B777, DC-10, and MD-11.

Yearly Day-Night Average Sound Level – see DNL.

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Appendix A

APPENDIX A
FAA POLICIES, GUIDANCE, AND REGULATIONS

A.1 NOISE CONTROL POLICIES AND GUIDANCE

The Federal Aviation Administration has promulgated a series of regulations based on directions from Congress as provided in a series of authorizing statutes. Four separate Federal Aviation Regulations have been developed to specifically address permissible aircraft noise levels, operating procedures and studies of aircraft noise levels. These regulations apply to activity within the United States. Additionally, the International Civil Aviation Organization (ICAO) has developed and accepted similar regulations, which control the noise levels generated by aircraft operating in international airspace.

A.1.1 FEDERAL AVIATION REGULATION (FAR) PART 36

Part 36 of the Federal Aviation Regulations sets forth noise levels that are permitted for aircraft of various weights, engine number and date of certification. Originally released in 1974 as a result of Congress' modification of the Federal Aviation Act of 1958 through the Noise Control Act of 1972, aircraft were divided into three classes, based on the amount of noise they produced at three specific noise measurement locations during certification testing. These classes (or stages) were:

Stage 1 – the oldest and loudest aircraft, typically of the first generation of jets, designed before 1974, and having measured noise levels that exceed the standards set for the other classes of aircraft. This group included many of the first generation of jet aircraft used in passenger and cargo service, including the B-707, early B727 and B737 aircraft, and early DC-8s. Under F.A.R. Part 91, all such aircraft weighing more than 75,000 pounds were removed from the U.S. operating fleet by 1985, unless modified to meet Stage 2 noise standards. In 2001, less than 100 Stage 1 aircraft remain active in the domestic fleet; all are business jet aircraft weighing less than 75,000 pounds.

Stage 2 – aircraft that were type certified before November 15, 1975 that met noise levels defined by the FAA at takeoff, sideline and approach measurement locations. The permissible amount of noise increased with the weight of the aircraft above 75,000 pounds and the number of engines. This category included many of the second-generation jet aircraft such as the B-727, B-737-200, and DC-9 that were extensively used in passenger and cargo service. Under F.A.R. Part 91, all such aircraft weighing more than 75,000 pounds were removed from the U.S. operating fleet by 2000, unless modified to meet Stage 3 noise standards. In 2001, many Stage 2 business jet aircraft weighing less than 75,000 pounds remain operational.

Stage 3 – aircraft that meet the most stringent noise level requirements at takeoff, sideline, and approach measurement locations for their weight and engine number. This category includes the great majority of active business jet aircraft and all aircraft in passenger and cargo service that weigh more than 75,000 pounds. Although discussions have taken place on establishing more restrictive noise levels, no action had been taken by early 2002 to establish a phase out schedule for Stage 3 aircraft.

Stage 4 – aircraft that meet a composite noise level several decibels less than the levels established for Stage 3 aircraft. Although a Stage 4 category is the subject of considerable discussion on the world stage and in a point of negotiation between the United States and the European Union, Stage 4 rules and noise levels have not been formalized. In 2001, the United States participated in negotiations through the Committee on Aviation Environmental Protection (CAEP), an ICAO subcommittee, that the composite reduction of noise should be 10 decibels below Stage 3 standards.

A.1.2 FAR PART 91

Part 91 of the Federal Aviation Regulations, as applied to noise, established schedules for phasing louder equipment out of the operating fleet of aircraft weighing more than 75,000 pounds. The schedules called for all Stage 1 aircraft over 75,000 pounds to be removed from the fleet by 1982, with the exception of two engine aircraft in small city service, which were allowed to continue in service until 1985. The schedule for the retirement of Stage 2 aircraft called for the removal of all such aircraft by the end of 1999, with interim retirement dates of 1994, 1996, and 1998 for the removal of portions of the Stage 2 fleet.

No retirement schedules have been imposed for aircraft weighing less than 75,000 pounds.

A.1.3 FAR PART 150

Part 150 of the Federal Aviation Regulations sets forth the standards under which a Part 150 Noise Compatibility Study is conducted. The background and requirements for such studies are presented earlier in this chapter. Notably, the preparation of a Noise Compatibility Plan under FAR Part 150 is a voluntary action by an airport proprietor. The process of preparing the plan is intended to open/enhance lines of communication between the airport, its neighbors and users. It is the only mechanism to provide for the mitigation of aircraft noise impacts on noise-sensitive surrounding areas that is not directly tied to airfield development or airspace utilization conducted subject to the rules for preparation of an Environmental Impact Statement or Environmental Assessment.

Through the end of 2000, a total of 274 airports had received federal AIP grant monies as a result of approved Part 150 Noise Compatibility Programs completed since 1982. These grants totaled more than $2.921 Billion. Additionally, another $1.6 Billion has been committed to noise mitigation actions funded by Passenger Facility Charges authorized for collection for as many as 49 years into the future at different airports[1].

A.1.4 FAR PART 161

Part 161 of the Federal Aviation Regulations was published in 1991, subsequent to passage of the Airport Capacity and Noise Act of 1990. That act established the requirement and schedule for the phase out of Stage 2 aircraft over 75,000 pounds. In return for that action, Congress severely restricted the ability of local communities to impose actions that would restrict the aircraft access to any airport. Different levels of requirements were established for voluntary restrictions, restrictions on Stage 2 aircraft and restrictions on Stage 3 aircraft. These requirements are applicable to all aircraft except propeller-driven aircraft weighing less than 12,500 pounds, supersonic aircraft, and Stage 1 aircraft.

A.1.4.1 Restrictive Agreements

Subpart B sets notification requirements for the implementation of Stage 3 restrictions through agreements between airport operators and all affected airport users. (Presumably, this same procedure would be followed for implementing agreements for Stage 2 restrictions.) Before going into effect, notice of these proposed agreements must be published in local newspapers of area wide circulation, posted prominently at the airport, and sent directly to all regular airport users, the FAA, Federal, state and local agencies with land use control authority, community groups and business organizations, and any aircraft operators that are known to be interested in providing service to the airport (new entrants). After this notification period, the agreement can be implemented if all current users and any new entrants proposing to serve the airport within 180 days sign on to the proposed restriction.

Stage 2 Restrictions

Subpart C sets forth the requirements for establishing restrictions on Stage 2 aircraft operations. It requires a study of the proposed restriction that must include:

1. an analysis of the costs and benefits of the proposed restriction;
2. a description of the alternative restrictions;
3. a description non-restrictive alternatives that were considered and a comparison of the costs and benefits of those alternatives to the costs and benefits of the proposed restriction.

[1] Through Fiscal Year 2000

It further requires that the study use the noise methodology and land use compatibility criteria established in FAR Part 150.[2] The study must also use currently accepted economic methodology. Where restrictions on Stage 2 aircraft weighing less that 75,000 pounds are involved, the study must include separate detail on how the restriction would apply to aircraft in this class.

After completing the study, the airport operator must publish a notice of the proposed restriction and an opportunity for public comment in a newspaper of general circulation in the area, post a notice prominently in the airport, and notify the FAA, local governments, all airport tenants whose operations might be affected by the proposed restrictions, and community groups and business organizations.[3] The FAA must publish an announcement of the proposed restriction in the *Federal Register*.[4]

The required study and public notice must be completed at least 180 days before the airport operator implements the proposed restriction.[5] There is no specific provision in ANCA or Part 161 for FAA action on the airport's proposed Stage 2 restriction. In practice, the FAA has reviewed Stage 2 Part 161 Studies for completeness. No specific deadlines for this review process are set in Part 161.

Stage 3 Restrictions

Subpart D establishes the requirements that an airport operator must follow in order to implement a noise or access restriction on Stage 3 aircraft. The required analysis must include the same elements required for a proposed restriction on Stage 2 aircraft. In addition, the required Part 161 Study must demonstrate "by substantial evidence that the statutory conditions are met." These six conditions, specified in ANCA are:

- Condition 1: The restriction is reasonable, non-arbitrary, and non-discriminatory.
- Condition 2: The restriction does not create an undue burden on interstate or foreign commerce.
- Condition 3: The proposed restriction maintains safe and efficient use of the navigable airspace.
- Condition 4: The proposed restriction does not conflict with any existing Federal statute or regulation.
- Condition 5: The applicant has provided adequate opportunity for public comment on the proposed restriction.

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2 14 CFR part 161, Secs. 161.9, 161.11, and 161.205(b).
3 14 CFR part 161, Sec. 161.203(b).
4 14 CFR part 161, Sec. 161.203(e).
5 14 CFR part 161, Sec. 161.203(a).

- Condition 6: The proposed restriction does not create an undue burden on the national aviation system.[6]

The applicant must also prepare an environmental assessment or documentation supporting a categorical exclusion.[7]

After submission by an airport operator of a complete Part 161 application package, the FAA has 30 days to review it for completeness. Notice of the proposed restriction must be published by the FAA in the *Federal Register*. After reviewing the application and public comments, the FAA must issue a decision approving or disapproving the proposed restriction within 180 days after receipt of a the complete application. This decision is a final decision of the FAA Administrator for purposes of judicial review.[8]

A.1.4.2 Consequences of Failing to Comply with Part 161

Subpart F describes the consequences of an airport operator's failure to comply with Part 161. The sanction provided for in Subpart F is the termination of the airport's eligibility to receive airport grant funds and to collect passenger facility charges.[9] Most of Subpart F describes the process for notifying airport operators of apparent violations, dispute resolution, and implementation of the required sanctions.

A.1.5 ICAO RULES

The Convention on International Civil Aviation (also known as *Chicago Convention*), was signed on 7 December 1944 by 52 States. Pending ratification of the Convention by 26 States, the Provisional International Civil Aviation Organization (PICAO) was established. It functioned from June 6, 1945 until April 4, 1947. By March 5, 1947 the 26th ratification was received. ICAO came into being on April 4, 1947. In October of the same year, ICAO became a specialized agency of the United Nations. ICAO is now 185 nations strong.

During 2000 and 2001, ICAO's Committee on Aviation Environmental Protection (CAEP) has evaluated the introduction of a new noise standard. In September 2001, the ICAO Council met and agreed to the following:

1. Established a new Stage 4 standard that is 10 decibels quieter than Stage 3 for aircraft newly-certified after 2006.
2. If a member state decides to permit noise restrictions on any Stage 3 aircraft, the ICAO Assembly recommends that such restriction:

[6] 14 CFR part 161, Sec. 161.305(e).
[7] 14 CRF part 161, Sec. 161.305(c).
[8] 14 CFR part 161, Sec. 161.313(b)(2).
[9] 14 CFR part 161, Sec. 161.501.

- Be based on the noise performance of the aircraft (the EU has imposed a restriction based on engine by-pass ratio);
- Be tailored to the noise problem of the airport concerned in accordance with the **balanced approach**;
- Be partial in nature, whenever possible, rather than the complete withdrawal of operations at an airport;
- Take into account possible consequences for air transport services for which there are no suitable alternatives, such as long-haul service;
- Consider the special circumstances of operators from developing countries in order to avoid undue economic hardship on them and by granting them exemptions;
- Introduce such restrictions gradually over time, where possible, in order to take into account the economic impact on affected operators;
- Give operators a reasonable period of advance notice;
- Take into account the economic and environmental impact on civil aviation in terms of recent events; and
- Inform ICAO and other states of all such restrictions imposed.

The balanced approach to noise management endorsed by the ICAO Assembly consists of "identifying the noise problem at an airport and then analyzing the various measures available to reduce noise through the exploration of four principal elements with the goal of addressing the noise problem in the most cost-effective manner". The four principal elements of the balanced approach are:

- Reduction of noise at the source
- Land-use planning and management
- Noise abatement operational procedures
- Operating restrictions

A.2 NOISE RESEARCH AND DEVELOPMENT ACTIVITY

The National Aeronautics and Space Administration (NASA) have been charged with providing pre-competitive research endeavors in long-term, high-risk, high-payoff technologies and to "provide revolutionary advancements that protect U.S. leadership for future generations. The impact of NASA's research on our national transportation system, our national security, the environment, and our economy demonstrates a clear government role in support of the public good."[10]

To that end, NASA has conducted the Advanced Subsonic Transport (AST) program, which has now transformed into the Quiet Aircraft Technology (QAT) program. To help conduct research, NASA has created the Technical Working Group made up of NASA and FAA experts, industry leaders, and academia.

The goal of the QAT Program is to develop technology that, when implemented, reduces the impact of aircraft noise to benefit airport neighbors, the aviation industry, and travelers. NASA's goals for the QAT program include a balanced approach to noise reduction through determining "Community Noise Impact", "Airframe System Noise Reduction", and "Engine System Noise Reduction".

Noise Reduction Goal : Reduce the perceived noise levels of future aircraft by a factor of 2 (10 dB) from today's subsonic aircraft within 10 years, and by a factor of four (20 dB) within 25 years relative to 1997 "best in fleet" (757, 777 aircraft).

A.3 LAND USE POLICIES AND GOVERNANCE

This section discusses the role of land use controls, which is responsible for implementing those controls, and the FAA Mitigation Policy.

A.3.1 THE ROLE OF LAND USE CONTROLS IN PART 150 PLANS

The Federal Aviation Regulation (FAR) Part 150 Program was established under the Aviation Safety and Noise Abatement Act of 1979 and allows airport operators to voluntarily submit noise exposure maps and noise compatibility programs to the FAA for review and approval. A noise compatibility program sets forth the measures that an airport operator "has taken" or "has proposed" for the reduction of existing incompatible land uses and the prevention of additional incompatible land uses within the area covered by noise exposure maps. Typically recommended noise abatement measures fall into three categories:

[10] Excerpt from NASA's Aeronautics & Space Transportation Technology : Three Pillars for Success, "Message from the Administrator", Daniel S. Goldin, March 1997

1. **Operational** measures – these measures are applied at the airfield or to aircraft operations and include changes in runway use or changes in flight-track location.
2. **Preventive** measures – land use control measures to prevent the new noise-sensitive land uses from occurring in the existing and future airport noise contours; such measures include compatible land use zoning or noise overlay zoning within off-airport noise exposure areas.
3. **Corrective (Remedial)** measures – mitigation measures applied to existing incompatible land uses; such measures include acquisition or sound insulation of noise-sensitive property. (Noise-sensitive property is defined as houses, schools, churches, nursing homes, hospitals, and libraries.)

The FAA adopted land use compatibility guidelines relating types of land use to airport sound levels when it promulgated FAR Part 150 in 1985. These guidelines, reproduced as **Table A-1**, *Land Use Compatibility Guidelines – FAR Part 150*, show the compatibility parameters for residential, public (schools, churches, nursing homes, hospitals, libraries), commercial, manufacturing and production, and recreational land uses.

The Part 150 guidelines are the basis for defining areas potentially eligible for Federal funding through the Airport Improvement Program. The *Airport Improvement Handbook* states, "Noise compatibility projects usually must be located in areas where noise measured in day-night average sound level (DNL) is 65 (dB) or greater."[11] Federal funding is available at noise levels below 65 DNL if the airport operator (Sponsor) determines that incompatible land uses exist below 65 DNL and the FAA concurs with the Sponsor's determination.

As shown in Table A-1, all land uses within areas below 65 DNL are considered to be compatible with airport operations. Residential land uses are generally incompatible with noise levels above 65 DNL. In some areas, residential land use may be permitted in the 65-70 DNL with appropriate sound insulation measures implemented. This is done at the discretion of local communities. Schools and other public use facilities located between 65 and 75 DNL are generally incompatible without sound insulation. Above 75 DNL, schools, hospitals, nursing homes, and churches are considered incompatible land uses. The information presented in Table 1 is meant to act as a guideline. According to FAR Part 150, "Adjustments or modifications of the descriptions of the land-use categories may be desirable after consideration of specific local conditions."[12]

[11] FAA Order 5100.38A, Chapter 7, paragraph 710.b.
[12] FAR Part 150, Part B *Noise Exposure Map Development*, Section A150.101 *Noise contours and land usages*, paragraph (c).

Table A-1
LAND USE COMPATIBILITY GUIDELINES - FAR PART 150

	YEARLY DAY-NIGHT AVERAGE SOUND Level (DNL) In Decibels					
LAND USE	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools, hospitals, 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]	N[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	25	30	N	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	Y[5]	N[5]	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Table A-1, Continued
LAND USE COMPATIBILITY GUIDELINES - FAR PART 150

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable 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.

Key To Table A-1

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

Notes for Table A-1

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 stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
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 a NLR of 25 dB.
7. Residential buildings require a NLR of 30 dB.
8. Residential buildings not permitted.

Source: *FAR Part 150 Airport Noise Compatibility Planning*, Appendix A, Table 1.

Therefore, specific land use controls are implemented at the discretion of local governments. An airport Sponsor typically does not have the authority to implement local land use controls.

Land use management measures used for Part 150 purposes include both preventive and corrective techniques. Preventive land use management techniques seek to prevent the introduction of additional noise-sensitive land uses within existing and future airport noise contours. Preventive measures include two categories – regulatory and policy:

Regulatory:

- Compatible Use Zoning: commercial, industrial, or farmland zoning
- Zoning Changes, Residential Density: large-lot zoning, planned development, multi-family zoning
- Noise Overlay Zoning: special regulations within high-noise areas
- Transfer of Development Rights: zoning framework to authorize private sale of development rights to encourage sparse development in high-noise areas
- Environmental Zoning: environmental protection zoning to support airport land use compatibility
- Subdivision Regulation Changes: require dedication of noise and avigation easements, plat notes
- Building Code Changes: require soundproofing in new construction
- Dedicated Noise and Avigation Easements: require for development permits
- Fair Disclosure Regulations: require seller to notify buyer of aircraft noise

Policy:

- Comprehensive Planning: policies supporting land use compatibility. Can involve specific land use plans and policies to guide rezoning, variances, conditional uses, public projects
- Capital Improvement Programming: public investments which support airport land use compatibility

Corrective land use management techniques seek to remedy existing and projected future unavoidable noise impacts in existing areas of incompatible land use. Corrective land use management techniques can also be classified in one of two general categories: modify use and maintain use. Corrective measures include:

Modify Existing Use:

- Guaranteed Purchase (Fee Simple): outright purchase of property with the intent of removing incompatible use by demolition of structure
- Development Rights Purchase: purchase of rights to develop property
- Land Banking: acquisition of vacant land for long-term airport facility needs
- Redevelopment: acquisition and redevelopment of property

Maintain Existing Use:

- Purchase Assurance: airport Sponsor acts as buyer of last resort, sound insulates house, sells property, retains easement
- Sales Assistance: airport Sponsor sound insulates house, guarantees that the property owner will receive the appraised value, or some increment thereof, regardless of final sales value that is negotiated with a buyer, retains easement
- Sound Attenuation: sound insulation of homes, noise-sensitive public facilities, retains easement
- Noise and Avigation Easement Purchase: purchase of easement only

A.3.2 FAA FINAL POLICY ON PART 150 NOISE MITIGATION MEASURES

The FAA issued a final policy to establish a distinction between remedial and preventive noise mitigation measures proposed by airport operators and submitted for approval by the Federal Aviation Administration under noise compatibility planning regulations. In the notice of final policy[13] effective October 1, 1998, the FAA stated the following:

- As of October 1, 1998, the FAA will approve under 14 CFR Part 150 only remedial noise mitigation measures for existing incompatible development and only preventive noise mitigation measures in areas of potential new incompatible development.
- The FAA will not approve remedial noise mitigation measures for new incompatible development that occurs in the vicinity of airports.

[13] FAA Notice of Final Policy, October 1, 1998.

- The use of AIP funds will be affected to the extent that such use depends on approval under Part 150.

The Airport Noise Compatibility Planning Program (14 CFR Part 150) was established under the Aviation Safety and Noise Abatement Act of 1979 (49 U.S.C. 47501 through 47509, hereinafter referred to as ASNA). The Part 150 program allows airport operators to submit noise exposure maps and noise compatibility programs to the FAA voluntarily. According to the ASNA, a noise compatibility program sets forth the measures that an airport operator has taken or has proposed for the reduction of existing incompatible land uses and the prevention of additional incompatible land uses within the area covered by noise exposure maps.

The ASNA embodies strong concepts of local initiative and flexibility. The submission of noise exposure maps and noise compatibility programs is left to the discretion of local airport operators. Airport operators also may choose to submit noise exposure maps without preparing and submitting a noise compatibility program. The types of measures that airport operators may include in a noise compatibility program are not limited by the ASNA, allowing airport operators substantial latitude to submit a broad array of measures--including innovative measures--that respond to local needs and circumstances.

The criteria for approval or disapproval of measures submitted in a Part 150 program are set forth in the ASNA. The ASNA directs the Federal approval of a noise compatibility program, except for measures relating to flight procedures: (1) if the program measures do not create an undue burden on interstate or foreign commerce; (2) if the program measures are reasonably consistent with the goal of reducing existing incompatible land uses and preventing the introduction of additional incompatible land uses; and (3) if the program provides for its revision if necessitated by the submission of a revised noise exposure map. Failure to approve or disapprove a noise compatibility program within 180 days, except for measures relating to flight procedures, is deemed to be an approval under the ASNA. Finally, the ASNA sets forth criteria under which grants may be made to carry out noise compatibility projects, consistent with ASNA's overall deference to local initiative and flexibility.

The FAA is authorized, but not obligated, to fund projects via the Airport Improvement Program (AIP) to carry out measures in a noise compatibility program that are not disapproved by the FAA. Such projects also may be funded with local PFC revenue upon the FAA's approval of an application filed by a public agency that owns or operates a commercial service airport, although the use of PFC revenue for such projects does not require an approved noise compatibility program under Part 150.

In establishing the airport noise compatibility planning program, which became embodied in FAR Part 150, the ASNA did not change the legal authority of state and local governments to control the uses of land within their jurisdictions. Public controls on the use of land are commonly exercised by zoning. Zoning is a power reserved to

the states under the U. S. Constitution. It is an exercise of the police powers of the states that designates the uses permitted on each parcel of land. This power is usually delegated in state enabling legislation to local levels of government.

Many local land use control authorities (cities, counties, etc.) have not adopted zoning ordinances or other controls to prevent incompatible development (primarily residential) within the noise impact areas of airports. An airport noise impact area, identified within noise contours on a noise exposure map, may extend over a number of different local jurisdictions that individually control land uses.

While airport operators have included measures in noise compatibility programs submitted under Part 150 to prevent the development of new incompatible land uses through zoning and other controls under the authorities of appropriate local jurisdictions, success in implementing these measures has been mixed.

One or more of the factors hindering effective land use controls may be of sufficient importance to preclude some jurisdictions from following through on the land use recommendations of an airport's Part 150 noise compatibility program. When either an airport sponsor's or a non-airport sponsor's jurisdiction allows additional incompatible development within the airport noise impact area, it can result in noise problems for the people who move into the area. This can, in turn, result in noise problems for the airport operator in the form of inverse condemnation or noise nuisance lawsuits, public opposition to proposals by the airport operator to expand the airport's capacity, and local political pressure for airport operational and capacity limitations to reduce noise. Some airport operators have taken the position that they will not provide any financial assistance to mitigate aviation noise for new incompatible development. Other airport operators have determined that it is a practical necessity for them to include at least some new residential areas within their noise assistance programs to mitigate noise impacts that they were unable to prevent in the first place. Over a relatively short period of time, the distinctions blur between what is "new" and what is "existing" residential development with respect to airport noise issues.

Airport operators currently may include new incompatible land uses, as well as existing incompatible land uses, within their Part 150 noise compatibility programs and recommend that remedial noise mitigation measures--usually either property acquisition or noise insulation--be applied to both situations. These measures have been considered to qualify for approval by the FAA under 49 USC 47504 and 14 CFR Part 150. The Part 150 approval enables noise mitigation measures to be considered for Federal funding under the AIP, although it does not guarantee that Federal funds will be provided.

Final Policy

Therefore, as of October 1, 1998, the FAA will approve remedial noise mitigation measures under Part 150 only for incompatible development, which exists as of that date. Incompatible development that potentially may occur on or after October 1, 1998, may only be addressed in Part 150 programs with preventive noise mitigation measures. This policy will affect the use of AIP funds to the extent that such funding is dependent on approval under Part 150. Approval of remedial noise mitigation measures for bypassed lots or additions to existing structures within noise impacted neighborhoods, additions to existing noise impacted schools or other community facilities required by demographic changes within their service areas, and formerly noise compatible uses that have been rendered incompatible as a result of airport expansion or changes in airport operations, and other reasonable exceptions to this policy on similar grounds must be justified by airport operators in submittals to the FAA and will be considered by the FAA on a case-by-case basis. This policy does not affect AIP funding for noise mitigation projects that do not require Part 150 approval, that can be funded with PFC revenue, or that are included in FAA-approved environmental documents for airport development.

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Appendix B

APPENDIX B
FIELD NOISE MEASUREMENTS AND NOISE COMPLAINTS

This appendix provides the results of temporary monitoring conducted to provide information to the development of noise contour modeling, an overview of Philadelphia International Airport's permanent noise monitoring system, and the complaints about aircraft noise documented by the airport's management staff.

B.1 NOISE MEASUREMENTS

A noise measurement program was conducted during the week of October 11, 1999. This field measurement program was intended to provide numerous measurements of individual aircraft overflight events. The measurements were compared with pre-existing data base information related to aircraft noise level and performance characteristics. The information collected during the measurement program included acoustical output, as measured at known locations, as well as flight trajectory data (the aircraft's three-dimensional location) relative to the noise measurement site.

Measurements made for short periods are unique to that one period, and may not represent the average of the events that would occur at that location over a longer period of time. The relationship between field measurements and computer-modeled average noise levels is comparable to that between a book and its cover. While the cover (single-event measurements) may indicate something of the character of a book, and receive inordinate attention based on its color or graphics, the total story (average noise level) is in all the words that constitute the story. It is on the total story that the critic makes his assessment. In other words, the modeling process simulates overall average annual conditions (the book) while field measurements (the cover) reflect only a small part of the whole story.

Aircraft noise measurements were collected for daytime and nighttime periods. Measurements concentrated on the collection of a variety of single overflight noise information, with emphasis on the noise generated by air carrier aircraft during arrival and departure east and west of the airport. Measurements occurred during all times that the airport was operating, including overnight during the cargo operation.

B.2 NOISE MEASUREMENT SITES

Noise monitoring sites were chosen at 41 locations based on their proximity to the airport, the flow of aircraft operations during the measurement program, and areas of historic noise concerns. **Exhibit B-1** illustrates the locations of the noise measurement sites. General sites were selected on the basis of ambient noise level (or more

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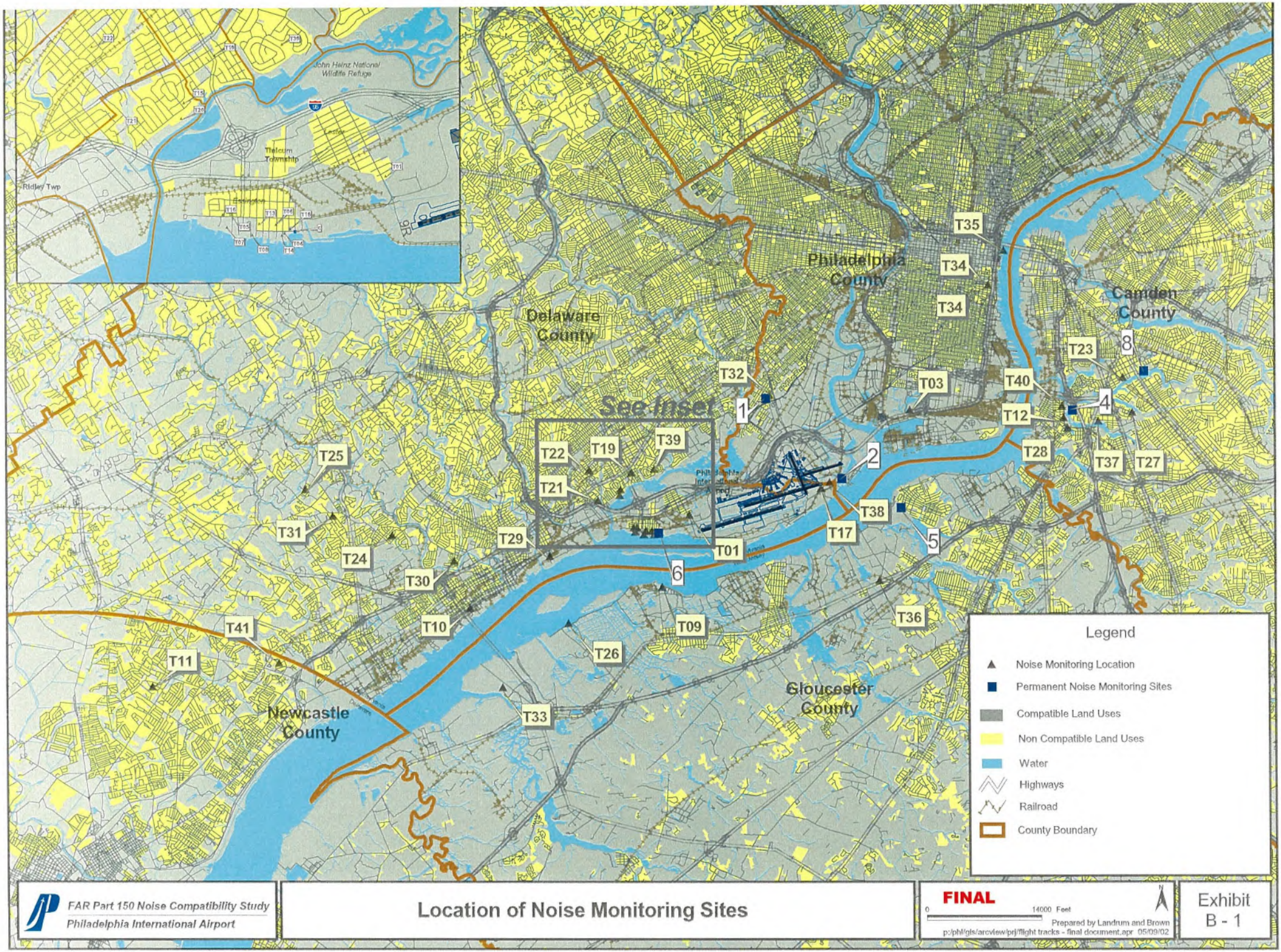
John Heinz National Wildlife Refuge
Tinicum Township
Ridley Twp
Philadelphia County
Delaware County
Camden County
Gloucester County
Newcastle County
See Inset
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Legend
Noise Monitoring Location
Permanent Noise Monitoring Sites
Compatible Land Uses
Non Compatible Land Uses
Water
Highways
Railroad
County Boundary
FAR Part 150 Noise Compatibility Study
Philadelphia International Airport
Location of Noise Monitoring Sites
FINAL
0
14000 Feet
Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/flight tracks - final document.apr 05/09/02
Exhibit
B - 1

specifically, the absence of loud ambient noise), locations of flight tracks derived from preliminary early analysis of Automated Radar Terminal System (ARTS) information, locations of noise complaints received by the Airport, and the locations of concentrations of residential use in overflown areas. Specific locations were suggested by airport staff and members of the public, as well as through application of consultant experience. Specific selection criteria included the following:

- Emphasis on areas of numerous aircraft noise events according to earlier evaluations.
- Representative sampling of all major types of operations and aircraft using the Philadelphia International Airport.
- Screening of each site for local noise sources or unusual terrain characteristics, which could affect measurements.
- Location in or near areas from which complaints about aircraft noise were received, or where there are concentrations of people exposed to numerous aircraft overflights.
- Location adjacent to, or in the proximity of, concentrated ground movements by aircraft producing high ramp, run-up and idle thrust noise levels.

While there is no end to the number of locations available for monitoring, the selected sites fulfill the above criteria and provide a representative sampling of the varying aircraft noise conditions in the vicinity of the airport. Information collected during the noise measurement program included single-event peak dBA levels (Lmax), Sound Exposure Levels (SEL), event duration, time of occurrence and aircraft type.[1]

B.3 ACOUSTICAL MEASUREMENTS

This section provides a technical description of the acoustical measurements that were performed for the Philadelphia International Airport Part 150 Study. Described here are the instrumentation that was employed, calibration procedures followed, and related data collection items and procedures.

B.3.1 INSTRUMENTATION

Four sets of acoustical instrumentation and analysis equipment were used in order to obtain acoustical data to compare with standard data associated with aircraft noise. The major instrumentation that was used is listed in **Table B-1**.

[1] Lmax refers to the maximum A-weighted noise level recorded for a single noise event. SEL is a logarithmic expression of the all the sound energy for a single noise event compressed into one second. Durations are expressed in seconds and the identification of aircraft types was done visually from the ground as the aircraft passed over head.

Table B-1
ACOUSTICAL MEASUREMENT INSTRUMENTATION
Philadelphia International Airport

Number	Instrument Type
4	Metrosonics dB-3080 Metrologger Sound Analyzer
4	Metrosonics 1/2" pendant Microphones w/ Windscreens
4	Metrosonics cl-304 Acoustical Calibrator

Source: Landrum & Brown, 2002.

B.3.2 MEASUREMENT PROCEDURES

Aircraft noise levels were recorded using the equipment indicated in the above table for each of the 41 sites. ARTS data was obtained from the airport's flight and noise monitoring system to compare to measured events. The noise-monitoring program was designed to provide a sampling of single events throughout the study area. It was not designed to record cumulative noise levels. The monitors were attended while active to ensure that only aircraft noise events were recorded. The monitoring procedure called for the operator to enable the noise monitor when a noise event first became audible and continue monitoring that event until the noise level receded back to ambient levels, usually lasting a duration of 20-50 seconds. After the event, the operator recorded the average noise level (Lavg), the sound exposure level (SEL), the event duration, and the maximum sound level (Lmax). Other information, such as aircraft type and operational characteristics, was also annotated, as available.

Noise measurement programs must be conducted for relatively long sampling periods (at least one week per location several times a year), and at a large number of dispersed locations before they can be used to define the location of noise contours. Even then, a computer-generated set of noise contours is necessary and long-term measurement data is used to adjust these contours. As applied at Philadelphia International Airport, the noise contours were not created by or adjusted to reflect long-term measured data.

The Philadelphia International Airport program provided for the collection of a large number of single-event measurements at a variety of locations throughout the community at distances ranging from several hundred feet to several miles between the aircraft and the monitoring site. This information allowed, when correlated with the ARTS records and operating schedules, the determination of applicable noise curves and performance characteristics within the Integrated Noise Model (INM) database for the most significant aircraft and operators. The measured data generally reflected the noise levels within the INM database for those aircraft operated by the jet operators at

the airport. Insufficient numbers of operations by any individual aircraft type were available to allow conclusions to be reached in support of modification of any noise curves or standard operational data.

B.3.3 WEATHER INFORMATION

The noise measurements taken during this study were obtained during a period of the year that has historically represented an average of the annual weather conditions. The measurements were recorded during both clear and overcast sky conditions. The general weather pattern varied throughout the measurement period, with occasional wind shifts that provided samples of departure and approach operations to both ends of the primary runways.

B.3.4 MEASUREMENT RESULTS SUMMARY

The noise measurement program revealed a wide range of noise exposure levels from aircraft activity in the airport environs. The measured noise levels from departing aircraft tended to produce SEL and peak decibel levels several decibels higher than those of arriving aircraft. This difference is caused by two characteristics of the separate operations. First, exposure to noise above the background levels from arriving aircraft is typically shorter than from departing aircraft, resulting in less cumulative energy to be factored into the SEL exposure level. Second, the power settings used during approach are less than those necessary to climb during the takeoff, resulting in several decibels less noise than measured at similar locations during departure.

An evaluation of the SEL and peak decibel (Lmax) levels measured at the various locations indicates that the SEL always runs several decibels louder than the Lmax. When the Lmax is low, the SEL may be as much as 10 to 15 decibels higher than the peak level, but when the Lmax is high, the SEL is typically only 6 to 12 decibels louder. Again, this characteristic is the result of longer exposure to noise levels above background levels during takeoff events. **Table B-2** provides a synopsis of the measurements. For reference during the following discussion, Exhibit B-1 shows the noise monitoring sites.

Immediately to the west of the airport, a number of measurements were taken in the Tinicum Township area (Sites T-01; T-02; T-04; T-05; T-06; T-07; T-08; T-13; T-14; T-16; T-18). Measurements recorded closer to the airport resulted in Lmax noise levels ranging from the upper 60s to 90 decibels. Farther west in Tinicum, lower Lmax noise levels were recorded, ranging from 55 to 84 decibels. To the north of Tinicum, in Ridley, Norwood, Prospect Park, and Willow Park, the Lmax noise levels ranged from 51 to 73 decibels. In almost all cases, the loudest aircraft observed at these sites was a Boeing 727.

Table B-2
TEMPORARY NOISE MONITORING RESULTS
Philadelphia International Airport

Site Code	Description	Date	Times	SEL Range (in decibels)	Lmax Range (in decibels)	Peak Aircraft
T01	4th & Iriquois - Tinicum, PA (departures)	10/11/99	11:15 - 13:25	65.8 - 99.5	63.6 - 89.1	MD82
T02	4th & Iriquois - Tinicum, PA (departures)	10/11/99	12:55 - 13:10	81.1 - 94.6	71.1 - 86.3	MD88
T03	Franklin Roosevelt Park – Tinicum, PA (departures)	10/11/99	13:55 - 14:35	75.5 - 86.9	62.8 - 74.2	B747
T04	Front Street and Jansen – Tinicum, PA (departures)	10/11/99	14:40 - 15:15	80.0 - 98.2	71.4 - 90.1	B747
T05	201 Taylor Avenue – Tinicum, PA (departures)	10/11/99	14:45 - 15:25	76.9 - 84.6	67.8 - 76.3	B727
T06	334 Bartram Avenue – Tinicum, PA (departures)	10/11/99	15:25 - 16:15	72.1 - 89.6	60.4 - 80.6	MD88
T07	Governor Printz State Park Tinicum, PA (departures)	10/11/99	15:35 - 16:15	66.9 - 90.5	55.0 - 83.9	MD88
T08	River Watch Condominiums, Carre Avenue - Tinicum, PA (departures)	10/11/99	16:25 - 16:40	70.6 - 89.6	63.0 - 82.3	B737
T09	Green Acres Park – Crap Point, NJ (departures)	10/12/99	09:50 - 10:20	74.2 - 93.1	62.6 - 84.4	MD80
T10	Eddystone Ave. at 2nd St. – Chester, PA (departures)	10/12/99	10:00 - 10:20	77.9 - 88.2	65.4 - 78.5	DC9
T11	2518 Blackwood – Wilmington, DE (arrivals)	10/12/99	11:10 - 11:30	69.1 - 76.7	60.5 - 69.9	-
T12	Gloucester Park (arrivals)	10/12/99	13:15 - 13:55	75.3 - 84.3	57.2 - 72.7	B757
T13	132 Carre Ave.– Tinicum, PA (arrivals)	10/12/99	13:00 - 14:20	72.5 - 80.1	63.1 - 72.2	B737
T14	4 Jansen Street – Tinicum, PA (arrivals)	10/12/99	14:25 - 14:45	77.8 - 85.6	68.5 - 77.4	B737
T15	Rodney Road, North of Darby Road – Ridley, PA (departures)	10/12/99	14:40 - 15:05	75.4 - 83.1	62.6 - 73.0	B727
T16	2nd & Corrinthian and Essington – Tinicum, PA (arrivals)	10/12/99	14:50 - 15:00	74.6 - 83.8	62.0 - 71.6	B737
T17	Fort Mifflin Entrance (arrivals)	10/12/99	23:10 - 23:45	82.9 - 103.6	71.2 - 99.7	DC8
T18	Front Street and Erickson – Tinicum, PA (departures)	10/13/99	03:00 - 3:25	82.9 - 93.2	72.4 - 82.9	B727
T19	Lincoln & 4th – Norwood, PA (departures)	10/13/99	03:30 - 03:40	70.1 - 70.6	55.8 - 59.0	-
T20	Rooney Road – Ridley, PA (departures)	10/13/99	03:45 - 03:55	74.3	74.3	-
T21	123 LaDomus – Willow Park, PA (departures)	10/13/99	06:23 - 07:00	61.7 - 83.2	62.0 - 72.7	B727
T22	Madison Av, Edgewater Condos – Prospect Park, PA (departures)	10/13/99	07:15 - 007:49	79.8 - 85.8	66.0 - 72.7	B727

Table B-2, Continued
TEMPORARY NOISE MONITORING RESULTS
Philadelphia International Airport

Site Code	Description	Date	Times	SEL Range (in decibels)	Lmax Range (in decibels)	Peak Aircraft
T23	1011 Eldridge, Collingswood, NJ (arrivals)	10/13/99	12:15 - 12:50	69.5 - 85.7	62.1 - 79.8	B737
T24	Harrison & Scarlet - Aston, PA (arrivals)	10/13/99	12:20 - 12:40	70.2	64.2	-
T25	Elm & Mount (Beechwood Park) – Aston, PA (departures)	10/13/99	13:03 - 14:00	71.0 - 82.3	59.0 - 75.1	-
T26	115 Flood Gate Road (Speedway) – Bridgeport, NJ (departures)	10/13/99	14:00 - 14:28	63.3 - 83.2	53.0 - 76.2	B737
T27	Rd "A" near Corner of Rd "B" Audobon Park, PA (arrivals)	10/13/99	14:15 - 14:44	73.9 - 82.7	64.5 - 72.2	B767
T28	Klenn & Johnson – Gloucester, NJ (arrivals)	10/13/99	00:20 - 00:46	77.9 - 84.3	64.7 - 72.7	DC8
T29	2nd & Eddystone - Eddystone, PA (departures)	10/14/99	09:30 - 10:11	70.9 - 84.7	60.3 - 71.9	B727
T30	310 3rd St – Aston, PA (departures)	10/14/99	09:40 - 10:27	68.5 - 91.5	59.5 - 81.2	MD80
T31	112 Gerald – Aston, PA (departures)	10/14/99	09:40 - 10:45	71.1 - 91.8	60.2 - 88.2	B737
T32	Jason St. – Eastwick, PA (departures)	10/14/99	12:03 - 14:25	65.0 - 86.6	52.3 - 79.7	Single Prop
T33	116 Buttonwood Lane - Bridgeport, NJ (departures)	10/13/99	12:10 - 13:00	70.8 - 86.3	59.2 - 75.7	MD88
T34	2nd St & Monroe, Center City - Philadelphia, PA (no observations)	10/14/99	12:50 - 1:15	-	-	-
T35	Pier 3, Columbus Blvd – Philadelphia, PA (no observations)	10/14/99	12:15 - 12:45	-	-	-
T36	71 Jobstown Rd (St Paul's Church) – Paulsboro, NJ (arrivals)	10/14/99	12:30 - 12:37	75.7	66.1	-
T37	16 Wilson St. – Haddon, PA (arrivals)	10/14/99	14:27 - 14:59	74.9 - 83.3	64.6 - 74.6	MD88
T38	Fort Mifflin (arrivals)	10/14/99	16:48 - 17:04	92.6 - 98.5	86.1 - 90.7	B757
T39	33 Martin Ave - Norwood, PA (departures)	10/15/99	10:05 - 10:45	63.9 - 75.5	51.5 - 65.9	-
T40	938 Mercer St - Gloucester, PA (departures)	10/15/99	10:30 - 10:50	76.4 - 85.8	64.6 - 75.7	MD80
T41	Society Dr. - Claymont, DE (arrivals)	10/15/99	10:36 - 10: 47	76.0 - 77.4	63.9 - 66.2	B727

T= Temporary Site SEL = Sound Exposure Level Lmax = Maximum Noise Level
dBA= A-Weighted Decibels

Note: The blank cells in this table indicate that no data was recorded or that the aircraft could not be identified from the site.

Source: Landrum & Brown, 1999.

Additional sites to the west of the airport were measured, including the areas of Aston, Northern New Jersey, and Northern Delaware. Because of the proximity of these locations to the airport, aircraft were generally higher and quieter than those observed closer to the airport. Lmax noise levels ranged from the low 50s to in some cases the mid 80 decibels. The loudest recorded levels were created by direct overflights, while the lower levels resulted from aircraft "fly-bys".

To the east of the airport, measurement sites were selected in Philadelphia, Camden County, New Jersey, and Gloucester County, New Jersey. In most cases, these sites recorded arrival operations, which tend to be quieter than departure operations. The Lmax noise levels at these sites ranged from 62 to 78 decibels. In addition to these sites, two separate measurements were taken at Fort Mifflin. As expected, because of its proximity to the airport, the noise levels were higher than at any of the other measurement sites. These Lmax levels ranged from 70 to 99 decibels.

B.4 PERMANENT NOISE MONITORING SYSTEM

In 1996 the airport procured the Total Airport Management Information System (TAMIS). TAMIS is a sophisticated flight tracking system/noise-monitoring system that was acquired as part of the Runway 8-26 project in an effort to show a commitment to the local communities and be more proactive with airport noise concerns.

TAMIS is a powerful tool that incorporates several data elements including FAA radar data, noise measurements, and community noise complaints. The FAA radar data allows the airport to track the flight paths of aircraft operating out of Philadelphia International or Northeast Philadelphia Airports. The benefit of the data is the ability of the Division of Aviation to respond to public concerns on specific aircraft events, as well as being able to monitor runway utilization, fleet mix, and the use of noise abatement procedures. This data was key to the creation of the noise contours for this Part 150 Study.

TAMIS also consists of seven permanent and four portable noise monitors. The permanent monitors record noise measurements 24 hours a day 365 days a year. This allows the airport to monitor the trend of aircraft noise at various times of the year as well as provide vital information to calibrate or check the output from the INM. The portable monitors provide a public service to the residents in the surrounding communities. As an example, the airport would place a monitor at a person's home for a short period of time to provide the homeowner with a snapshot of the single event noise levels occurring at their home.

Finally the airport maintains a 24-hour noise hotline that allows citizens to voice concerns to the airport. This information is entered into TAMIS to provide a permanent record of the complaint. The complaint can then be correlated with actual FAA radar flight track data to determine the most likely aircraft operation that may have caused their concern.

B.5 NOISE COMPLAINT HISTORY

Noise complaint records dating back to 1998 were gathered in a database format for analysis in this study. The airport received 274, 602, 285, and 274 noise complaints in 1998, 1999, 2000, and 2001 respectively. **Exhibit B-2** illustrates the geographic locations of the noise complaints within the map boundary. As the exhibit illustrates, a large cluster of complaints occurs in the Northern Delaware area, with smaller clusters in Tinicum Township and the City of Philadelphia. The remainder of the noise complaints are scattered across the southern portion of Delaware County, and across Philadelphia County, with a small concentration in Camden County, east of the airport. The small pockets of residential land in Gloucester County, New Jersey also recorded noise complaints.

The noise complaint database was used in conjunction with the subsequent noise analysis to assist in the identification of noise concerns and in the development of mitigation and noise abatement measures.

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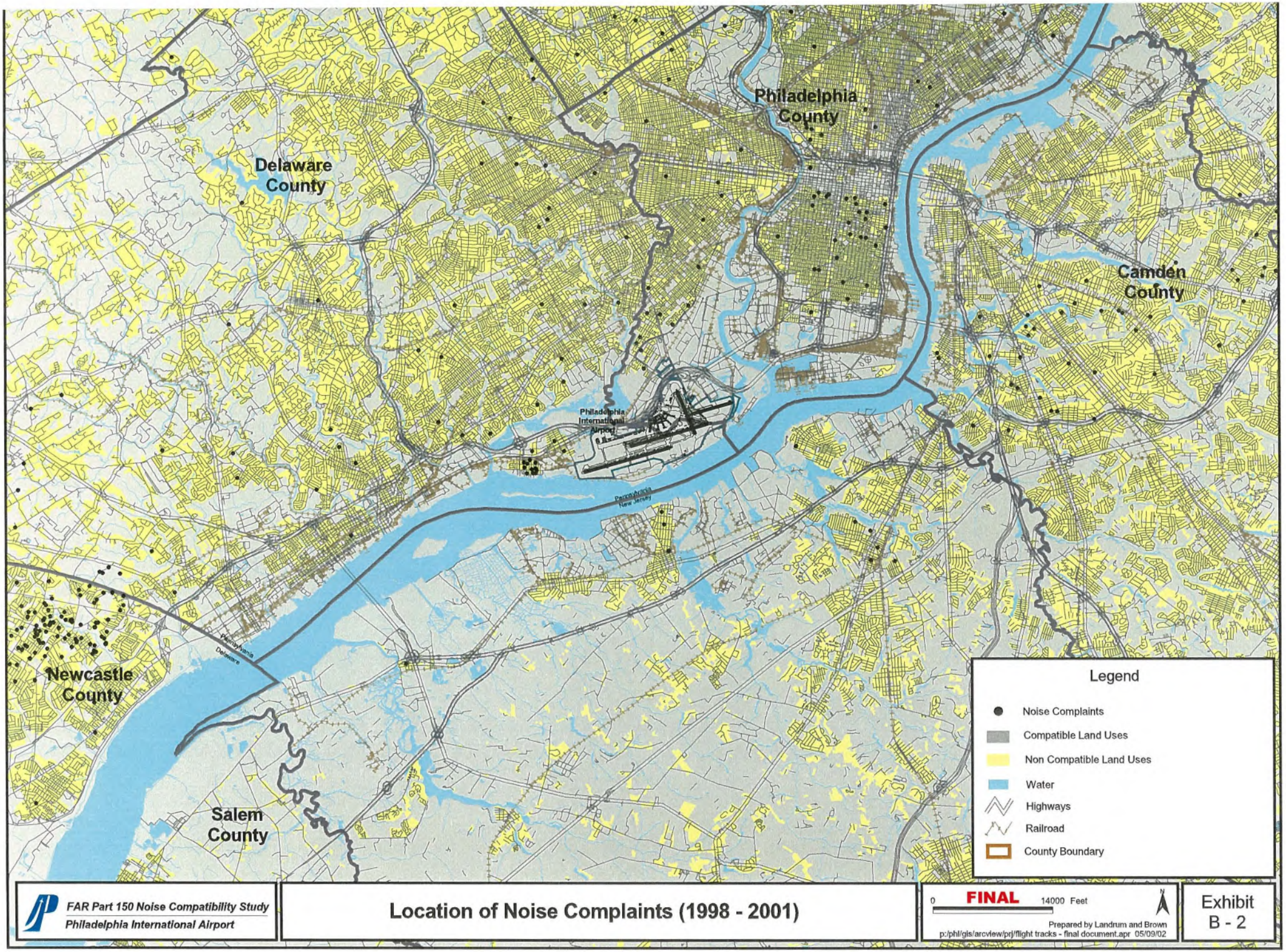

Philadelphia County
Delaware County
Camden County
Philadelphia International Airport
Pennsylvania
New Jersey
Pennsylvania
Delaware
Newcastle County
Salem County
Legend
Noise Complaints
Compatible Land Uses
Non Compatible Land Uses
Water
Highways
Railroad
County Boundary
FAR Part 150 Noise Compatibility Study
Philadelphia International Airport
Location of Noise Complaints (1998 - 2001)
0
FINAL
14000 Feet
Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/flight tracks - final document.apr 05/09/02
Exhibit
B - 2

Appendix C

APPENDIX C
NOISE MODELING METHODOLOGY

This Appendix sets forth the background material necessary for the reader to understand the principles of noise, as well as the preparation of noise exposure contours and the development of estimates of noise impacts associated with those contours. The data is derived from a variety of sources including, but not limited to, records maintained by airport management and the FAA, and mapping available from the airport and local planning agencies.

Section C.1 and C.2 provides background information necessary to understand the properties of sound and noise, including how noise levels are measured and expressed mathematically.

Section C.3 provides basic information on the noise metric and computer model used to compute noise, and a statement relative to the comparability of baseline information and the years indicated on the official noise mapping for the airport.

Section C.4 sets forth the detailed input data that was used to prepare noise exposure contours for 2001 and year 2006 baseline conditions as shown in Chapter 2, *Baseline Noise Exposure*.

Section C.5 summarizes operating information related to the proposed Noise Compatibility Program contours that are shown in Chapter 4, *Noise Compatibility Plan*.

C.1 SOUND AND NOISE

Sound is created by a vibrating source that induces vibrations in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source like ripples on a pond. Sound waves dissipate with increasing distance from the source. Sound waves can also be reflected, diffracted, refracted, or scattered. When the source stops vibrating, the sound waves disappear almost instantly and the sound ceases.

Sound conveys information to listeners. It can be instructional, alarming, pleasant and relaxing, or annoying. Identical sounds can be characterized by different people, or even by the same person at different times, as desirable or unwanted. Unwanted sound is commonly referred to as "noise."

Sound can be defined in terms of three components:

1. Level (amplitude)
2. Pitch (frequency)
3. Duration (time pattern)

C.1.1 SOUND LEVEL

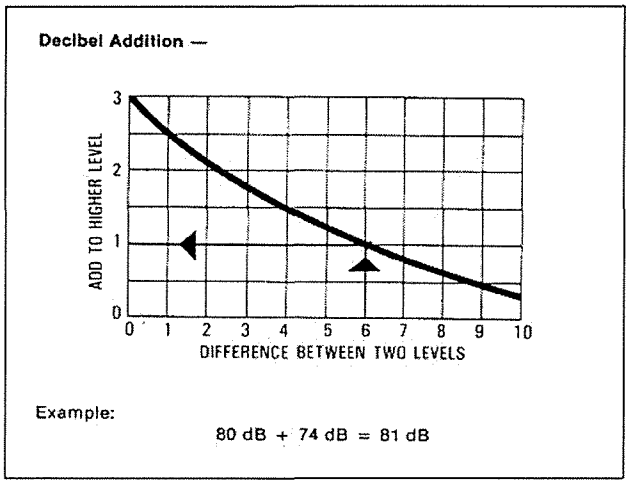
The level of sound is measured by the difference between atmospheric pressure (without the sound) and the total pressure (with the sound). Amplitude of sound is like the relative height of the ripples caused by the stone thrown into the water. Although physicists typically measure pressure using the linear Pascal scale, sound is measured using the logarithmic decibel (dB) scale. This is because the range of sound pressures detectable by the human ear can vary from *1 to 100 trillion units*. A logarithmic scale allows us to discuss and analyze noise using more manageable numbers. The range of audible sound ranges from approximately 1 to 140 decibels, although everyday sounds rarely rise above about 120 decibels. The human ear is extremely sensitive to sound pressure fluctuations. A sound of 140 decibels, which is sharply painful to humans, contains *100 trillion (10^{14}) times more* sound pressure than the least audible sound.

By definition, a 10-decibel increase in sound is equal to a tenfold *(10^1)* increase in the mean square sound pressure of the reference sound. A 20-decibel increase is a 100-fold *(10^2)* increase in the mean square sound pressure of the reference sound. A 30-decibel increase is a 1,000-fold *(10^3)* increase in mean square sound pressure.

A logarithmic scale requires different mathematics than used with linear scales. The sound pressures of two separate sounds, expressed in decibels, are not arithmetically additive. For example, if a sound of 80 dB is added to another sound of 74 dB, the total is a one-decibel increase in the louder sound (81 dB), not the arithmetic sum of 154 dB. If two equally loud noise events occur simultaneously, the sound pressure level from the combined events is 3 dB higher than the level produced by either event alone.

Logarithmic averaging also yields results that are quite different from simple arithmetic. Consider the example shown in **Exhibit C-2**. Two sound levels of equal duration are averaged. One has an Lmax of 100 dB, the other 50 dB. Using conventional arithmetic, the average would be 75 dB. The true result, using logarithmic math, is *97 dB*. This is because 100 dB has far more energy than 50 dB (100,000 times as much!) and is overwhelmingly dominant in computing the average of the two sounds.

Exhibit C-1:
EXAMPLE OF ADDITION OF TWO DECIBEL LEVELS



Source: *Information on Levels.* EPA. March 1974.

Human perceptions of changes in sound pressure are less sensitive than a sound level meter. People typically perceive a tenfold increase in sound pressure, a 10-dB increase, as a doubling of loudness. Conversely, a 10-dB decrease in sound pressure is normally perceived as half as loud. In community settings most people perceive a 3-dB increase in sound pressure (a doubling of the sound pressure or energy) as just noticeable. (In laboratory settings, people with good hearing are able to detect changes in sounds of as little as one decibel.)

C.1.2 SOUND FREQUENCY

The pitch (or frequency) of sound can vary greatly from a low-pitched rumble to a shrill whistle. If we consider the analogy of ripples in a pond, high frequency sounds are vibrations with tightly spaced ripples, while low rumbles are vibrations with widely spaced ripples. The rate at which a source vibrates determines the frequency. The rate of vibration is measured in units called "Hertz" -- the number of cycles, or waves, per second. One's ability to hear a sound depends greatly on the frequency composition. Humans hear sounds best at frequencies between 1,000 and 6,000 Hertz. Sound at frequencies above 10,000 Hertz (high-pitched hissing) and below 100 Hertz (low rumble) are much more difficult to hear.

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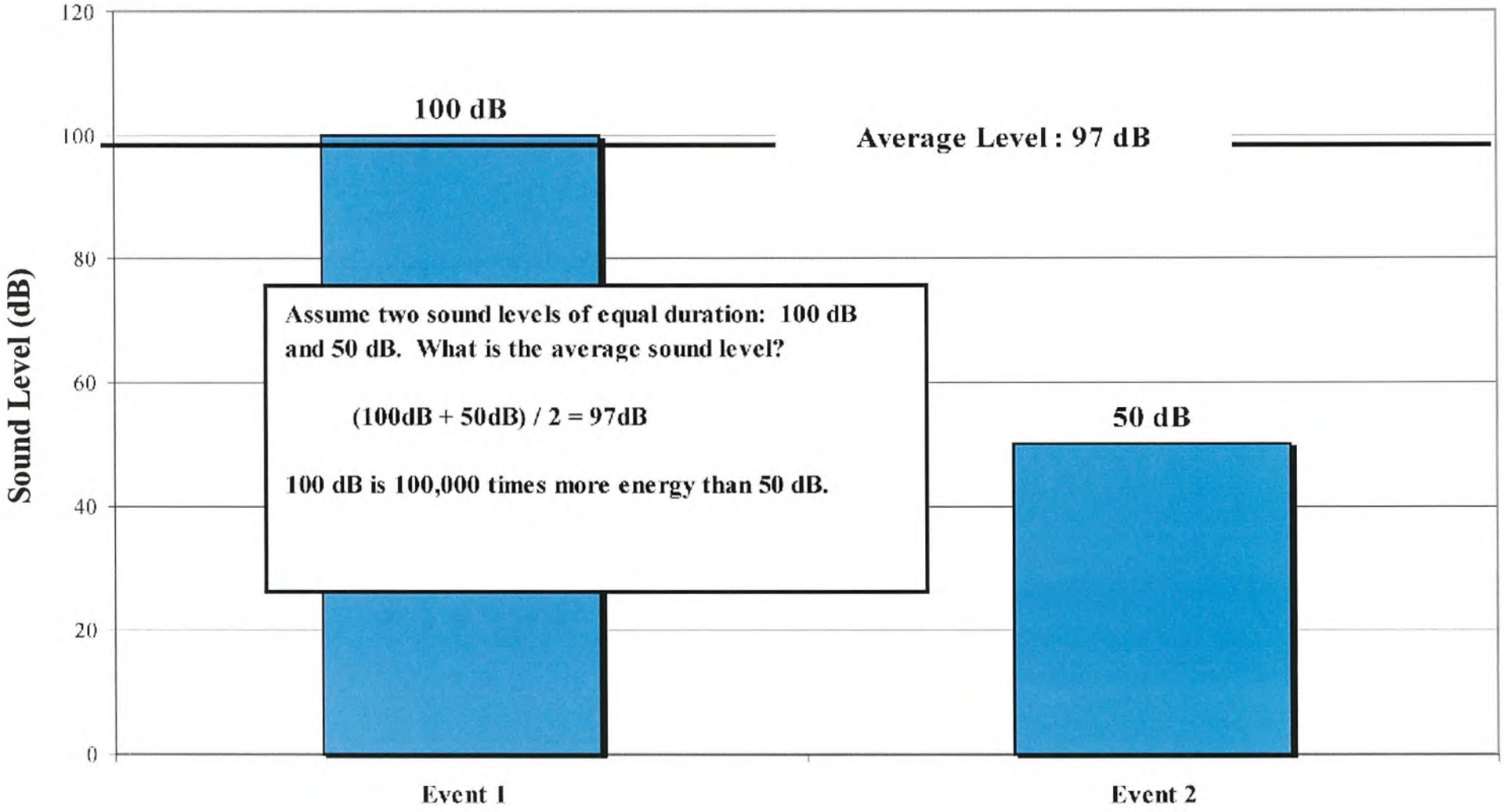
Sound Level Averaging



If we are attempting to measure sound in a way that approximates what our ears hear, we must give more weight to sounds at the frequencies we hear well and less weight to sounds at frequencies we do not hear well. Acousticians have developed several weighting scales for measuring sound. The A-weighted scale was developed to correlate with the judgments people make about the loudness of sounds. The A-weighted decibel scale (dBA) is used in studies where audible sound is the focus of inquiry. The US Environmental Protection Agency (EPA) has recommended the use of the A-weighted decibel scale in studies of environmental noise. [1] Its use is required by the Federal Aviation Administration (FAA) in airport noise studies.[2]

C.1.3 DURATION OF SOUNDS

The duration of sounds – their patterns of loudness and pitch over time – can vary greatly. Sounds can be classified as *continuous* like a waterfall, *impulsive* like a firecracker, or *intermittent* like aircraft overflights. Intermittent sounds are produced for relatively short periods, with the instantaneous sound level during the event roughly appearing as a bell-shaped curve. An aircraft event is characterized by the period during which it rises above the background sound level, reaches its peak, and then recedes below the background level.

C.2 STANDARD NOISE DESCRIPTORS

Given the multiple dimensions of sound, a variety of descriptors, or metrics, have been developed for describing sound and noise. Some of the most commonly used metrics are discussed in this section. They include:

1. Maximum Level (**Lmax**)
2. Time Above Level (**TA**)
3. Sound Exposure Level (**SEL**)
4. Equivalent Sound Level (**Leq**)
5. Day/Night Average Sound Level (**DNL**)

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1 *Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety.* U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, P. A-10.

2 "Airport Noise Compatibility Planning." 14 CFR part 150, Sec. A150.3.

C.2.1 MAXIMUM LEVEL (Lmax)

Lmax is simply the highest sound level recorded during an event or over a given period of time. It provides a simple and understandable way to describe a sound event and compare it with other events. In addition to describing the peak sound level, Lmax can be reported on an appropriate weighted decibel scale (A-weighted, for example) so that it can disclose information about the frequency range of the sound event in addition to the loudness.

Lmax, however, fails to provide any information about the duration of the sound event. This can be a critical shortcoming when comparing different sounds. Even if they have identical Lmax values, sounds of greater duration contain more sound energy than sounds of shorter duration. Research has demonstrated that for many kinds of sound effects, the total sound energy, not just the peak sound level, is a critical consideration.

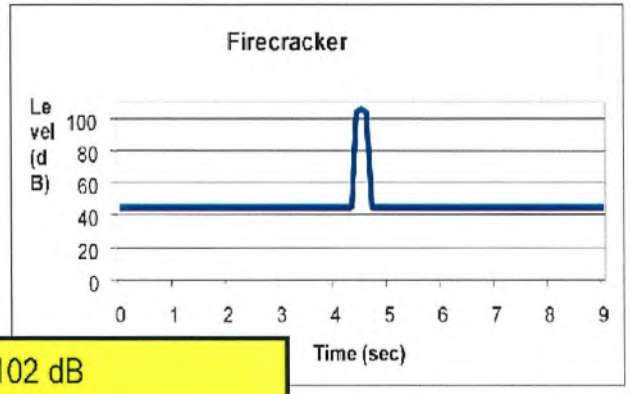
C.2.2 TIME ABOVE LEVEL (TA)

The "time above," or TA, metric indicates the amount of time that sound at a particular location exceeds a given sound level threshold. TA is often expressed in terms of the total time per day that the threshold is exceeded. The TA metric explicitly provides information about the duration of sound events, although it conveys no information about the peak levels during the period of observation.

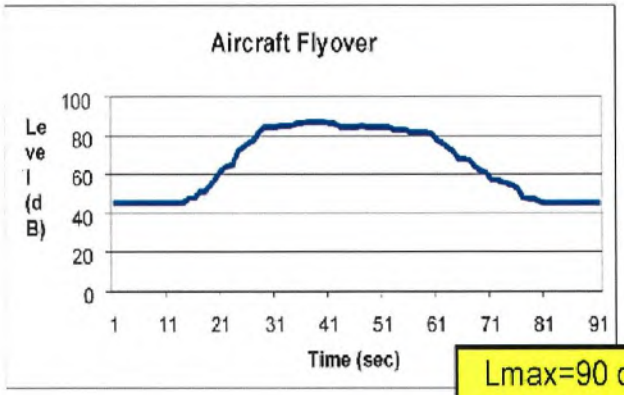
C.2.3 SOUND EXPOSURE LEVEL (SEL)

The sound exposure level, or SEL metric, provides a way of describing the total sound energy of a single event. In computing the SEL value, all sound energy occurring during the event, within 10 decibels of the peak level (Lmax), is mathematically integrated over one second. (Very little information is lost by discarding the sound below the 10-decibel cut-off, since the highest sound levels completely dominate the integration calculation.) Consequently, the SEL is always greater than the Lmax for events with a duration greater than one second. SELs for aircraft overflights typically range from 5 to 10 decibels higher than the Lmax for the event.

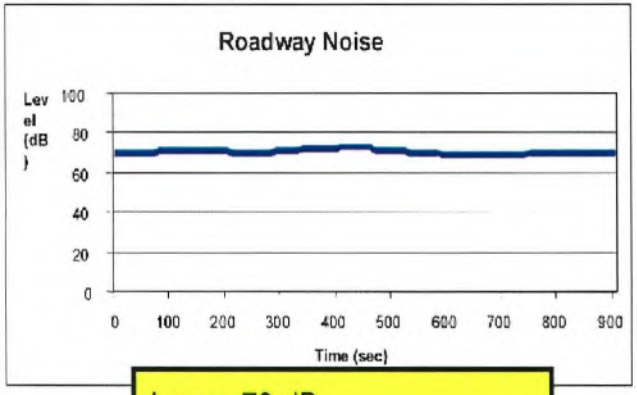
Exhibit C-3 shows graphs of instantaneous sound levels for three different events: an aircraft flyover, roadway noise, and a firecracker. The Lmax and the duration of each event differ greatly. The pop of the firecracker is quite loud, 102 dB but lasts less than a second. The aircraft flyover has a considerably lower Lmax at 90 dB, but the event lasts for over a minute. The Lmax from the roadway noise is even quieter at only 72 dB, but it lasts for 15 minutes. By considering the loudness and the duration of these very different events simultaneously, the SEL metric reveals that the total sound energy of all three is identical. This can be a critical finding for studies where total noise dosage is the focus of study. As it happens, research has shown conclusively that noise dosage is crucial in understanding the effects of noise on animals and humans.



Lmax=102 dB
SEL=100 dB
Leq=105
Event Duration=0.3 seconds



Lmax=90 dB
SEL=100 dB
Leq=82
Event Duration=70 seconds



Lmax=72 dB
SEL=100 dB
Leq=71
Event Duration=900 seconds

C.2.4 EQUIVALENT SOUND LEVEL (Leq)

The equivalent sound level (Leq) metric may be used to define cumulative noise dosage, or noise exposure, over a period of time. In computing Leq, the total noise energy over a given period of time, during which numerous events may have occurred, is logarithmically averaged over the time period. The Leq represents the steady sound level that is equivalent to the varying sound levels actually occurring during the period of observation. For example, an 8-hour Leq of 67 dBA indicates that the amount of sound energy in all the peaks and valleys that occurred in the 8-hour period is equivalent to the energy in a continuous sound level of 67 dBA. Leq is typically computed for measurement periods of one hour, eight hours, or 24 hours, although any time period can be specified.

Exhibit C-4 shows the relationship of Leq to Lmax and SEL. In this example, four noise events occur during one hour. The SELs for each event range from 90 to 108 dB. The Leq for this one-hour period would be 75 dB. Note that this Leq value is derived from only four events during the one-hour period. When converted to SELs, the sound events accounted for only four seconds during the hour; silence occurred during the remaining 3,596 seconds. This again indicates the dominance of loud events in noise summation and averaging computations.

Leq is a critical noise metric for many kinds of analysis where total noise dosage, or noise exposure, is under investigation. As already noted, noise dosage is important in understanding the effects of noise on both animals and people. Indeed, research has led to the formulation of the "equal energy rule." This rule states that it is the total acoustical energy to which people are exposed that explains the effects the noise will have on them. That is, a very loud noise with a short duration will have the same effect as a lesser noise with a longer duration if they have the same total sound energy.

C.2.5 DAY/NIGHT AVERAGE SOUND LEVEL (DNL)

The DNL metric is really a variation of the 24-hour Leq metric. Like Leq, the DNL metric describes the total noise exposure during a given period. Unlike Leq, however, DNL, by definition, can only be applied to a 24-hour period. In computing DNL, an extra weight of 10 decibels is assigned to any sound levels occurring between the hours of 10:00 p.m. and 7:00 a.m. This is intended to account for the greater annoyance that nighttime noise is presumed to cause for most people. Recalling the logarithmic nature of the decibel scale, this extra weight treats one nighttime noise event as equivalent to ten daytime events of the same magnitude.

As with Leq, DNL values are strongly influenced by the loud events. For example, 30 seconds of sound of 100 dB, followed by 23 hours, 59 minutes, and 30 seconds of silence would compute to a DNL value of 65 dB. If the 30 seconds occurred at night, it would yield a DNL of 75 dB.

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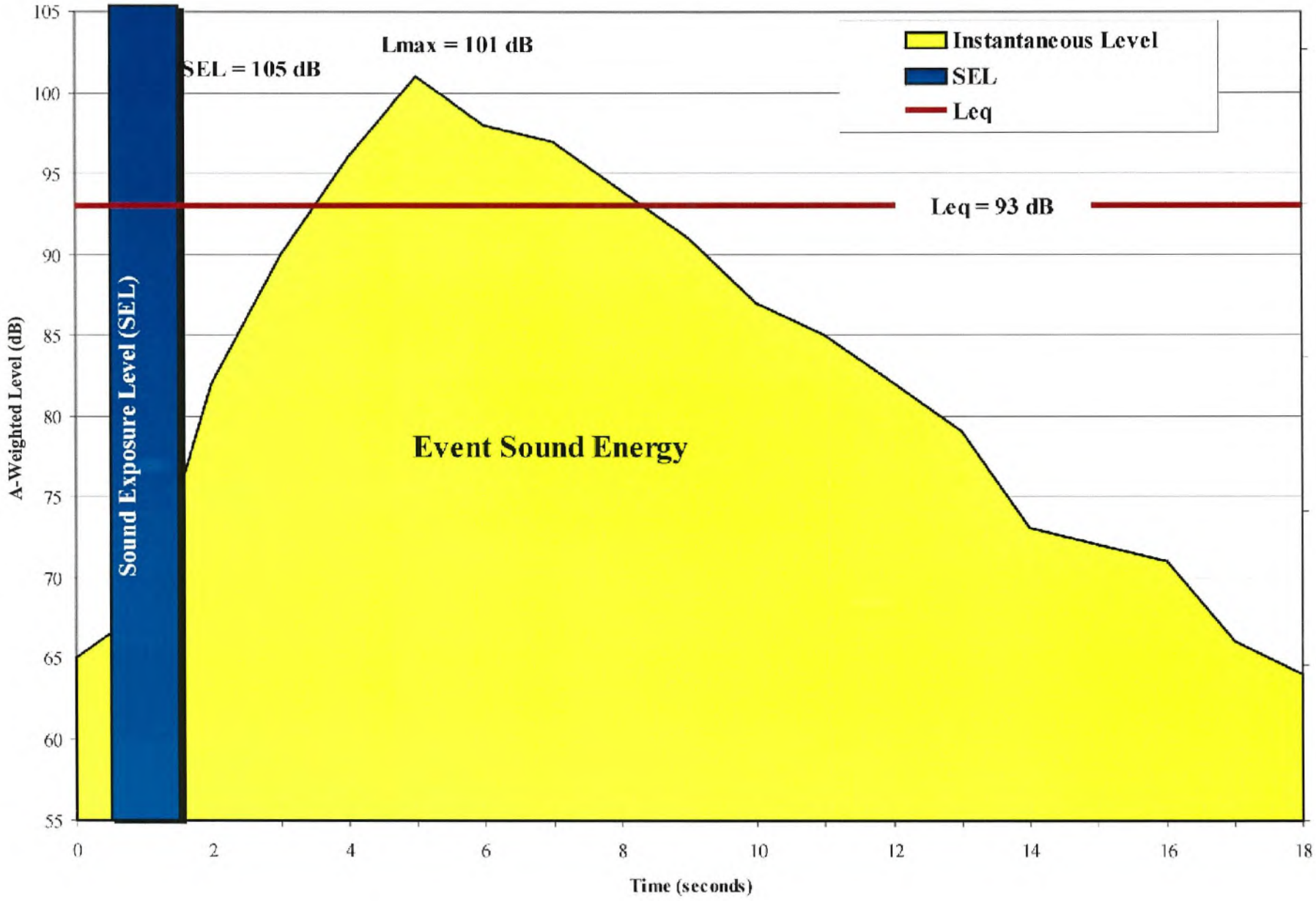

FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Relationship Among Sound Metrics

FINAL
Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/images.apr 05/09/02

Exhibit
C - 4

This example can be roughly equated to an airport noise environment. Recall that an SEL is the mathematical compression of a noise event into one second. Thus, 30 SELs of 100 dB during a 24-hour period would equal DNL 65 dB, or DNL 75 dB if they occurred at night. This situation could actually occur in places around a real airport. If the area experienced 30 overflights during the day, each of which produced an SEL of 100 dB, it would be exposed to DNL 65 dB. Recalling the relationship of SEL to the peak noise level (Lmax) of an aircraft overflight, the Lmax recorded for each of those overflights (the peak level a person would actually hear) would typically range from 90 to 95 dBA.

C.2.5.1 Federal Requirements to Use DNL in Environmental Noise Studies

DNL is the standard metric used for environmental noise analysis in the United States. This practice originated with the EPA's effort to comply with the Noise Control Act of 1972. The EPA designated a task group to "consider the characterization of the impact of airport community noise and develop a community noise exposure measure."[1] The task group recommended using the DNL metric. The EPA accepted the recommendation in 1974, based on the following considerations:

1. The measure is applicable to the evaluation of pervasive, long-term noise in various defined areas and under various conditions over long periods of time.
2. The measure correlates well with known effects of the noise environment on individuals and the public.
3. The measure is simple, practical, and accurate.
4. Measurement equipment is commercially available.
5. The metric at a given location is predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.[3]

Soon thereafter, the Department of Housing and Urban Development (HUD), Department of Defense, and the Veterans Administration adopted the use of DNL.

At about the same time, the Acoustical Society of America developed a standard (ANSI S3.23-1980) which established DNL as the preferred metric for outdoor environments. This standard was reevaluated in 1990 reached the same conclusions regarding the use of DNL (ANSI S12.40-1990).

[3] *Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety.* U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, Pp. A-1–A-23.

In 1980, the Federal Interagency Committee on Urban Noise (FICUN) met to consolidate Federal guidance on incorporating noise considerations in local land use planning. The Committee selected DNL as the best noise metric for the purpose, thus endorsing the EPA's earlier work and making it applicable to all Federal agencies. [4]

In response to the requirements of the Aviation Safety and Noise Abatement (ASNA) Act of 1979 and the recommendations of FICUN and EPA, the FAA established DNL in 1981 as the single metric for use in airport noise and land use compatibility planning. This decision was incorporated into the final rule implementing ASNA, Federal Aviation Regulation Part 150, in 1985.

In the early 1990s, Congress authorized the creation of a new interagency committee to study airport noise issues. The Federal Interagency Committee on Noise (FICON) was formed with membership from the EPA, the FAA, the U.S. Air Force, the U.S. Navy, the Department of Housing and Urban Development (HUD), the Department of Veterans Affairs (VA), and others. FICON concluded in its 1992 report that Federal agencies should "continue the use of the DNL metric as the principal means for describing long term noise exposure of civil and military aircraft operations."[5] FICON further concluded that there were no new sound descriptors of sufficient scientific standing to substitute for the DNL cumulative noise exposure metric.[6]

In 1993, the FAA issued its *Report to Congress on Effects of Airport Noise*. Regarding DNL, the FAA stated, "Overall, the best measure of the social, economic, and health effects of airport noise on communities is the Day-Night Average Sound Level (DNL)."[7]

C.3 GENERAL INFORMATION

The same noise metric and noise model was used to compute all noise contours and other evaluations prepared for the Part 150 Study Update for Philadelphia International Airport.

C.3.1 NOISE METRIC

The FAA has stipulated that noise exposure maps prepared for Part 150 studies will be based on the annual Day-Night Average Sound Level (DNL). This noise metric (measurement description) was developed under the auspices of the Environmental Protection Agency (EPA) and embodies extensive information regarding the physical description of transportation noise as related to human annoyance in residential areas.

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4 *Guidelines for Considering Noise in Land Use Planning and Control.* Federal Interagency Committee on Urban Noise (FICUN). 1980.

5 *Federal Agency Review of Selected Airport Noise Analysis Issues.* Federal Interagency Committee on Noise (FICON). August 1992, Pp. 3-1.

6 *Federal Agency Review of Selected Airport Noise Analysis Issues,* Technical Report, Volume 2. Federal Interagency Committee on Noise (Technical). August 1992, Pp. 2-3.

7 *Report to Congress on Effects of Airport Noise.* Federal Aviation Administration. 1993, P. 1.

DNL is defined as the average A-weighted sound level during a 24-hour period with a 10-decibel penalty applied to noise events that occur at night (10:00 p.m. to 6:59 a.m.). Noise contours are lines connecting points of equal noise level; typically, for Part 150 studies, these levels are 65, 70, and 75 DNL.

C.3.2 NOISE MODEL

The noise levels were computed during this study using Version 6.0b of the Integrated Noise Model (INM). The INM was developed under the guidance of the FAA and is the only model generally approved by the FAA for use in Part 150 studies. The noise pattern calculated by the INM for an airport is a function of several factors, including; the number of aircraft operations during the period evaluated, the types of aircraft flown, the time of day when they are flown, the way they are flown, how frequently each runway is used for landing and takeoff, and the routes of flight used to and from the runways. Substantial variations in any one of these factors may, when extended over a long period of time, cause marked changes to the noise pattern.

C.3.3 COMPARABILITY OF CONDITIONS

Noise evaluations for all conditions of the Part 150 Study Update are based on actual operations levels for the period of January 2000 through December 2000 and for year 2006 forecasts of operations, as provided by the Airport's master plan study, conducted concurrent to this study. FAR Part 150 requires that the contours on the official Noise Exposure Maps be dated during and five years after the date of submission. Since work was begun on these evaluations in early 2001, the year 2000 serves as the foundation of information for current conditions. Since the difference between baseline and 2000 operations levels was not significant until after the terrorist activity of September 11, 2001, the baseline period operations are considered to be applicable to 2001 as well. Subsequent to September 11, 2001, a downturn of aviation activity has occurred throughout the United States, but as of this writing, insufficient time has passed to forecast modifications to future travel patterns as a result of it. Consequently, the forecasts of the master plan, present during August 2001, are used to represent future activity levels. Most analysts believe the downturn of activity in late 2001 will be short-term and that the demand for travel will return to levels present prior to September 11, 2001.

C.4 BASELINE NOISE EXPOSURE PATTERNS

Several types of operational information are required to produce baseline noise exposure patterns for the airport. These include estimates of the numbers of actual operations by specific aircraft types at different periods of the day, flight path locations, runway and flight path utilization, and aircraft operating characteristics.

C.4.1 NUMBER OF OPERATIONS

The average daily numbers of aircraft arrivals and departures during the current baseline period are presented in **Table C-1** for the several categories of users that operate at Philadelphia International Airport. **Table C-2**, details the individual aircraft types by day or night operation. The number of operations and their distribution during the day are derived from operations schedules and radar records collected for the Airport. **Table C-3** and **Table C-4** provide similar information for 2006. The FAR Part 36 noise stage of each aircraft is also indicated.

Table C-1
AVERAGE DAY OPERATIONS * - JANUARY 2000 TO DECEMBER 2000
Philadelphia International Airport

User Group	Arrivals		Departures		Total	
	Day	Night	Day	Night	Day	Night
Cargo and Air Carrier						
Heavy Jets	25	20	28	22	53	42
Air Carrier Light Jets	314	25	308	27	622	52
Regional/Business Jets	50	19	51	16	101	35
Propeller Aircraft	188	21	192	19	380	40
Total	577	85	579	84	1,156	169

* Data rounded to the nearest whole operation.

Day = 7:00 a.m. to 9:59 p.m.

Night = 10:00 p.m. to 6:59 a.m.

Source: Landrum & Brown, 2001.

Table C-2
CURRENT AVERAGE DAY OPERATIONS BY AIRCRAFT TYPE
Philadelphia International Airport

User Group & INM Type	Part 36 Stage	Aircraft Type	Arrivals		Departures		Total	
			Day	Night	Day	Night	Day	Night
Cargo/Heavy Jets								
727EM1	3	Boeing 727-100 (retrofit)	0	1	0	1	0	2
727EM2	3	Boeing 727-200 (retrofit)	1	2	0	3	1	5
727QF	3	Boeing 727-100 (re-engine)	1	4	1	4	2	8
74720A	3	Boeing 747-200A	2	1	2	0	4	1
757PW	3	Boeing 757-200	0	4	0	4	0	8
757RR	3	Boeing 757-200	0	2	0	2	0	4
767300	3	Boeing 767-300	4	1	4	0	8	1
767CF6	3	Boeing 767-200	8	0	8	0	16	0
777200	3	Boeing 777-200	2	0	2	0	4	0
A310	3	Airbus 310	0	2	0	2	0	4
DC93LW	3	DC-9 30 Series (retrofit)	1	0	1	0	2	0
DC870	3	DC-8 70 Series	6	3	10	6	16	9
Subtotal			**25**	**20**	**28**	**22**	**53**	**42**
Air Carrier Jets								
727EM2	3	Boeing 727-200 (retrofit)	14	2	14	1	28	3
737300	3	Boeing 737-300	32	4	27	7	59	11
7373B2	3	Boeing 737-300	30	0	30	0	60	0
737400	3	Boeing 737-400	47	1	47	1	94	2
737500	3	Boeing 737-500	8	0	7	1	15	1
737800	3	Boeing 737-800	2	0	2	0	4	0
737N17	3	Boeing 737-200 (retrofit)	9	1	9	1	18	2
737N9	3	Boeing 737-200 (retrofit)	3	0	3	0	6	0
757PW	3	Boeing 757-200	4	1	5	1	9	2
757RR	3	Boeing 757-200	22	4	21	2	43	6
A319	3	Airbus 319	27	2	27	2	54	4
A320	3	Airbus 320	22	4	24	2	46	6
DC93LW	3	DC-9 30 Series (retrofit)	40	2	37	3	77	5
DC95HW	3	DC-9 50 Series (retrofit)	8	1	8	1	16	2
F10065	3	Fokker 100	18	1	19	0	37	1
MD82/83	3	MD-82 Series	28	2	28	5	56	7
Subtotal			**314**	**25**	**308**	**27**	**622**	**52**
Regional/Business Jets								
CL600	3	Business Jet	3	4	4	3	7	7
CL601	3	Canadair Regional Jet	35	3	35	3	70	6
LEAR35	3	Business Jet	6	7	6	5	12	12
MU3001	3	Business Jet	6	5	6	5	12	10
Subtotal			**50**	**19**	**51**	**16**	**101**	**35**
Propeller Aircraft								
BEC58P	N	Twin Engine Prop	10	1	6	0	16	1
DHC6	N	Commuter prop	69	11	80	8	149	19
DHC8	N	Commuter prop	94	9	92	10	186	19
SF340	N	Saab 340	15	0	14	1	29	1
Subtotal			**188**	**21**	**192**	**19**	**380**	**40**
Grand Total			**577**	**85**	**579**	**84**	**1156**	**169**

Source: Landrum & Brown, 2001, from PHL master plan forecasts, DMJM, 2001.

Table C-3
AVERAGE DAY OPERATIONS * - 2006
Philadelphia International Airport

User Group	Arrivals		Departures		Total	
	Day	Night	Day	Night	Day	Night
Cargo and Air Carrier Heavy Jets	13	22	16	18	29	40
Air Carrier Light Jets	367	28	357	30	724	58
Regional/Business Jets	49	16	52	13	101	29
Propeller Aircraft	207	26	280	32	487	57
Total	636	92	705	93	1,341	184

* Data rounded to the nearest whole operation.

Day = 7:00 a.m. to 9:59 p.m.

Night = 10:00 p.m. to 6:59 a.m.

Source: Landrum & Brown assessment of forecasts, 2001.

Table C-4
2006 AVERAGE DAY OPERATIONS BY AIRCRAFT TYPE
Philadelphia International Airport

User Group & INM Type	Part 36 Stage	Aircraft Type	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total Day	Total Night
Cargo/Heavy Jets								
727EM1	3	Boeing 727-100 (retrofit)	0	1	0	1	0	2
727EM2	3	Boeing 727-200 (retrofit)	1	3	1	3	2	6
727QF	3	Boeing 727-100 (re-engine)	0	3	1	2	1	5
74720A	3	Boeing 747-200A	1	1	1	0	2	1
757PW	3	Boeing 757-200	0	5	1	3	1	8
757RR	3	Boeing 757-200	0	2	0	3	0	5
767300	3	Boeing 767-300	1	2	3	0	4	2
767CF6	3	Boeing 767-200	6	1	5	1	11	2
777200	3	Boeing 777-2002	1	0	1	0	2	0
A310	3	Airbus 310	1	1	1	1	2	2
DC93LW	3	DC-9 30 Series (retrofit)	0	1	0	1	0	2
DC870	3	DC-8 70 Series	2	2	2	3	4	5
Subtotal			**13**	**22**	**16**	**18**	**29**	**40**
Air Carrier Jets								
727EM2	3	Boeing 727-200 (retrofit)	10	2	10	2	20	2
7373B2	3	Boeing 737-300	35	1	30	0	65	1
737300	3	Boeing 737-300	31	4	29	5	60	9
737400	3	Boeing 737-400	69	1	68	1	177	2
737500	3	Boeing 737-500	9	0	8	1	17	1
737N9	3	Boeing 737-200 (retrofit)	3	0	3	0	6	0
737N17	3	Boeing 737-200 (retrofit)	10	1	10	1	20	2
757PW	3	Boeing 757-200	4	1	4	1	8	2
757RR	3	Boeing 757-200	23	1	23	1	46	2
A320	3	Airbus 320	65	12	69	7	134	19
DC93LW	3	DC-9 30 Series (retrofit)	43	2	41	5	84	7
DC95HW	3	DC-9 50 Series (retrofit)	9	1	8	1	17	2
F10065	3	Fokker 100	25	1	26	0	51	1
MD82	3	MD-82 Series	19	0	21	1	40	1
MD83	3	MD-88 Series	12	1	7	4	19	5
Subtotal			**367**	**28**	**357**	**30**	**724**	**58**
Regional/Business Jets								
CL600	N	Business Jet	1	3	2	2	3	5
CL601	N	Regional Jet	41	3	42	3	83	6
LEAR35	N	Business Jet	4	7	5	5	9	12
MU3001	N	Business Jet	3	3	3	3	6	6
Subtotal			**49**	**16**	**52**	**13**	**101**	**29**
Propeller Aircraft								
BEC58P	N	Twin Engine Prop	6	1	5	0	11	1
DHC6	N	Commuter prop	76	13	126	12	202	25
DHC8	N	Commuter prop	113	11	133	18	246	29
SF340	N	Saab 340	12	1	16	2	28	2
Subtotal			**207**	**26**	**280**	**32**	**487**	**57**
Grand Total			**636**	**92**	**705**	**93**	**1,341**	**184**

Source: Landrum & Brown, 2001, from PHL master plan forecasts, DMJM, 2001.

C.4.2 RUNWAY UTILIZATION

The usage of the various runways at the airport is a principal element in the definition of the noise exposure pattern. The more frequently jet aircraft use a runway, particularly at night and for departures, the greater the noise exposure energy associated with that runway. The proportional use of the runways is based largely on their length and the relationship of their position relative to the terminal, as well as the average conditions of wind direction and velocity. The distribution of aircraft between the four runways was based on runway utilization records derived from the Airport's automated Airport Management Information System (TAMIS) for the year 2000. The Automated Radar Terminal Services (ARTS) radar data that is collected by the TAMIS provides definitive information relative to the runways used by specific aircraft or users, as well as the location of aircraft in flight in the airport environs.

Currently, jet aircraft that weigh more than 75,000 pounds land from the west (on Runways 9L/R) and take off to the east (on Runways 9L/R and 8) approximately 30 percent of the time. Jets land from the east on Runways 27L/R and 26, and depart on Runways 27L/R approximately 70 percent of the time. Runway 8 is not used for landings, nor is Runway 26 used for takeoffs by these aircraft. Jets weighing less than 75,000 pounds use Runway 17/35 as well as the east-west runways. The stagger of the runways, with the outboard runway (nearest the Delaware River) physically located parallel to and west of the inboard runway (nearest the terminal complex), results in jet traffic west of the airport arriving to and departing from the outboard runway, while jet traffic east of the airport typically arrives to or departs from the inboard runway. These patterns remain generally consistent for both day and nighttime periods.

Propeller aircraft do not significantly affect the location of the noise exposure pattern, except in areas where these are the only aircraft operated. At Philadelphia International Airport, propeller aircraft are more frequent users of Runway 17/35 than are jet aircraft. Propeller aircraft are not able to accept unfavorable wind directions and wind velocities as high as those accepted by jet aircraft. Thus, a greater number of propeller aircraft operations are forced to use the crosswind runway and operate more directly into the wind. An assessment of the wind conditions and radar data indicates the use of Runway 17/35 by between 50 and 60 percent of takeoffs and landings by commuter and general aviation propeller aircraft. The remaining propeller operations utilize the east-west runways, in much the same manner as jet aircraft, although they also use Runway 8/26 for east-west operations. **Table C-5** provides the runway utilization derived from the TAMIS for the current condition. **Exhibit C-5** graphically displays the general runway use characteristics for an annual average 24-hour period at the airport.

Table C-5
CURRENT AND FUTURE CONDITIONS
DETAILED RUNWAY UTILIZATION BY USER GROUP

DAYTIME ARRIVALS (7:00 a.m. to 9:59 p.m.)									
Category	**09L**	**09R**	**17**	**27L**	**27R**	**35**	**8**	**26**	**Total**
Cargo/Heavy Jet	0.8%	28.0%	0.9%	16.7%	54.5%	0.0%	0.0%	0.0%	100.0%
Air Carrier Jet	0.8%	27.0%	0.0%	5.7%	66.4%	0.0%	0.0%	0.0%	100.0%
Air Carrier Propeller	1.1%	10.3%	20.3%	2.3%	20.2%	35.6%	0.0%	10.2%	100.0%
GA - Business Jet	1.3%	30.6%	5.8%	2.4%	32.9%	20.7%	0.0%	3.5%	100.0%
GA - Propeller	0.7%	10.5%	22.3%	1.9%	9.9%	41.3%	0.0%	13.5%	100.0%
DAYTIME DEPARTURES (7:00 a.m. to 9:59 p.m.)									
Category	**09L**	**09R**	**17**	**27L**	**27R**	**35**	**8**	**26**	**Total**
Cargo/Heavy Jet	28.1%	7.2%	0.0%	45.1%	19.7%	0.0%	0.0%	0.0%	100.0%
Air Carrier Jet	25.5%	1.9%	0.0%	65.0%	7.6%	0.0%	0.0%	0.0%	100.0%
Air Carrier Propeller	5.9%	0.0%	9.4%	24.6%	10.6%	39.6%	9.8%	0.0%	100.0%
GA - Business Jet	10.1%	1.1%	19.2%	22.3%	17.5%	18.1%	11.6%	0.0%	100.0%
GA - Propeller	2.3%	0.4%	25.2%	14.8%	6.9%	35.6%	14.9%	0.0%	100.0%

NIGHTTIME ARRIVALS (10:00 p.m. to 6:59 a.m.)									
Category	**09L**	**09R**	**17**	**27L**	**27R**	**35**	**8**	**26**	**Total**
Cargo/Heavy Jet	1.4%	26.5%	0.0%	40.1%	32.0%	0.0%	0.0%	0.0%	100.0%
Air Carrier Jet	1.5%	31.2%	0.0%	2.5%	64.8%	0.0%	0.0%	0.0%	100.0%
Air Carrier Propeller	1.1%	10.3%	20.3%	2.3%	20.2%	35.6%	0.0%	10.0%	100.0%
GA - Business Jet	4.1%	26.9%	1.4%	5.5%	41.4%	17.2%	0.0%	3.5%	100.0%
GA - Propeller	4.7%	18.7%	12.1%	0.9%	15.9%	24.3%	0.0%	23.4%	100.0%
NIGHTTIME DEPARTURES (10:00 p.m. to 6:59 a.m.)									
Category	**09L**	**09R**	**17**	**27L**	**27R**	**35**	**8**	**26**	**Total**
Cargo/Heavy Jet	22.8%	5.5%	0.0%	55.5%	16.2%	0.0%	0.0%	0.0%	100.0%
Air Carrier Jet	32.2%	2.1%	0.0%	56.0%	9.7%	0.0%	0.0%	0.0%	100.0%
Air Carrier Propeller	6.2%	0.0%	13.0%	19.2%	7.9%	38.9%	14.6%	0.0%	100.0%
GA - Business Jet	9.4%	0.6%	39.2%	15.55	17.7%	7.2%	10.5%	0.0%	100.0%
GA - Propeller	3.1%	0.0%	29.1%	12.6%	20.5%	15.0%	19.7%	0.0%	100.0%

Category Key	**Description**
Cargo/Heavy Jet	UPS, other cargo, and Heavy Jet air carrier (e.g., 767, 777, 747, A340)
Air Carrier Jet	Large Jet air carrier (e.g., 727, 737, 757, A319, A320, MD80)
Air Carrier Propeller	Propeller air carrier (e.g., twin turboprop)
GA - Business Jet	GA Business Jet (e.g., C550, C650, MU3, Gulfstream)
GA - Propeller	GA Propeller (e.g., single/twin engine prop and turboprop)

Source: Landrum & Brown evaluation of TAMIS data, 2001.

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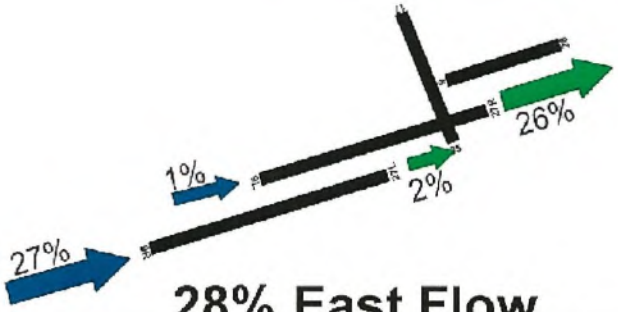
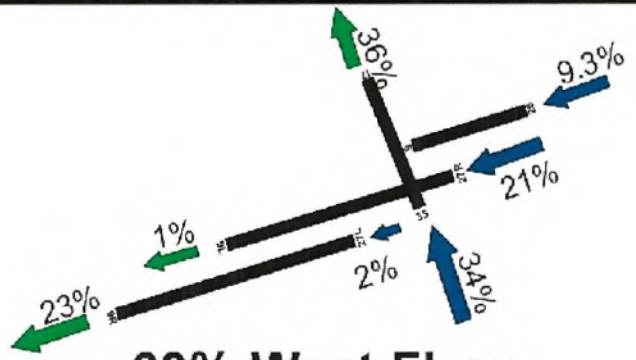
Commercial Jet Aircraft

72% West Flow

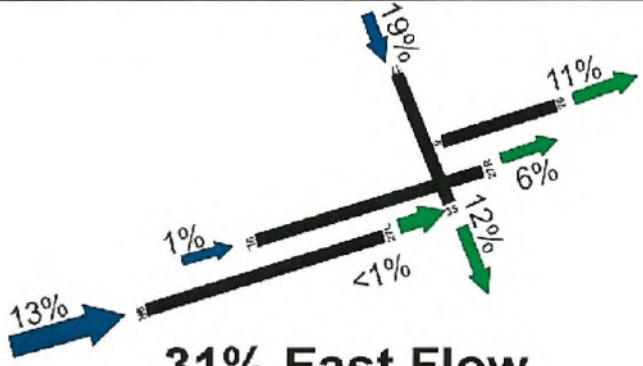


28% East Flow

General Aviation and Propeller Aircraft



69% West Flow



31% East Flow

Arrivals

Departures

N

FAR Part 150 Noise Compatibility Study
Philadelphia International Airport

Runway Utilization Flow

FINAL
Prepared by Landrum and Brown
p:/phl/gis/arcview/prj/images.apr 05/09/02

Exhibit C - 5

C.4.3 FLIGHT TRACK LOCATIONS AND USE

A flight track is the path over the ground that an aircraft flies to or from the airport. The flight tracks at Philadelphia International Airport have been created and verified from the TAMIS compilation of ARTS radar data, interviews with air traffic controllers, and discussions with airport noise staff. Currently, jet departure corridors are defined to both the east and west of the airport which result in overflight of the Delaware River during the initial stages of climb. This has resulted in the concentration of departure activity over or along the banks of the river while jet aircraft remain below approximately 2,000 (east flow) and 3,000 (west flow) MSL. In some cases, jet aircraft departing from Runway 27R are directed to maintain runway headings to enhance safety and required separations between them and aircraft departing simultaneously on Runway 27L. In these cases, the departures from Runway 27R may fly over populated areas along the north bank of the river in Tinicum Township before they are directed over more compatible areas. East of the airport, the departure corridor is developed entirely with compatible land uses until well beyond the areas considered to be significantly impacted by aircraft noise. This Part 150 Study Update has considered alternative changes in track locations to reduce the effects of departures from Runway 27R that overfly Tinicum Township, but has found no operational solution to abate aircraft noise in that area that may be implemented without substantial impacts upon the operating efficiency of the airport.

The radar data gathered for a sample period during 2000 was used to develop a series of consolidated flight tracks which are representative of the corridors used by aircraft as they land at or depart from the Airport. **Exhibit C-6** depicts the location of consolidated INM flight tracks representative of departure operations, overlaid on a map of ARTS departure tracks for a sampling period of both east and west flow traffic. **Exhibit C-7** presents similar data for arrival operations. The tracks are composed of both backbone[8] and sub-tracks that account for the dispersion of operations across a corridor of flight, rather than along a single constrained path. This is most useful at airports where wide flight corridors are present, such as are used by departures at Philadelphia International. The use of sub-tracks for the definition of baseline noise patterns allows a more definitive description of overall operating characteristics where ARTS data is available. **Table C-6** provides the proportion of operations assigned to each of the flight tracks indicated on the exhibits.

[8] The FAA's INM v6.0b uses a backbone and sub-track system to represent dispersed flight corridors. A backbone and sub-tracks are a set of flight tracks that represent a wide corridor, allowing the user to define a percentage of use for each sub-track. The use of this tool results in more accurately modeled flight corridors.

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